

SCOMM

#444.29

Electromagnetic Pollution

by Robert O. Becker
and Andrew A. Marino

High-tension wires
may be hazardous
to your health

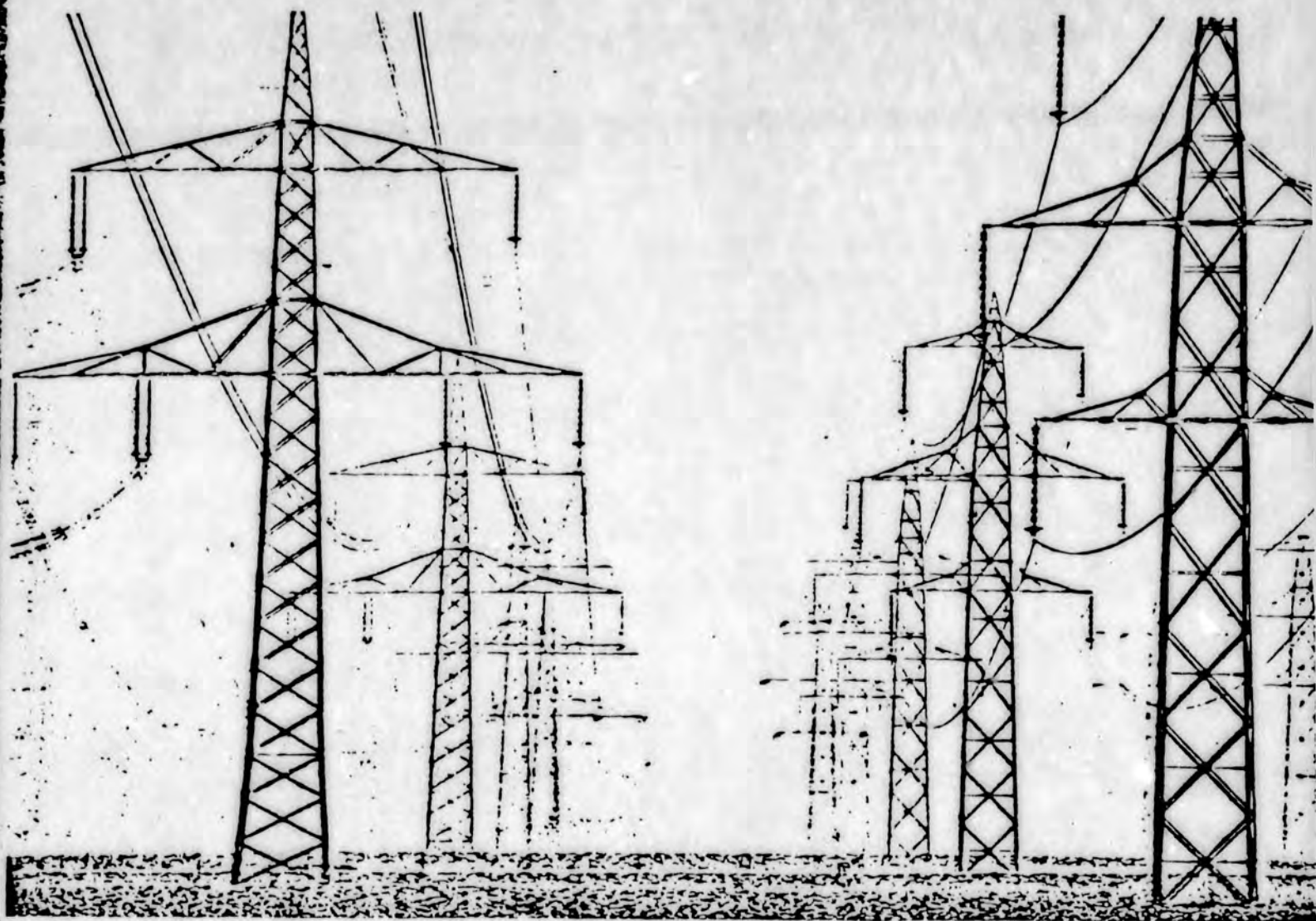


Photo by René Bunn (Magnum)

The American landscape would be unfamiliar were it lacking high-voltage transmission poles standing like metal skeletons strung with high-tension wires. These and other products of modern power and communications industries, such as radio, television, and radar, all operate in the electromagnetic spec-

trum—those waves present in our environment (produced both naturally and artificially) which we cannot hear, see, feel, or otherwise detect with our senses without instrumental intervention.

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Until recently, scientists believed that electromagnetic radiation had no effect on life. No obvious diseases had been identified as having been caused by such energy. Expert opinion held that there was little or no connection in nature between electromagnetic radiation and biological tissue, other than gross heating effects from high doses. And so industry has gone ahead expanding its use of the electro-

magnetic spectrum with the assurance that no danger exists. We now live submerged in a sea of unperceived electromagnetic radiation.

What Is Electromagnetic Radiation?

The electromagnetic spectrum extends from wavelengths of millions of meters to ultrashort cosmic rays. Light is a special case. It is the only part of the spectrum which we can actually perceive directly. The others, like the long wavelengths used in seismic exploration, are masked from our direct perception. Clinical medicine uses the very short wavelengths in x-rays and industry exploits the largest share of the spectrum which lies between one hertz and one hundred gigahertz. The most commonly used frequency—sixty hertz—is used by electric power systems.

Only part of our electromagnetic environment occurs naturally—most of it is artificially produced. Naturally occurring long-wavelength electromagnetic radiation in the Earth's atmosphere primarily results from geophysical processes and from lightning. Extraterrestrial sources, such as radiation from the sun, account for the short wavelengths.

Human activities within the last hundred years have profoundly changed the natural electromagnetic background waves which have prevailed since the beginning of evolution. Power and communication systems have drastically altered the frequencies and the strength of the nonionizing electromagnetic radiation (NIEMR) in the environment.

Biological Effects

Recent research on the solid-state properties of biological tissue now offers us some new and troubling clues as to the interaction of life with very weak NIEMR waves. A number of scientists have begun to report biological effects due to exposure to these waves.

In some cases, investigators have succeeded in identifying the biological significance of naturally occurring nonionizing electromagnetic radiation, while other reports describe the nonthermal responses of organisms exposed to artificial radiation.

First, consider the findings that at least some birds use geomagnetic clues in their orienting processes and that disturbances in the magnetic environment disrupt this ability. Another link between life and electromagnetic energy can be found in the work of James D. Hays and Neil D. Opdyke of the Lamont-Doherty Geological Observatory. Studying oceanic sediments, they claimed that in those geologic periods during which the Earth's magnetic field reversed its direction, an unusually large number of organisms died and some species of marine life became extinct. Frank A. Brown of Northwest-

ern University has shown that living organisms exhibit changes in their behavior and physiology relating to corresponding periods in the Earth's electromagnetic environment. In still another series of experiments, this time on humans, Rutger Wever of the Max Planck Institute found that circadian rhythms are affected by the existing atmospheric electromagnetic environment.

Other laboratory experiments exposing animals and humans to artificially produced electric and magnetic fields further suggest the connection. In 1973, Dietrich E. Beischer of the Naval Aerospace Medical Research Laboratory, using ten subjects, reported that certain levels of artificially produced magnetic field exposure to humans result in elevated serum triglycerides, substances related to arteriosclerotic disease. James H. McElhany of West Virginia University showed that certain levels of low frequency electric fields can cause bone tumors in rats and Gordon Marsh of the University of Iowa found that even lower doses can interfere with the growth pattern of flatworms. James R. Hamer of UCLA reported that an electric field about one hundred times weaker than that employed by Marsh can affect animal reaction-time performance. In the microwave region, Milton M. Zarat of New York University and others reported that exposure to nonthermal intensity levels could cause cataracts in mammals.

In our laboratory, we found that rats exposed to a sixty hertz electric field for one month exhibited hormonal and biochemical changes similar to those caused by stress. The study employed an electric field comparable in strength to that produced at ground level by a typical high-voltage transmission line. In another experiment, we continuously exposed three generations of rats to the electric field and found increased infant mortality and severely stunted growth. Our results appear to indicate that the applied electric field primarily affects the central nervous system and activates the stress-response mechanism. Chronic stress can produce a wide variety of diseases and pathological conditions.

Health Hazards?

Now that abundant evidence establishes that both natural and artificially produced NIEMR can produce some biological effects, it raises serious questions of possible health hazards for humans. Nonetheless, the Environmental Protection Agency and state health or environmental agencies have not significantly supported the necessary research to establish safe exposure levels. Until now, on the assumption that the fields and energy levels associated with power and communication systems could not produce nonthermal biological effects, Western

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Electromagnetic Pollution

Continued from page 15

nations have evolved no standards to protect populations from excessive exposure. Note, however, that the Soviet Union has stringent regulations governing human exposure at both the low and high frequency regions of the spectrum.

This odd discrepancy emerges in the current diplomatic squabble between the USSR and the U.S. over Soviet bombardment of the U.S. embassy in Moscow with microwave energy. The in-

tensity level being employed by the Soviets is less than the U.S. safety level (which is based solely on the possibility of inducing tissue heating), but greater than the level which the open Soviet scientific literature indicates can cause biological effects. As a consequence, the U.S. government has no formal basis upon which to claim embassy employees may be suffering hazards to their health.

A recently released Defense Intelligence Agency report suggested that nonthermal levels of microwaves might have offensive weapons applications. The report found that Soviet scientists are aware that chronic exposure to non-thermal microwave energy has great potential for development as a means of disrupting behavior patterns and for use as an interrogation tool. It has been reported that the Soviet bombardment of the American embassy which occurred between October 1975 and January 1976 was highest at 18 microwatts per square centimeter. In contrast, the American microwave oven emission standard is 1,000 microwatts per square centimeter and the American occupa-

tional exposure standard is 10,000 microwatts per square centimeter. The Soviet exposure standard is ten microwatts per square centimeter.

The use of electromagnetic energy in the U.S. continues to expand. The generation of high-voltage transmission lines currently being constructed will operate at 765,000 volts, as compared to the present maximum of about 500,000 volts. The electric utility industry has begun developing the technology to operate at more than a million volts. The U.S. Navy has proposed to build a gigantic antenna in Michigan which would radiate at very low frequencies. Communications facilities at all frequencies continue to proliferate.

Recent scientific evidence on the biological effects of nonionizing radiation requires that we know whether or not chronic exposure is hazardous to health. This may be the right moment to halt those technologies which may result in further electromagnetic pollution until scientific studies establish safe levels not only for humans but for the entire ecosystem. □



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Mark
FEB 20 1980

February 14, 1980

The Honorable Brian Rogers
Alaska State House
Pouch V
Juneau, Alaska 99811

Dear Representative Rogers:

Legislation providing for funding and construction of the proposed Anchorage/Fairbanks Transmission Line Intertie justifies a position of highest priority early this session. Support documentation is contained in appropriate pages taken from the Anchorage-Fairbanks Intertie Supplementary Study conducted by the International/R.W. Retherford Engineering firm and an economic study performed by Anchorage Municipal Light and Power personnel in cooperation with GVEA and the Fairbanks Municipal Utilities System, copies of which are enclosed.

The figures speak for themselves. However, in the event you are not into engineering studies, we will summarize the results for you.

The following plan is recommended:

1. Build approximately 158 miles of new transmission line and connect to existing facilities at Healy and Willow at an approximate 1983 dollar costs of \$54,827,000.
2. The new section is to be built to specifications designed to ultimately transmit energy to both Interior and South Central Alaska supplied from the Upper Susitna Hydroelectric Project.
3. Once completed, the Intertie will be capable of providing for economy energy transactions, a pooling of reserve capacities, and emergency power support between the State's population centers. Further it will be used to supply energy for the Susitna Project once construction is underway.

4. The benefits are substantial. Following is a brief description of the several major ones:

Co-Chairmen
Bob Penney
Lee Wareham

Treasurer
John Spencer

Secretary
Dave Hutchens

February 14, 1980

A savings in direct fuel costs in excess of \$5,000,000 annually.

A savings in capital investment for reserve generator units of \$847,000 annually.

A savings thru displacement by electricity generated from high efficiency natural gas fired units rather than expensive oil fired generation of 425,180 barrels of fuel oil each year.

These are the major ones; there are many more.

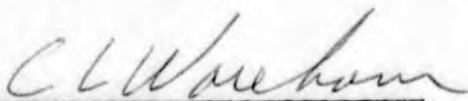
5. Financing. We propose the State appropriate \$54,827,000 from the general fund early this session and that said funds be administered by the Alaska Power Authority for the purpose of constructing the transmission line project in an expeditious manner. (SB No. 385 sufficiently addresses the funding issue.)


Further, that the utilities using said intertie be assessed appropriate wheeling and/or capacity charges sufficient to cover all operations and maintenance costs incurred by the APA following completion of the facility.

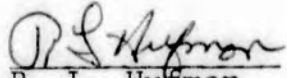
Principal and interest costs associated with the capital investment to be held in abeyance pending completion of the first phase of the Upper Susitna Hydro Project. At that time all capital costs for the line will be co-mingled with those of the prime project and amortized accordingly.

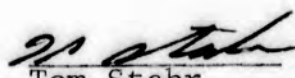
This project will benefit thousands of Alaskans and is therefore most worthy of your support.

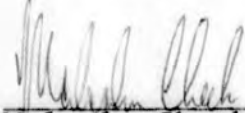
Thank you and best wishes.

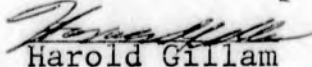

Lee Wareham, Co-chairman
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MEA


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Gen. Mgr.
Fbks MUS

Enclosures

1. Portions of Engineering Analysis
2. Economic Evaluation

INTRODUCTION

In December 1979 the Economic Feasibility Study for a possible Anchorage - Fairbanks Transmission Intertie (Intertie Study) was completed by IECO-RWRA for the Alaska Power Authority. This Intertie Study reviewed alternative intertie designs that considered the railbelt requirements for generation with and without the Susitna hydroelectric project.

The study concluded that a feasible intertie was possible without the Susitna project as well as with it. The optimized designs for the alternatives studied were for the total line length (323 miles) and included the following voltage and conductor configurations:

| <u>Alternative Cases</u> | <u>Interconnection Description</u> | <u>Voltage kV-circ</u> | <u>Optimum ACSR kcmil-no.cond</u> | <u>Capability MW</u> |
|--------------------------|------------------------------------|------------------------|-----------------------------------|----------------------|
| W/o Susitna: | | | | |
| I A & B | Anchorage - Ester | 230 s/c | 954 - 1/c | 130 |
| I C | Anchorage - Ester | 345 s/c | 795 - 2/c | 380 |
| I D | Anchorage - Ester | 230 s/c | 954 - 1/c | 130 |
| W/ Susitna: | | | | |
| II A | Anchorage - D. Canyon | 345 s/c x2 | 954 - 2/c | 1200 |
| | D. Canyon - Ester | 230 s/c x2 | 1510 - 1/c | 370 |

After study of the report it was suggested by the Anchorage Municipal Light and Power (AMLP) and the Golden Valley Electric Association (GVEA) that it would be useful to analyze an arrangement that would use existing lines (including a pending extension of a Matanuska Electric Association (MEA) line from Willow to Sunshine) with new line constructed for the remaining portion -- such new line to be built according to the design criteria of Susitna (see II A in the above Table).

The Alaska Power Authority (APA) authorized a brief supplementary study to determine the approximate transfer capabilities and construction costs of such an arrangement. The following pages report the results of this study.

Genesis of This Report

The Intertie Study concluded that a 230 kV single-circuit transmission line with a line loading capability of 130 MW is economically feasible in 1984. This line design is smaller in capacity than would be required if the Susitna Project were constructed. A line design compatible with the Susitna Project was not found feasible by 1984 although the larger capacity circuit is deemed technically preferable for the Anchorage - Fairbanks connection. Further studies were recommended toward finding a way to support this larger capacity circuit.

The suggestion of GVEA and AMLP to study an interim arrangement that would maximize the use of existing lines (resulting in the least amount of new construction) was supported by the APA as a potentially practical way to accomplish the intertie at an earlier date and provide that new construction would be compatible with the larger capacity circuits suitable for the Susitna Project.

The purpose of the following pages is to examine the technical character of such an arrangement with a view toward maximizing the power transfer capability at minimum initial construction cost.

Technical Scope of This Report

The depth of technical review of the interim arrangement described above will include only steady-state analysis of several line configurations with an assigned limit of approximately 30 degrees of power angle between the buses at Pt. MacKenzie and Gold Hill. The stability of these configurations is not analyzed. No serious stability problems are anticipated with the power angle limit as stated.

Future Stability Analysis

If it is determined that an interim system configuration as described herein be implemented, it is important to make a complete stability analysis that would consider the characteristics of such intertie, the connected rotating machinery (generators, motors) and the control characteristics (governors, voltage regulators, relaying and switching, etc.) Such a study would provide the guidelines for selection or modification of control equipment, if necessary, and establish guidelines for operating the interconnected system.

Line Configurations Studied

Five general line configurations were studied to provide information regarding line transfer capabilities and related construction costs:

- I- Existing Lines to Willow and Healy
 New 345 kV s/c line with 2-954 kcm, Willow to Susitna Jct. - 72 miles
 New 230 kV s/c line with 1-1510 kcm, Susitna Jct. to Healy - 86.5 miles
 Operate lines as follows:
- | | |
|--------------------|------------------------------------|
| Pt. Mack - Teeland | 230 kV |
| Teeland - Willow | 115 kV |
| Willow - Healy | 230 kV (add 32 MVAR Shunt Reactor) |
| Healy - North Pole | 138 kV (add 28 MVAR Shunt Reactor) |
- Use two winding transformers and no series compensation
- II- Same as I above, except:
 Use autotransformers and series compensation (20%, Willow to Healy)
- II-1 Same as II above, except:
 Existing lines to Sunshine and Healy
 New 345 kV s/c line with 2-954 kcm, Sunshine to Susitna Jct.-43.5 miles
 Operate lines as follows:
- | | |
|--------------------|------------------------------------|
| Pt. Mack - Teeland | 230 kV |
| Teeland - Sunshine | 115 kV |
| Sunshine - Healy | 230 kV (add 32 MVAR Shunt Reactor) |
| Healy - North Pole | 138 kV (add 28 MVAR Shunt Reactor) |
- III- Same as II-1 above, except:
 Operate lines as follows:
- | | |
|----------------------|---|
| Pt. Mack - Teeland | 230 kV |
| Teeland - North Pole | 138 kV (add <u>no</u> new Shunt Reactors) |
- Use autotransformer at Teeland and no series compensation
- III-1 Same as III above, except:
 Use series compensation (20%, Sunshine to Healy)

Summary and Conclusion

Load Flow studies of 13 Cases with the five configurations previously described were made using the General Electric Company "CIFLO\$" program. The line and transformer data, and the worksheets for these cases are attached as Appendix-A.

The following Table-1, "Load Flow Summary Data" contains selected data from the load flow calculations and construction cost estimates for the various configurations. These estimates were developed from the cost data in the original Intertie Study. A sample calculation is shown in Appendix-B attached.

The load flow cases studied clearly show that an interim transmission intertie operated at 138 kV from an assumed supply point at Teeland substation to connect with the GVEA existing 138 kV system at Healy is a technically feasible connection capable of transferring up to 50-plus megawatts of power from Fairbanks to Anchorage and up to 35-plus megawatts from Anchorage to Fairbanks.

It is also shown that by constructing an additional 28.5 miles of new line to Willow an additional 5 megawatts could be transmitted. A more detailed review of the work sheets shows that the "weak" links of such an interim circuit arrangement are the existing 138 kV lines.

Such an interim arrangement is easily capable of transmitting at least 200,000,000 kWh of energy annually and providing reserve capacity as indicated. This could postpone other investments and provide an opportunity for exchange of the lowest cost energy alternatives available along the interconnected system.

If it is assumed that the energy exchanges possible are worth 3 cents per kWh (fuel cost differences now appearing in Anchorage and Fairbanks support this probability) a \$6,000,000 per year minimum saving in fuel

cost is possible. The added value of reserve sharing would increase the annual savings attributable to this intertie. Depending on financing costs, it would appear that the \$45,000,000 investment is attractive particularly when it is remembered that several million dollars of the cost is for future capacity related to the Susitna Project.

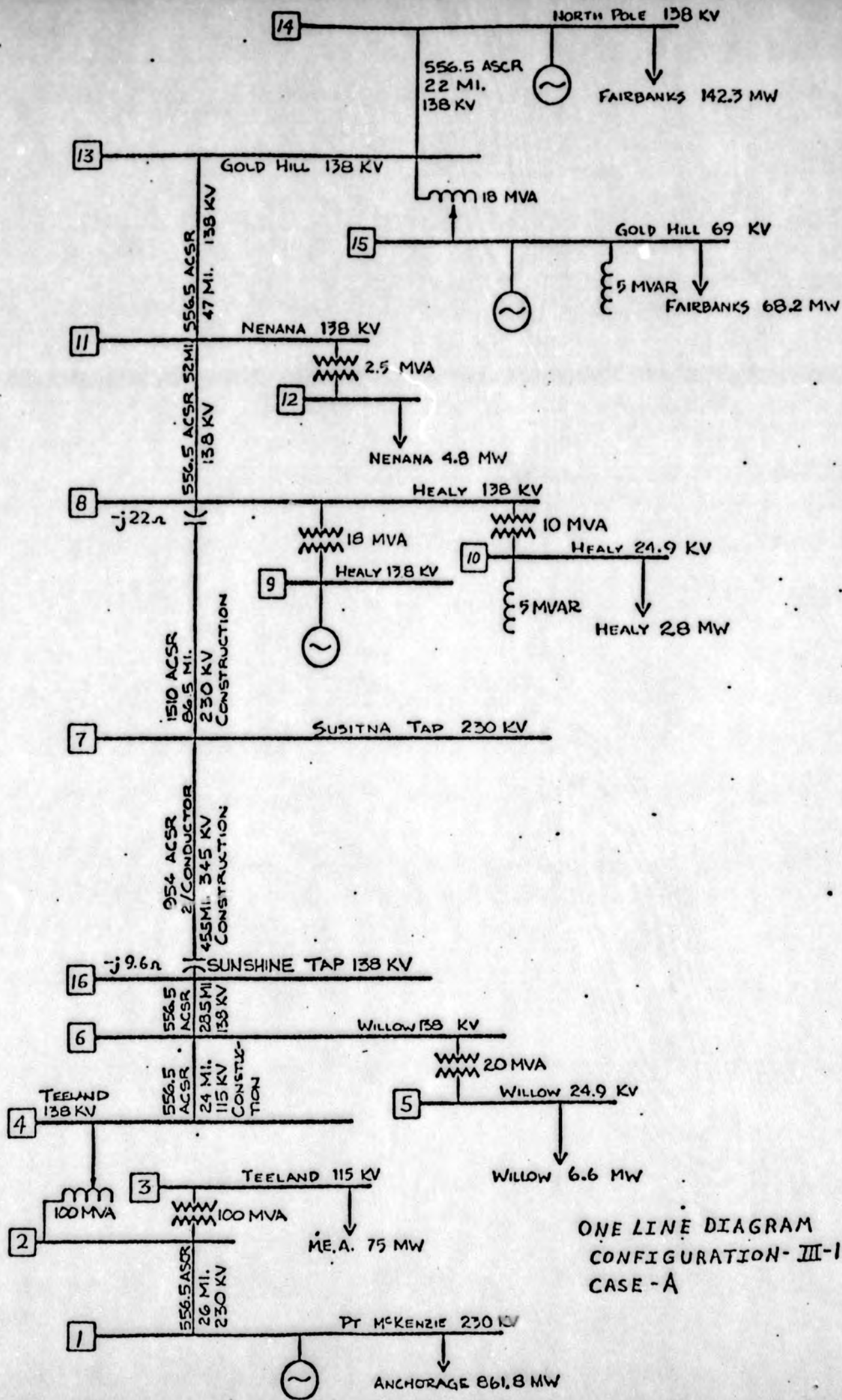
It is recommended that this interim arrangement is worth serious consideration particularly in view of the opportunity to accelerate the completion of an important segment of a renewable energy project. A decision to begin by mid-1980 would allow for construction to start in the winter of 1980-81 and for completion by mid 1983.

Additional specific studies to arrive at the basic details for design support and for negotiations of operating, wheeling and maintenance agreements should be implemented early in the course of action toward accomplishment of such a project.

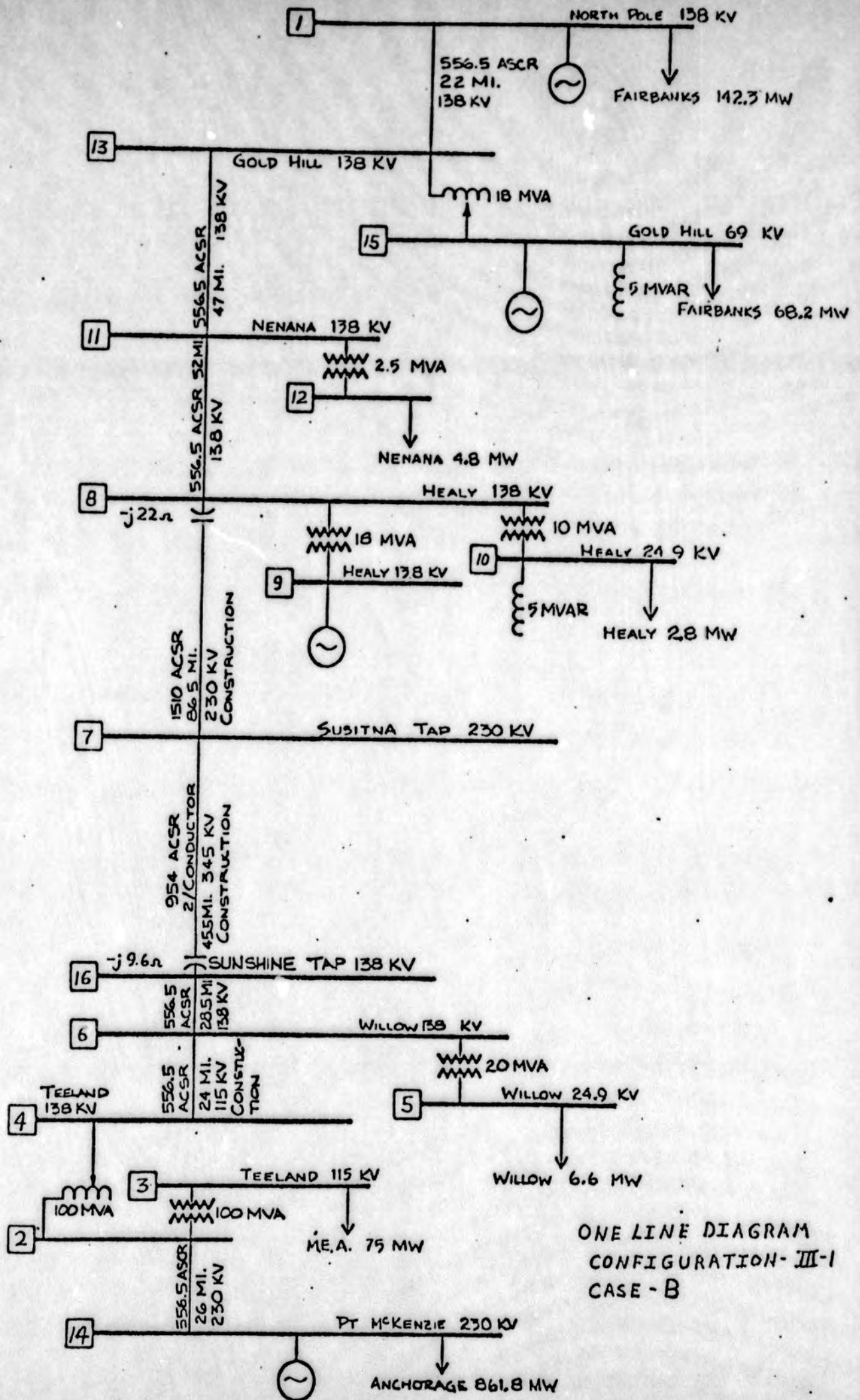
TABLE-1
LOAD FLOW SUMMARY DATA

| CASE | Load Flow Load Year | Line Section Power Transfer - MW | Line Voltage Range - % | Line Loss %/MW* | Power Angle - degrees Pt. Mack - N.Pole | Total Construction Cost** |
|-------|---------------------------------------|-------------------------------------|---------------------------|--------------------|--|------------------------------|
| I | CASE A Anch-Fbks 1984 Loads | Willow to Healy 35 | 102 to 112 | <u>2.5</u> 3.4 | 33° | \$ 63,727,000 |
| | CASE B Fbks-Anch 1984 Loads | Healy to Willow 50 | 99 to 108 | <u>2.2</u> 2.0 | 27° | \$ 63,727,000 |
| | CASE C Fbks-Anch 1984 Loads | Healy to Willow 16 | 99 to 105 | n.a. | 9° | \$ 63,727,000 |
| II | CASE A Anch-Fbks 1984 Loads | Willow to Healy 39 | 102 to 108 | <u>2.9</u> | 28° | \$ 63,371,000 |
| | CASE B Anch-Fbks 1990 Loads | Willow to Healy 31 | 98 to 104 | <u>2.5</u> 6.5 | 30° | \$ 63,371,000 |
| | CASE C Fbks-Anch | Healy to Willow 51 | 97 to 104 | <u>1.6</u> 3.5 | 23° | \$ 63,371,000 |
| II-1 | CASE A Anch-Fbks 1984 Loads | Sunshine to Healy 36 | 102 to 107 | <u>3.0</u> 4.1 | 31° | \$ 52,630,000 |
| III | CASE A Anch-Fbks 1984 Loads | Sunshine to Healy 34 | 103 to 106 | <u>2.8</u> 3.8 | 30° | \$ 44,587,000 |
| | CASE B Open circ.-Healy 1984 Loads | Sunshine to Healy 0 | 104 to 112 | --- | 3° | \$ 44,587,000 |
| III-1 | CASE A Anch-Fbks 1984 Loads | Sunshine to Healy 35 | 103 to 106 | <u>2.9</u> 3.9 | 28° | \$ 45,032,000 |
| | CASE B Fbks-Anch 1984 Loads | Healy to Sunshine 54 | 102 to 105 | <u>4.5</u> 4.2 | 31° | \$ 45,032,000 |
| | CASE C Anch-Fbks 1990 Loads | Sunshine to Healy 27 | 100 to 105 | <u>3.0</u> 7.5 | 31° | \$ 45,032,000 |
| | CASE D Fbks-Anch 1990 Loads | Healy to Sunshine 53 | 97 to 104 | <u>2.7</u> 5.9 | 30° | \$ 45,032,000 |

* Line Loss is calculated as a % of the total Generation on line for each case. MW are also shown.
 ** Construction costs estimated using unit costs from Intertie Study (See Appendix B for sample).



ONE LINE DIAGRAM
CONFIGURATION-III-1
CASE-A



ONE LINE DIAGRAM
 CONFIGURATION- III-1
 CASE - B

Report of
Technical Advisory Committee
on
Economics of Anchorage - Fairbanks
Minimal Transmission Intertie

Anchorage Municipal Light & Power
Golden Valley Electric Association
Fairbanks Municipal Utilities System

January 1980

Robert W. Retherford Associates' Anchorage-Fairbanks transmission intertie supplementary study for maximizing use of existing lines with new lines at Susitna Design capacity, completed January 24, 1980, demonstrated the probable technical feasibility of transmitting economy energy from Anchorage to Fairbanks and reserve generating capacity from Fairbanks to Anchorage over a minimal transmission line. This report examines the economics of such interchanges for Configuration III - 1 Cases A and B of the RWRA study.

ECONOMY ENERGY

From data in the supplementary study it was estimated that annual losses in transmitting 200 million KWH at economy energy from Anchorage to Fairbanks would be about 4% or 8 million KWH. 200 million KWH generated by AMLP would replace 192 million KWH generated by GVEA with simple cycle and regenerative combustion turbines averaging 13,000 BTU per KWH.

AMLP's fuel consumption to generate the economy energy was determined by using the General Electric HPROD production costing program to model generator operation. HPROD was run for AMLP's system load plus economy energy and for AMLP system load alone. The difference between the two amounts of fuel was the fuel burned to generate the economy energy for GVEA. The following table shows the fuel saved.

FUEL CONSUMPTION, MILLIONS OF BTU GENERATION BY

| <u>YEAR</u> | <u>GVEA</u> | <u>AMLP</u> | <u>FUEL SAVED</u> |
|-------------|-------------|-------------|-------------------|
| 1984 | 2,500,000 | 2,200,000 | 300,000 |
| 1985 | 2,500,000 | 2,330,000 | 170,000 |
| 1986 | 2,500,000 | 2,560,000 | -60,000 |

The 300,000 million BTU saved in 1984 is equivalent to about 52,000 barrels of fuel oil. The amount of fuel consumed by AMLP to generate economy energy increases each year; as AMLP system load grows, less efficient generating units must be operated to produce the economy fuel.

Monetary savings from economy energy, of course, depend on the relative costs of fuel in Anchorage and Fairbanks. To give an idea of the amounts of money involved without attempting to forecast fuel prices several years hence, fuel was priced at present values of \$2.85 per million BTU for GVEA and \$0.829 per million BTU for AMLP:

FUEL COSTS
GENERATION BY

| <u>YEAR</u> | <u>GVEA</u> | <u>AMLP</u> | <u>SAVING</u> |
|-------------|-------------|-------------|---------------|
| 1984 | \$7,125,000 | \$1,824,000 | \$5,301,000 |
| 1985 | 7,125,000 | 1,932,000 | 5,193,000 |
| 1986 | 7,125,000 | 2,122,000 | 5,003,000 |

The supplementary study showed that GVEA could provide 53 MW of reserve generating capacity to AMLP over the transmission line. Without this reserve capacity it would be necessary for AMLP to install a peaking combustion turbine to maintain firm generating capacity. Capital recovery costs of such a peaking turbine were estimated to be \$847,000 annually at today's prices. The value of 53 MW of reserve capacity furnished by GVEA to AMLP over the transmission line would thus be \$847,000 annually.

SUMMARY

Adding the value of economy energy to that of reserve generating capacity produced the following total value of the transmission line to AMLP and GVEA:

| <u>YEAR</u> | <u>ECONOMY ENERGY</u> | <u>RESERVE CAPACITY</u> | <u>TOTAL</u> |
|-------------|-----------------------|-------------------------|--------------|
| 1984 | \$5,301,000 | \$847,000 | \$6,148,000 |
| 1985 | 5,193,000 | 847,000 | 6,040,000 |
| 1986 | 5,003,000 | 847,000 | 5,850,000 |

COST ESTIMATE (1979 Dollars)CONFIGURATION III-1

| | | | |
|-----|--|----------------------------|---------------------|
| 1. | <u>New Transmission Lines</u> | | |
| 1.1 | Healy - Susitna Tap, 86.5 m. (sc, 230 kV, 1510 kcmil ACSR) | \$176,693./mile | 15,283,945 |
| 1.2 | Susitna Tap - Willow 71.5m (sc, 345 kV, 2 x 954 kcmil ACSR) | \$253,320./mile | 18,112,380 |
| | | | |
| | | <u>Transmission Total:</u> | <u>\$33,396,325</u> |
| 2. | <u>Substations</u> | | |
| 2.1 | Healy 138 kV Addition of Series Compensation | 150,000 | |
| 2.2 | Healy 138 kV Circuit breakers & property | 243,000 | |
| 2.3 | Willow 138 kV Addition of Series Compensation | 150,000 | |
| 2.4 | Willow 138 kV Circuit breakers and property 60 MVA Autotransformer 115/138 kV | 1,243,000 | |
| | | | |
| | | <u>Substations Total:</u> | <u>\$ 1,786,000</u> |

CONFIGURATION III-1 (Cont.)

TOTAL COSTS (1979)

| | |
|---------------------------|------------------|
| Transmission Lines | \$ 33,396,325 |
| Substations | 1,786,000 |
| Control and Communication | 3,300,000 |
| Engineering/Design | <u>3,000,000</u> |
| | \$ 41,482,325 |

DISBURSEMENTS AND ESCALATION

| | | |
|------------|-------------------|----------------------------|
| | | <u>Escalated @ 8% p.a.</u> |
| 1981 (7%) | 2,903,760 | 3,387,000 |
| 1982 (25%) | 10,370,580 | 13,064,000 |
| 1983 (68%) | <u>28,207,985</u> | <u>38,376,000</u> |
| | 41,482,325 | 54,827,000 |
| | | - <u>41,482,325</u> |
| | Total Escalation | 13,344,675 |

PROJECT COST SUMMARY

| | |
|---------------|---------------------|
| Project Costs | \$41,482,325 |
| Escalation | <u>13,344,675</u> |
| Total | <u>\$54,827,000</u> |

THE BONFIRE ROARED, throwing long shadows onto the steel and concrete base of an 800-kilovolt direct-current transmission tower in Stearnes County, Minnesota. Some 150 tough, weather-bitten farmers joked and sang around the blaze, thoroughly enjoying their wienie roast. The prairie air was sweet, and the black, rich soil was lush with corn, alfalfa and the fat, fertile Holsteins that are the backbone of the American dairy industry. Most of the men had already put in a long day and would have to be back at their barns by dawn to milk the cows.

But the farmers had more on their minds than beer and hot dogs. They were armed to the teeth with shotguns, slingshots and monkey wrenches. And they weren't a bit surprised when a group of Minnesota troopers roared up in a dozen cruisers and shouted through bullhorns that the "party" was on power-line right-of-way and would have to disperse.

The farmers yelled back that the cops could "forget it," then blinded them with high-powered lights, whipped out oversized slingshots called "wrist rockets" and opened fire using steel ball bearings. Within minutes, every window in the police cars was shattered and the officers were in hasty, undignified retreat.

The angry farmers then went to work with their wrenches. Soon afterward, two 150-foot-high transmission towers, worth at least \$100,000 each, had crashed to the ground, victims of what the farmers affectionately call "bolt weevils." The wienie roast was over, but it had cost the builders of the power line at least a quarter of a million dollars.

That "roast" last summer was just another battle in the farmers' war for solar energy and against a string of 800-kilovolt transmission lines being built across their land. The 420-mile line is due to begin commercial operation some time this month. The farmers don't intend to let that happen.

THE MINNESOTA POWER line is the \$350 million spine of a \$1.25 billion project that is a key element in the massive exploitation of Western coal. The package includes a North Dakota coal mine, a 1000-megawatt coal-fired generator near the mine mouth, two switching stations and the power line. The deal has been put together by two Minnesota electric cooperatives, the United Power Association (UPA) of Elk River and the Cooperative Power Association (CPA) of Edina.

Any scenario for America's energy future that includes fossil or nuclear energy is built on the idea that large central generators will send huge amounts of power long distances "by wire." The basic strategy is to burn the coal at the mine to avoid high shipping costs and then send the juice by wire to the cities where air-pollution levels are already far too high to consider burning more coal in or near them. Obviously, with as many as seventy new coal-fired generators being considered for construction throughout the West, reliable ultrahigh-voltage power lines will be needed.

HARVEY WASSERMAN's next book, *'Energy War: Reports from the Front,'* will be published this fall.

There are currently almost half a million miles of these power lines strung across the United States, involving rights-of-way equal in area to New Jersey. Without these channels for transmitting large amounts of current from source to user, the American energy picture would have to be radically revised. Which is just what some of the Minnesota farmers want.

One of the first acts against the power line was in June 1976, when an irate Stearnes County dairyman named Virgil Fuchs ran his tractor over some surveying equipment. Fuchs' chief gripe was that the line would rip his acreage into separate pieces. "We work as a family," he complained. "We paid to buy our land close together to operate as a family farm." The last thing he wanted was the "horrible predicament" of giant electric towers cutting up the family parcel.

Fuchs' neighbors and friends had similar feelings. Of 476 Minnesota landowners who had their property crossed by the line's route, only one-third willingly sold easements. The rest were forced to sell by the

Union in 1967 and 1968 on workers continuously exposed to electric fields. High blood pressure and various nervous disorders were common symptoms, as was decreased sexual potency.

Some parallel American studies have yielded similar conclusions. Dr. Andrew Marino, a biophysicist at the Veterans Administration Hospital in Syracuse, New York, and Dr. Robert O. Becker, an orthopedic surgeon, conducted studies in 1976 showing that mice born in electric fields, like those created by high-voltage power lines, grow to be just two-thirds the size of control

disease with electromagnetic radiation," Marino explains. "Instead, the field acts as a biological stresser. It imposes a physiological burden that the body must resist. When the body is overtaxed, general resistance breaks down. What results is disease to which the animal was previously prone."

In human beings, proven symptoms include hypertension and abnormal blood levels of serum triglyceride, an indicator of heart disease confirmed by the U.S. Navy's Beischer Study in 1973.

Industry reaction to Marino's and other scientists' work in the field ranges from

Revolt of the BOLT WEEVILS

courts. "They came in here and started pushing people around," says Gloria Woida of Sauk Centre. "They said, 'We're going to cram this power line down your throats.' So we said we'd cram it right back."

Since the resistance began, 200 farmers and their supporters have been arrested, eight towers toppled and thousands of glass insulators shattered—\$400,000 worth since January 1st, by company estimates. The Midwest prairie now rages with what is probably the most crucial energy confrontation in the United States today.

S WITH NUCLEAR POWER, mass concern about the safety of high-voltage transmission lines is a recent development.

The first major challenges came in Ohio in the early Seventies, when farmers found 765,000-volt lines and towers to be an ugly intrusion. They also found themselves on the receiving end of heavy electric jolts, especially in wet weather. "You never know when you're going to get a shock," says Clovis Strausbaugh of Wilkesville, Ohio. "It depends on how much electricity they are sending through and the weather and various things, but you can't tell what to expect. The electric company calls that a 'nuisance.' I call it living in fear."

The Ohioans also complain about a constant humming and crackling noise that began to make them worry about possible health hazards. Their fears were partially confirmed by studies done in the Soviet

The prairies rage as farmers topple power lines in today's most crucial energy confrontation

BY HARVEY WASSERMAN

animals. "There's no question that people are justified in trying to stop these lines," Marino maintains. "The danger has been established beyond all reasonable doubt. If at all possible, people should not be exposed to the field created by these lines."

Marino says that at least seventy studies have been published in the past few years indicating, among other things, that mice, monkeys, humans, birds, fish, dogs, flatworms, slime mold and flowers exhibit various abnormal symptoms when exposed to the electric fields. "There's no signature

low-level outrage to shouts of "garbage." "We've been given a clean bill of health," says Bob Sheldon, a thirty-four-year-old public-relations man for the CPA. "There's no reason whatsoever to suspect any problems from these lines." Harry Kronberg of the industry's Electric Power Institute adds that despite "the best scientific methods to identify them," the electric fields cause no "biological effect of significance."

The staff of the New York Public Service Commission, however, disagreed. "People who work on or near the lines should be

RANDOM NOTES

accident in Sylmar, California. Guercio and his instructor (who is in critical condition with a broken back) had taken off from a 100-foot cliff when the wind suddenly died and their glider plummeted to the ground. . . . **Michael Murphy** met Geronimo's ninety-year-old grandson, medicine man Joe Sunhawk, in Taos, New Mexico, recently and played him an impromptu version of "Geronimo's Cadillac." Sunhawk responded by doing a tomahawk dance, and later said that his grandfather would have liked the song. . . . Director **James Bridges** has signed **Jerry Hall** for a small role in *The Urban Cowboy*, currently shooting in Texas. . . . Part-time pitcher **Meat Loaf** has been named to the Broadway Show League's All-Star Team, along with comedian **Robert Klein**. . . . **Linda Ronstadt** sings harmony on the title track of *An American Dream*, the upcoming **Dirt Band** album that also features a reggae version of "Wolverton Mountain."

When **Jimmy Buffett's** wife, Janie, gave birth to a seven-pound baby girl last month, the first-time father—"like any normal parent"—staged a welcoming wingding that lasted nearly fifteen hours. "Savannah Jane was born at

Is disco slipping in the disco capital of America? Maybe—if you're prepared to swear by the April-May Arbitron ratings for New York-metropolitan-area radio stations. All-disco WKTU-FM, which stunned the music industry when it toppled longtime Top Forty ratings giant WABC-AM last spring, remains number one, but has dropped slightly. Strangely enough, the number-two spot is now held by WOR-AM, an all-talk station, with the mostly disco WBLS-FM placing a very strong third. WABC remains at number four.

Disco-sucksters shouldn't leap to any rash conclusions, though. As WKTU station manager **David Rapaport** calmly explains, "There's always a statistical error in these surveys. WOR was probably underestimated before; and when WBLS changed to ninety-nine percent disco, a lot of the listeners who'd been listening to us probably went back." The bottom line: "There are two disco stations now, and they have a fourteen percent share of the market."

In other words, no relief in sight for rock loyalists.

Cheap Trick's road manager, **Kirk Dyer**, was sliced on the chest, ribs, forearm and thigh when he prevented a knife-wielding Trick fan from

twenty years ago. . . . **Graham Parker, Lene Lovich, Alan Price, Rita Hayworth and Tatum O'Neal** were among the celebs who showed up for a disco party at the City National Bank in Beverly Hills on June 21st. Guests of honor were the **Jacksons**, who were given their latest passel of platinum records and international awards in the bank's vault. . . . **Nigel Olsson** was injured in a car crash in Atlanta on June 26th, when he drove past a stop sign that was reportedly "hidden by vegetation" and collided with another vehicle, whose driver was killed. Olsson has been charged with unintentional vehicular homicide, a misdemeanor.

I thought I was havin' a heart attack, it was so emotional," says ex-Fug **Ed Sanders**, describing the first performance of his *Karen Silkwood Cantata* at the Creative Music Studio near Woodstock, New York, on May 20th. "I mean, there were people in the audience weeping."

Written for two guitars, piano, drums, violin and bass (and three actors), the two-hour *Cantata* traces the antinuke martyr's life "from cradle to crash, as it were," Sanders says. "It's half-Sixties, half-six-o'clock news, with vocals, jazz."

Until he can bring an expanded version of the *Cantata* to New York this fall, Sanders is concentrating on two other projects—a book about the Eagles ("The new record's real good") and a possible reunion of the fabulous Fugs. "It would take a certain amount of moola to get everybody together, but this is the year to do it—just do one set, and then fold it forever."

It's not fashionable, it's short," says **Frank Zappa** of his new haircut, the first in "hundreds of years. I used to wear these little rubber-band things in my hair, and when I'd lose them, all my hair would just fall into my face. Finally, I just said, 'Fuck it,' and had Gail [his wife] cut it."

Zappa has also "laid off" his band and canceled his late-summer tour. He is currently completing a book to accompany *Joe's Garage*, his upcoming three-record opera (which he eventually hopes to make into a movie). "Frank is extremely tired," says a source close to the composer. "He rehearses sixteen hours a day, non-stop. His wife is having a baby in August, and the studio he's been building in his home will be finished September 1st. He feels it's irrational to go on tour now."

Frank Zappa, sans band, shows off his new hairstyle and recording studio at home in California.



seven a.m.," Buffett reports, "and I cracked the champagne at 7:30. **Jack Nicholson** and **Angelica Huston** came over, and some other friends, and the party went on till ten that night. Then there was the coming-home-from-the-hospital party and a couple of others. It was really about a week's worth of parties."

The new arrival is said to look a lot like her happy dad—not that he cares. "She just looks like Savannah to me," Buffett beams.

running onstage during a recent concert at the Beaumont Civic Center in Texas. Dyer and a security guard, who was also cut during the scuffle, were both treated at a local hospital and released. . . . **Blackfoot** leader **Rickie Medlocke** brought his sixty-seven-year-old grandfather out onstage in Jacksonville, Florida, to play harp on "Train, Train"—a song the elderly musician had written for his own band, **Shorty Medlocke and the Florida Plowhands**,

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cautioned against chronic exposure to the electric field," the staff wrote in a 1977 report to commission officials. They also recommended that buildings and fences in the area be grounded, vehicles not be refueled nearby and children not be unloaded from school buses under the line.

New York's 765-kilovolt line was completed despite ferocious local opposition and the staff report. But if Marino and his colleagues are correct, those half-million miles of power lines crisscrossing the country are doing us no good.

Meanwhile, the farmers have other prob-

WHEN THEY WANTED TO bring the line in, they said it was safe," says Jackie Thurk of Villard, Minnesota. "Then, when they tested it, they put up signs around it warning people to stay away because it was unsafe."

A mother of three, Jackie was recently convicted of assault after demonstrating against cement trucks headed for the power line. "They've lied to us so often you get so you don't believe anything they say at all," she adds bitterly.

With her husband, Kenny, who milks

really just using the CPA and UPA as a front for expansion, and the power lines are not only destructive but unnecessary. The two cooperatives are tied to the Mid-Continent Area Power Pool, a Midwestern electric grid dominated by the Northern States Power Company, a large Minneapolis investor-owned utility. "The electricity will go to the cities," says John Kearney, a Minneapolis organizer. "The profits will go to the big privates."

The cooperatives say otherwise. "We have to supply our share of the system's

sued troopers fleeing. Right now he faces conspiracy charges stemming from a high-powered rifle bullet that found its way through the window of a tower guard's pickup.

The Woidas are key figures in the power-line resistance movement and work closely with urban activists like John Kearney and George Crocker, the latter a gangling, bearded pacifist who went to prison rather than Vietnam. Now Crocker works in Lowry, Minnesota, and helps publish *Hold That Line*, a lively newsletter for farmers. For a while, the state media tried to make a divisive issue of antiwar and antinuclear radicals working in the right-wing prairies. But it didn't work, and the farmers have escalated their campaign to include active opposition to the local Monticello and Prairie Island nuclear plants.

"The city people had a lot to teach us," says Gloria Woida, looking warmly at John Kearney, who is munching dinner at her kitchen table. "Now we sort of view them as family."

In addition to antinuclear activists, the power-line farmers have struck up an alliance with local Indians. Earlier this month, a power-line delegation joined native American and antinuke forces for a dramatic march through the Black Hills to protest the mining of uranium on Indian land. The power-line farmers now use the same legal team that defended Indian activists after Wounded Knee, and Clyde Bellecourt, leader of the American Indian Movement, has called the farmers "the new Indians."



lems. Cows are supersensitive to electric current, and the introduction of even small doses of it has brought about claims of decreased milk production and disease. The towers can also disrupt key plowing and irrigation patterns. Moreover, nearly all the national power-line rights-of-way are routinely sprayed with toxic herbicides to keep them clear of weeds and underbrush. In some cases, utility companies use close cousins of Agent Orange, the notorious Vietnam defoliant linked to cancer and birth defects. The stuff is often sprayed from helicopters, and lack of precision can be fatal.

In the early days of the confrontation, there was talk of putting the power lines underground, which Andrew Marino feels would eliminate most of the health hazards. But the companies balked at the cost, which they said could be ten times as great as building the towers. They also believed the environmental impact would be greater.

Despite the controversy, the Bonneville Power Authority, based in the Northwest, is moving ahead with plans for a gigantic 1.2 million-volt transmission system to carry juice 1200 miles, from Washington State to Phoenix. Near South Bend, Indiana, the American Electric Power System is testing a line designed for up to 2 million volts — two and a half times bigger than what has been run through Ohio and upstate New York, capable of carrying more than five times the electricity that has brought war to Minnesota.

Farmers protest power-line construction near Lowry, Minnesota.

thirty Holsteins, Jackie lives in a comfortable ranch house recently converted to wood heat. "Saves us a good \$500 a year," says Kenny, pointing proudly to the fat new cord burner in the living room. Like his wife, Kenny has been arrested and has the snapshots to prove it. "Knead me in the back and threw me over the fence," he says with a wry smile. "One of them did a real good job on the kidneys."

The Thurks, both in their late thirties, are troubled by the economics of the power lines. By company admission, the project will double electric rates by 1981 and, says Kenny, staring out at the giant tower crossing his property, "we won't get a thing out of it." He feels the power lines are for Minneapolis and Chicago, not for his family.

The CPA and UPA are actually federations of thirty-four smaller rural power cooperatives, and thus are technically the property of the very farmers who are determined to stop the power lines. Farmhouses ring with dark rumors of corruption at co-op headquarters and with angry charges that the big, urban private utilities are manipulating the management of the rural companies to get a shot at the cheap federal loans that are available through the Rural Electrification Administration.

The farmers charge that the "system" is

power," says the CPA's Bob Sheldon. "Every bit of power used by our customers has to be generated from somewhere. This project is just our share of the system."

IT WAS JUST A MIDDLE-class farmer's wife yelling about the boys who 'wouldn't go fight for their country' in Vietnam," says Gloria Woida. "If you'd've told me I'd be fighting the state like this, I'd've said, 'You're nuts!' But we've been invaded!"

Gloria is a blond, vibrant, wisecracking mother of four who dominates the kitchen of her family's farmhouse like the captain of a ship. Her husband, Matt, is a tough, wiry fifty-one-year-old with a pencil mustache and a fierce temper. In December 1977, the power companies had to call in eighty-six police cruisers to oversee the surveying of the Woidas' 320-acre dairy farm. The family had learned that the towers would obstruct their three-year-old \$60,000 irrigation system, costing them \$20,000 per year in damages. The companies offered the Woidas a one-shot \$17,500 payoff, plus a few hundred dollars a year in compensation. Matt never picked up the checks, and when the police came on his land and maced protesters, they responded the next day with an anhydrous ammonia spray unit, sending the maroon-

FOR SOME OF THE FARM-ers," complains Bob Sheldon, "there doesn't really seem to be any solution short of tearing down the power lines. I don't really know why they're fighting. I'm not even sure if the farmers know."

They know.

"We want solar energy," says Gloria Woida. "We want all our farmers to be energy self-sufficient. And there's no reason why we can't be. We don't need those damn nuclear plants or strip mining. You can make a solar collector out of junk and it won't look like much, but, by George, it'll work. We've got wind and methane and we can grow our own grain for alcohol, just like in the moonshine days. And I'll tell you something, if the people decide that solar energy is what they want, there's no way the government is going to squash it."

"I expect in a few years we'll be sitting here totally energy self-sufficient. And that power line won't be operating."

In its own way, the companies seem to agree. For a while they tried posting full-time guards along the route, but the damage level increased. Martial law was declared in Stearnes and Pope counties in the winter of 1977-78, but that didn't work. And now Minnesota's new governor, Albert Quie, has named "power-line vandalism" as the top priority for the Bureau of Criminal Apprehension.

"I'm confident the line will open," says Sheldon. "I'm not very confident how reliable it will be. There's virtually no way to provide twenty-four-hour protection for such a long line. It's the same everywhere in the United States. You have to admit, it's a vulnerable system."

~~GOP~~

Mark

Feb. 22, 1980
Fairbanks, Ak.

Honorable Members of the Legislature
State Capital
Juneau, Ak.

Gentlemen;

I am encouraged by the testimony before the Senate Resources committee, regarding the Foks. Anch. Electric tie-in. In my opinion, this project is not, as some say, ten years ahead of time, but ten years behind time.

I feel that the Fbks, Anch. Electric tie-in should be only the start of a State Wide electric grid which would utilize the most efficient electric producing resources of each area of the state, water, wind, coal or what ever is the cheapest and most abundant.

Rather than waiting until we are suffering a shortage before developing new generating facilities, and then building for only the present, utilizing the most expensive power generating facilities available, we should be building for years in the future and taking advantage of reasonable electric power rates for both domestic and industrial uses.

I feel that there is no question about the type energy suitable for the arctic and the semi-arctic; electricity. We have enough water potential in the state to furnish electric power for the state of Alaska, western Canada and a good bit of the western United States. We have enough wind in various sites on the coast to almost power the state on wind alone. With a state wide grid, the intermittent power from the wind could be utilized. If wind and water did not suffice we have enough coal to power the state for several generations. Coal fired generating plants located in remote areas where much of the coal lies should offer no pollution problems.

Cheap power is the answer to making a success of life in this state. We have a - once in a lifetime opportunity now to build a state wide power system with our overflow oil revenue. We can invest this money in any number of things which will eat it up, or we can invest it in a system which will benefit the whole state for several generations to come.

As for peoples who might be displaced by water back-ups, do not take a page from the Feds, book and just kick them off, with a token payment. Make moving attractive to them. Resettle them at a site of thier own choosing. Provide decent housing, power, sanitation and an industry which would provide for thier futures and thier self respect. The overall benefits to the state would pay for such moves and impose no burden on the state.

respectfully

Jack V. Ferguson

DO NOT
ANSWER

D. System Expansion Plans

To determine the intertie's economic feasibility, alternative system expansion plans were prepared with and without the Anchorage-Fairbanks intertie. System expansion plans were developed to meet both the "probable" and "low" load demand projections.

To assume a nearly constant level of power generation reliability (LOLP Index) for all system expansion plans, a multi-area reliability (MAREL) computer study was performed. Annual load models for both areas were developed. The load models indicate that there is little diversity between the loads in the Anchorage and Fairbanks areas.

The 1984-1997 study period was selected to best suit system requirements. The earliest year when the intertie can be operational is 1984. Based on optimistic assumptions, the last generating unit of Upper Susitna Hydro-power Project will be on-line in January 1997.

E. Facility Cost Estimates

Cost estimates were developed for alternative system facilities to allow for economic comparisons. All costs were adjusted to January 1979 levels. Transmission line costs were calculated by using the TLCAP program. The same computer program calculated the line losses.

To provide a means for optimum economic dispatch of generating units on an interconnected system basis, costs for control and communication systems were included in the intertie cost estimates. Cost estimates for new generating plant facilities (gas-turbine units and coal-fired steam plants) were based on cost information in the Power Supply Study - 1978 report to GVEA, prepared by Stanley Consultants. Appropriate Alaskan construction cost location adjustment factors were applied to derive specific site cost estimates.

Construction power costs for the proposed Susitna Project were calculated. The results indicate a clear advantage for utilizing the intertie as a source of construction power.

F. Economic Feasibility Analysis

The economic feasibility analysis of the intertie was performed by discounting two cash flows (independent and interconnected systems) to a common year and then measuring the project benefits by the net present worth value. Facility costs for those new generating plants not affected by the introduction of the intertie were excluded from the analysis. The Transmission Line Economic Analysis Program (TLEAP), a computer program, was used to analyze the sensitivity of different escalation and discount rates on the capital costs of various alternatives. For principal investigations to establish definite feasibility analysis a 10% rate was used to discount cash flow in constant 1979 dollars.

G. Financial and Institutional Planning

A preliminary financial plan for implementation of the transmission intertie on a progressive basis was developed. The probable composition of institutions and participating utilities for ownership, management, and operating responsibilities is reviewed in this report, and present arrangements and possible future requirements are discussed.

2.2 CONCLUSIONS

The study shows that:

- The 230-kV single circuit intertie, having a 130-MW line loading capability (Case IA), is economically feasible in 1984, based only on benefits due to reduction of generation reserve plant capacity (reserve sharing). The net present-worth of the benefits are \$12,475,000. The benefits become marginal (\$945,000) if intertie costs are increased by 25 percent. In the case of "low" load forecast scenario the benefits are \$2,704,000.

- 2
- An increase in benefits is obtained if the 230-kV single circuit intertie (double circuit after 1992), in addition to generation reserve sharing, includes firm power transfer capability (Case IB). The benefits are \$24,054,000 or an increase of 93 percent over Case IA. Additional benefits due to supply of construction power to the Upper Susitna Project sites are \$5,579,000.
 - The 345-kV single circuit intertie (Case IC) is not economically feasible in 1984 based on the two scenarios developed in this study: generation reserve sharing only and reserve sharing plus firm power transfer capability. In the second scenario the results are negative (\$-426,000). Further studies are recommended to pursue the economic feasibility of the 345-kV intertie because from technical point of view the 345-kV voltage is more appropriate for the transmission distance between Anchorage and Fairbanks.
 - The 230-kV single circuit intertie with intermediate substations at Palmer and Healy (Case ID) is economically feasible in 1984. The benefits are \$20,344,000 including the power supplies to MEA system to Palmer and the proposed Upper Susitna Hydropower Project sites. If intertie costs are increased by 25 percent the benefits become \$11,656,000.
 - The fully integrated interconnected system operation generates additional benefits which are not quantified in this study. These benefits could be due to:
 - Decrease in spinning reserve requirements by reducing the on-line plant capacity for the combined system.
 - Coordination of maintenance scheduling which would improve combined system security and provide cost savings.
 - Economies from optimum dispatch of generating units on the interconnected system basis. It is definitely recommended that a multi-area production costing simulation study be performed to establish these additional benefits.

- Expansion plans for the interconnected system with the proposed Upper Susitna Project were developed to determine the effect of this project on the interconnected system expansion plans, the displacement of thermal generating units, and intertie transmission requirements with Susitna Project.
- If an early 230-kV transmission intertie is constructed in 1984, due considerations should be given for constructing the Anchorage-Susitna portion of this intertie for 345-kV and operating it temporarily at 230-kV.
- The average value of energy transfer cost (1984-2015) thru the 230-kV intertie is 32 Mills/kWh at 55 percent load factor when financed by 40/60% REA/FFB loan package and municipal bonds issued by Anchorage and Fairbanks.
- This Intertie Feasibility Study is only a part of the over- all power system expansion plans for the Railbelt area. Further studies will be required to establish definitive characteristics for this transmission intertie. These studies should be closely coordinated with the future expansion plans of all utilities in the Railbelt area.

Mack - Herz are some samples -

POWERLINE!

DEBORAH

I. Mismanagement

II. Health & Safety Effects



United Power Association and Cooperative Power Association have been working on the Coal Creek plant and powerline for many years. Two of the major points raised by citizens protesting the project have been (I) its costly mismanagement and (II) its health and safety effects.

I. Mismanagement

According to Cooperative Power Association's "Power Cost Study and Financial Forecast, 1979-1991", CPA members alone will have paid over \$1.4 billion just for debt service and interest expenses on this project by 1991. By then, only \$43 million will have been paid on the principal. Such costs have already caused bulk electric rates to more than double in the past two years. In 1977 CPA sold bulk power for 14.53 mills per kilowatt/hour, and it is up to 29.38 mills per Kwh for 1979. CPA projects rates will nearly double again by 1981, and by 1990 CPA aims to sell electricity for 80 mills per Kwh.

While UPA/CPA have been planning such rate increases for a long time, they have engaged in a massive advertising campaign during the summer of 1979 which claims that powerline protesters are the culprits responsible for rising

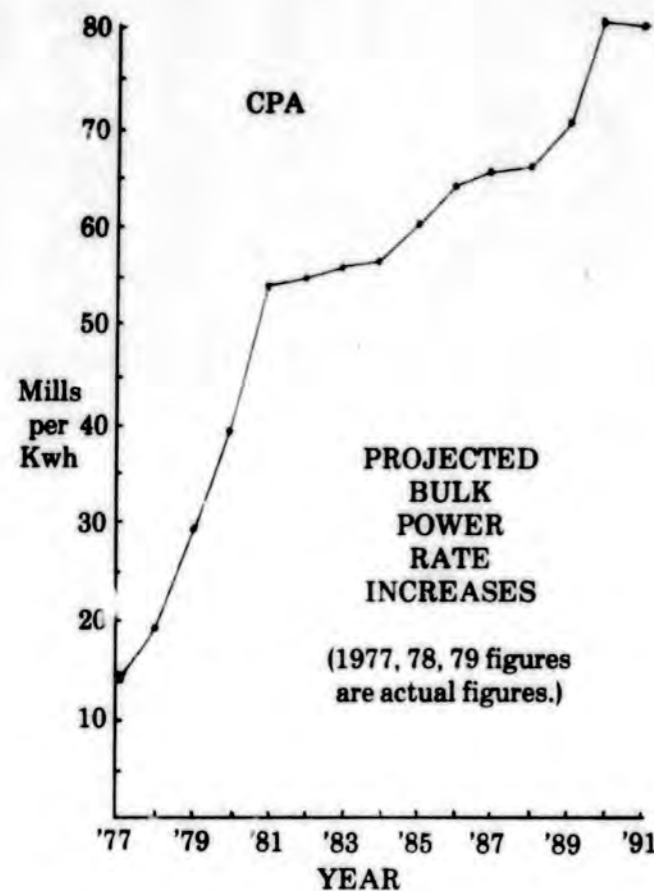
electric bills. UPA/CPA are using protesters as the scapegoat, but the only conclusion supported by UPA/CPA's own figures is that bad decision-making and gross mismanagement by UPA/CPA are the major reasons for increased costs to consumers.

Such a conclusion is documented by the CPA forecast, and by Theodore Barry & Associates, a consultant firm hired by CPA to find out what was wrong with this project. They concluded that CPA had been taken for a sucker by the Coal Company and that a mine-mouth plant should never have been built.

Such a conclusion is also documented by Booz, Allen & Hamilton, the consultant retained by UPA to figure out what to do about "schedule slippage and cost increases." In defining the problem, the consultant reported that material is being lost, work is done in the wrong order, engineering is sloppy, labor is inefficient, and so forth. Like we said, poor management and bad decision-making.

In the fall of 1978, UPA/CPA claimed \$140 million in damages due to the protest, a figure used by Governor Quie and other state officials to justify their misguided attempts to stamp out the protest. Of that \$140 million, \$90 million is 34 years' worth of interest, \$685,000 is listed under "security guards," and \$200,000 is actually called "vandalism."

All the rest, over \$49 million, is listed under such categories as hearings, data gathering, environmental protection costs, costs of re-negotiated contracts for accelerated work schedules, costs of additional material needed to meet required route changes and license requirements, additional supervisory costs, etc. As of the fall of 1979, the powerline protest is responsible for less than 1/2 of 1% of the increase in electric bills.



THE MORE IT COSTS, THE MORE WE USE?

According to CPA, the tremendous rate increases will somehow stimulate ever greater electric consumption. Even though CPA's demand peaked at 474 megawatts for both 1977 and 1978 (1976 wasn't far behind), they project a 1979 peak of 535 MW. By 1992 it is all the way up to 1237 MW. That is a projected peaking increase of over 8% per year, compared with an average national peak growth rate of 1-3% for the past several years. Another Minnesota utility, Northern States Power Co., experienced a summer peak electrical load for 1979 that actually *dropped* from the peak level in 1978.

The figures for total energy sales are almost as outlandish, with sales climbing from 2,259,000 Mwh in 1978 to a projected 5,500,000 Mwh in 1991. In a valiant attempt to meet their projections, UPA/CPA are pushing wasteful electric consumption, especially resistance heating.

With both rates and sales projected to increase exponentially, there is a violation of some very basic economic laws. Things are so far out of line that, according to CPA's figures, CPA is paying almost *twice* as much for the electricity they generate themselves as they pay for the electricity they purchase.

If we grant that this powerline will deliver 900 MW and that the investment for the project is \$1.24 billion, there is a cost of \$1,348 per kilowatt. The Barry Report states that \$450 is average for a fossil fired unit coming on line in 1980. There are 2 MW wind systems in operation at a cost of only \$360 per kilowatt, and wind is the most expensive alternative energy. Clearly, renewable sources already have a cost advantage over coal and nuclear facilities.

IF WE CAN AFFORD THIS ELECTRICITY, IT WILL KILL US.

II. Health & Safety Effects

The 800 KV DC powerline that runs through central Minnesota is a deadly means of energy transportation. The health effects of the line are every bit as dangerous as the radiation that leaked out of the Three Mile Island nuclear plant or the emissions of coal plants which form acid rains. The danger of the line comes from shocks, ionized gases formed by corona discharge, and from exposure to the electromagnetic field.

SHOCKS. Available literature indicates that shocks should be no more than "annoying inconveniences," yet there have already been dangerous jolts experienced under the line. While long-term problems created by repeated shocking should not be ignored, it is only a matter of time until a shock is the secondary cause of death or serious injury to someone working with machinery near the line.

AIR IONS. Air ions, or charged particles, are associated primarily with DC lines. The 1977 Minnesota Department of Health report, *Public Health and Safety Effects of High Voltage Overhead Transmission Lines*, views air ions with particular concern, stating, "In fact, it can be reasonably argued that the space-charge field [which forms the ion cloud]—from a public health and safety perspective—is the dominant DC effect.

The immediate effect of over-exposure to negative ions is similar to the effect of too much alcohol. Over-exposure to positive ions brings on headaches and a mental state of irritability and depression. Long-term effects of ion exposure are not well understood. Air ions also reduce the resistance of the atmosphere around the powerline, thus increasing the strength of the electromagnetic field.

CORONA DISCHARGE. The amount of corona discharge, or line loss, depends upon the line voltage and the diameter of the conductor. Any imperfection on the conductor, such as dust, scratches, corrosive pits, or water will cause an extremely high localized discharge. Corona discharge means that some of the electrons escape from the wire into the surrounding air, where they collide with the air molecules.

The split air molecules are chemically activated and can form new molecules, including ozone and nitric oxides. These chemicals are highly toxic to plant, animal and human life, even in very small concentrations. One ozone molecule per 12 million air molecules can be dangerous to

humans. Nitric oxides are ten times as toxic as ozone, and may combine with water in the air to cause acid rain to fall along the line route.

Preliminary calculations indicate that for every day the line is fully operational, each mile of line will produce 60 lbs. of ozone and 40 lbs. of nitric oxide! The line is over 425 miles long.

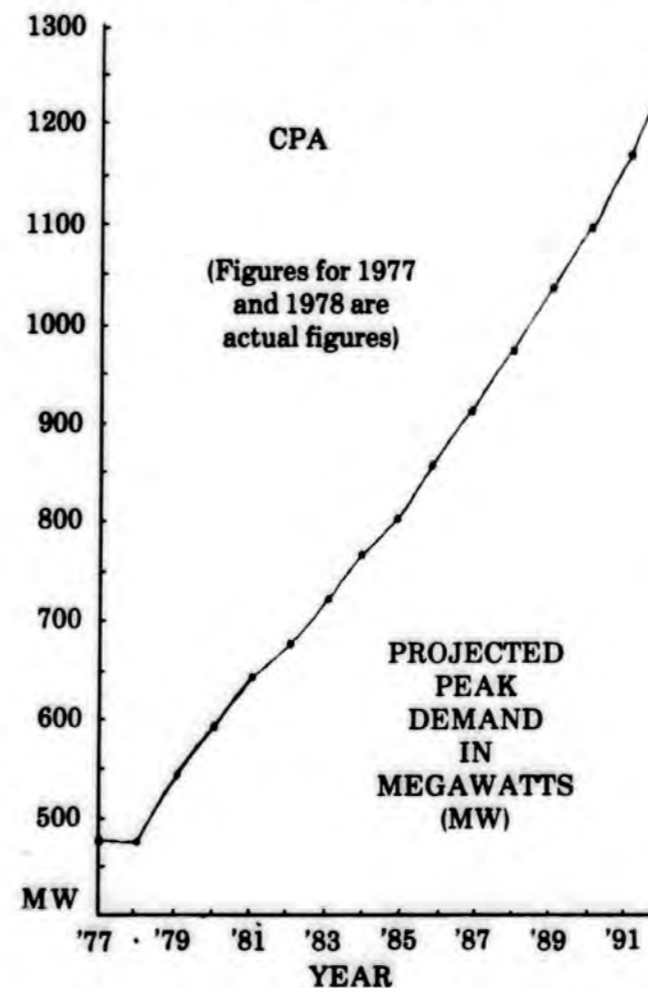
The symptoms of ozone and nitric oxide contamination are similar, and the initial effects include sinus trouble and the misery of an asthma attack. Other effects include chest pains, rapid heart beat, vomiting, coughing up blood, swollen glands, burning eyes, diarrhea, dizziness, and forgetfulness. Long-term effects include lung and heart damage and possible chromosome damage.

Corona discharge information source: Dr. Merle Hirsch, Physics Dept., University of Minnesota, Morris, authority on electrical discharges in the atmosphere.

ELECTROMAGNETIC FIELDS. The most subtle hazard posed by this powerline comes from exposure to electromagnetic fields, EmFs. Indeed, there is consensus throughout the scientific community that much more research needs to be done on the relationships between EmFs and life. Yet there is a substantial body of knowledge on the effects of EmFs. Just as the EmF is our most reliable information carrier (radio, television, etc.), living nature has used EmFs in the process of evolution to obtain information about changes in the environment as well as for the transmission, coding and storage of information within biological beings.

It has been found that in some cases the reactions of living organisms to EmFs occur only at certain "optimum" intensities. In other cases the effects increase when the intensity of the EmF is reduced, and in other cases the reaction to low and high intensities are of opposite nature. Cumulative biological effects produced by repeated exposure to EmFs at intensities well below the effective threshold for a single exposure have been observed. There is a virtually limitless number of variables which influence the effect of exposure on any particular living thing.

The informational aspect of the interaction of EmFs with biological organisms is very important, because these effects to *not* depend upon the amount of energy introduced into the system, but on the amount of information introduced



into it. This is known as the "trigger phenomenon," because very small amounts of energy can trigger major biological changes. Thus, in a 1977 document prepared for the utility industry and the Federal government by Battelle Pacific Northwest Laboratories entitled *Biological Effects of Static and Low-Frequency Electromagnetic Fields: An Overview of United States Literature*, it is reported that a 10 KV/Meter static electric field (which is exactly the same field permitted by the construction permit at ground level for this DC powerline) increases brain wave activity and decreases posterior-hypothalamic activity in rats. "Hypothalamic" refers to the brain's ability to control bodily functions. In their own ad campaign to convince people of the safety of the powerline, UPA/CPA admit that utility studies have found that EmFs cause delayed reaction times. That is admitting that the central nervous system is affected.

Additional biological effects of EmFs which have been noted experimentally include the symptoms of stress, decreased body weight from one generation of rats to the next, chromosomal abnormalities, glaucoma, and changes in blood chemistry: blood protein counts increased and the count of blood antibodies fluctuated, some decreasing and some increasing, depending on the field strength and the specific antibody. Impotence, sterility, and an increase in the incidence of blood cancers have been linked to long-term EmF exposure.

An excellent article covering the general subject of EmF effects on health was published in the Sept. 15, 1979 issue of Saturday Review.

A STRANGE COINCIDENCE

People who live and work along the line route have experienced the following effects from this powerline, with children being the most sensitive:

- Headaches
- Skin rashes
- Nosebleeds
- Fatigue
- Numbness
- Nervousness
- Respiratory problems
- Eye problems
- Tingling sensation all over the body.



UPA/CPA claim that all that may very well be, but it's all psychosomatic. Yet fish have abandoned streams under the powerline, wild life is gone from state-owned land near the line, and farmers under the line are having problems with their livestock which they have never had before.

Livestock under the line is skittish and jumpy, milk production has been reduced because cows have trouble letting down their milk, there has been some increase in livestock abortions and deformities at some farms along the line route, and cows pastured under the line come in for milking and shit all over the barn. Things were not like this before the powerline came, but these developments are also, no doubt, psychosomatic.

THIS POWERLINE MUST COME DOWN

Just as powerline protesters will not be the scapegoat for rising electric rates, neither will the inhabitants along the line route take on the role of guinea pig while the utilities experiment to see just how bad their line really is. This powerline is not safe; it costs too much; and we, the utility customers, simply don't need it. There is plenty of electricity already available to UPA/CPA. This powerline must come down. Please help us.

Powerline protesters mail a bi-weekly newsletter called *Hold That Line*. If you are interested in receiving the newsletter or any additional powerline information, contact: *Hold That Line*, Box 5, Lowry, Minnesota 56349.

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

* * * * *

The response to our newsletter reorganizing efforts has been good, thank you all for sending your cards, also, to all of you who sent contributions as well. For those of you who have not sent your cards back or dropped us a line, this is your last newsletter unless you do so. For those of you who live out of state, we understand the delay with the mail and will of course give you as much time as we can. Also, because of redoing our mailing list, the next issue of Hold That Line may be a bit later than usual, depending on how everything goes. Once again, thanks.

* * * * *

BOB SHELDON GETS THE BLUES FROM LOOKING AT HIS SHOES
WHILE LENNICK PLAYS HIDE & SEEK

How CPA and UPA have managed to mismanage \$1.4 billion of co-op money in the Coal Creek Project was the subject of the press conference held on the steps of CPA in Edina, Sept. 28. It's all reported in a book just released by the Environmental Policy Center called "Lines Across the Lands". (More on this book and how to obtain it in future issues of Hold That Line) The Minnesotans who participated in writing the book, Nancy Barsness, Dr. Wendell Bradley and John Kooiman set up the conference out in the cold because of course the doors to CPA are kept locked. Besides the press, there were some Dakota Electric Coop members who have been bitterly mad over their high electric bills. Bob Sheldon was there to do his cover-up job and there were those executives watching from inside. After all, this was a change from sitting and planning what kind of lounge chairs they'd have in the new \$8 million office.

That \$1.4 billion mismanagement is not because they failed to detect ravenous wire worms or glass eating blackbirds along the powerline. No, that cost is only a drop in the bucket. It's the unexplained things, of which more and more are being discovered, that add up - or don't add up. Like why is General Manager of CPA Ted Lennick also on the board of directors of Northwestern Bank Southwest which handles all of CPA's accounts including the mone from REA in Washington. Why did the Barry Report say that the coops are payin dearly for their banking and that there are excessive bank profits?

Well, the purposos of the press conference was to allow Lennick to answer these and other questions, but he was nowhere to be seen. "He had a previous engagement", mumbled Boy Wonder Bob Sheldon, still looking at the toes of his shoes. (Rumor Control has it that he was to have met with coop general managers but made his excuses saying that he had to be at a press conference where his bank would be under scrutiny. He must have gotten lost somewhere between there and Mexico.)

Bumbling Bob continued saying all kinds of intelligent things like "No comment" and "I don't know" till an angry coop member insisted on being allowed in his own building, to which Bob replied, "I'd rather stay outside." This made the man even more angry, hopefully angry enough to go home and insist on some changes in his own coop. With electric rates quadrupeling because of the Coal Creek Project there is going to be an ever increasing number of angry consumers and the Ted Lennicks, Bob Sheldons and other corporate executives might find themselves up a very Cold Creek!! (Without a paddle)

* * * * *

There's A Fight Going On Down In Kansas

Landowners in the path of a 345 KV Powerline down in Kansas are fighting back. While the project has been in the works for quite some time, up until a couple weeks ago the action pitted Kansas Power & Light against the Audubon Society because the proposed route went through some protected prairie lands. So Audubon got the line moved onto farmers, and with typical Utility arrogance

the landowners were left with 10 days to get ready for THE HEARING. (2)

Much was accomplished in 10 days. There were a couple organizational meetings which raised over \$2,000, and connections with lawyers were made, a steering committee was elected, and the groundwork was done on potential legal issues. But with the Hearing set for Oct. 3, what was most needed was more time. More time was got.

In their rush to get things started (material has already been purchased, etc.), it seems that KP&L and the State Agencies got so excited that the Hearing didn't have adequate Public Notice. So well over 100 Kansas farmers and ranchers got to watch the Agency wipe the egg off their face and listen to KP&L attorneys snarl contemptuously while venting their frustrations by stamping their feet and pulling their hair. It was great fun.

Anyway, the next hearing is a month or two away, and the issues are such that some angry Kansas farmers are likely to knock the socks off of KP&L. Developments like this are very encouraging to embattled Minnesota farmers, and we'll be watching closely . . .

* * * * *

LIVESTOCK MONITORING PROGRAM TO BEGIN

Since this Powerline has been in operation, farmers near the line have noticed more and more health problems with livestock. Busy farmers should not have to be responsible for proving that these problems are due to the line, but it is a job that needs doing and evidently the State and utilities are not interested in doing it. So a veterinarian and a family which runs a dairy operation made up a list of things to be checking on and keeping record for each cow. The list includes: exposure of the cow to the line, irregular heat cycles, cows being bred then coming around in heat again in 2 or 3 months, a drop in milk production, birth defects and abortions and other irregularities. These records are being verified by the vet.

It would be good if more farmers would contact their vets and set up a similar program, or contact Hold That Line for additional information. We will be covering this problem regularly, and would appreciate any information you could give us concerning affects you've experienced with the line on your animals and if there's a veterinarian willing to help.

* * * * *

PHIL MARTIN STEPS OUT

As General Manager of UPA, Phil Martin assumes a primary responsibility for skyrocketing rural electric bills, rapid environmental deterioration, and all the other blessings of the Powerline Project. On Sept. 29, Phil's neighbors got to find out a bit about the trouble Phil has been causing.

People were curious about the commotion in the neighborhood, and most of them politely took the leaflet and expressed some concern about the situation. Some didn't. "Don't bother the man at his own private home on his day off" they said. "If you have a complaint, take it to the office during business hours," they said. "This is terrible!" they said. So they got all excited and upset and called the cops. The cops turned the whole affair into a bona fide event. They were most careful to avoid aggravating protesters while reassuring the excited ones that "no crimes are actually being committed right now, but we'll keep a close eye on the situation." The big concerns of the Anoka police were "respect for private property", "everybody's (even yours) security", and "The Golden Rule".

Phil, of course, was nowhere to be found. Like we said last issue, he is noted for a special kind of courage. Phil was gone, but the kids he left behind knew that Protesters were coming. They did very well looking after Fifi, Phil's white poodle. On the 13th of Oct., we'll see if the General Manager of CPA, Ted Lennick has a white poodle, too.

FLASH ** FLASH ** FLASH ** FLASH ** FLASH ** FLASH ** FLASH

Remember that "Public Energy Forum"? Well, the buzzards from the Utility Industry and their assorted sycophants in government just backed out. They did not see fit to provide us peons with any reasons why - as if we don't know.

Nukes have been in the news every day in the past 2 weeks, but by far one of the biggest stories in that period of time took place right here in Minnesota.

At a little after 2pm on October 2nd, there was an accident at the Prairie Island Nuclear Power Plant at Redwing, Minnesota. Apparently a tube ruptured which produced a leak in the steam generator. This resulted in a release of radioactive gas into the atmosphere, what the utilities termed "a puff". At 2:30pm the governor's office was notified and at 2:45pm the Nuclear Regulatory Commission was informed. When did they inform the people living by the plant, you might ask. They didn't. Many heard about it on the radio hours later. Some farmers were working in their fields when they heard a huge pop and saw a large cloud rise above the plant. Northern Sun Alliance's phone was swamped with calls, many from Redwing people who wanted to get out or wanted to know what was going on or both.

Uncle Albert got on the news later in the day and said if he lived near the plant he wouldn't be worried and he's just quoting N&P statistics and "You got me!" He also said he didn't see any need for an evacuation, which is interesting since Minnesota doesn't have an evacuation plan. But N&P said everything was ok and not to worry. When asked whose electricity would be out as a result of the shutdown they replied, no one...we sell this electricity. The next day they said that they ran into "some complications" and it may be a little longer than we thought to get the plant running again. To top it off the day after that, they announced that 28,000 gallons of water from the damaged reactor will be "decontaminated" and dumped into the Mississippi River! What next?????

* * *

It seems the Minnesota Energy Agency (MEA) spent \$50,000 to hire the (Ronald) Hayes Associates to do an environmental report which the MEA needs for its Certificate of Need this fall. The MEA will not release this report, saying it would be too much of a hassle! There is a copy available through the Legislative Reference Library at the Capitol. We should be obtaining a copy soon and will keep you posted.

* * *

YIPEEEEE!!

Thursday, September 27, Southern Landowners Alliance of Minnesota (SLAM) won their court battle on the 345kV branch line. The Supreme Court gave for its reason that the landowners along the route should have had a better opportunity to argue against the line before their land was condemned. This means the court will appoint a 3 judge panel (sound familiar?) to hear many issues of conflict surrounding construction. Our congratulations goes out to SLAM, keep up the good work! In terms of the possible impact of such a decision, attorney Ken Tilsen summed it up in the Minneapolis Tribune when he said, "This indicates that the power companies have no right to run roughshod over normal procedures in determining these issues. And it means that at least part of the very unwise and unfortunate decision on construction of the powerline can be reversed."

* * *

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Because of the timing with mailing this issue of the newsletter, we are unable to give you an update on the Oeltjen trial scheduled to begin Oct. 9. We will have full coverage of the trial in our next issue of Hold That Line. Also, Tony Bartos comes up on his contempt charges Oct. 17 in Glenwood.

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Remember the next general meeting of GASP is scheduled for October 16th at 8:30pm in Lowry. Among other agenda items, we hope to have a guest from the farmers opposing a proposed highway down south. Also the new book put out by the Environmental Policy Center which many of you have asked about will be discussed. See you on the 16th!

BOOK REVIEW

~~This~~ is a continuation of a review we started last time on a book called Shutdown... testimony from an evidentiary hearing on a suit brought by a Nashville business woman, to shutdown the nuclear industry on constitutional, and health and safety grounds.

Dr. Ernest J. Sternglass was asked to testify on behalf of the defense because his research in the area of radiation was quite different from Dr. Gofman's. Sternglass did studies on infant mortality and leukemia and other cancer rates following the detonation of nuclear weapons during the '50's. The study began using 1945 statistics to present. This study deals with very small amounts of radiation given over long periods of time, which in Sternglass' words, "is precisely the kind of situation that we encounter in the peaceful nuclear cycle, where again we have very small amounts of radiation." From this information, Sternglass believes that "the present permissible limit will produce a significant increase in the number of deaths among babies, the newborn, and, of course, cancers at all ages." For example, before the first bombings on Japan, the average cancer rate of 100,000 5-9 year old males was 41 per year. There was significant increase in this number after each bombing took place, to the point where after the 2nd H-test and into the '60's, this number had increased 600%!

Sternglass has also done studies on mortality rates in areas near nuclear reactors in which the findings indicated cases of cancer increased much more than by what the NRC's projections would've shown. Sternglass went on to agree with Gofman's conclusion that the public hasn't been given a truthful picture of the health hazards from nuclear power. He goes on to say that the plaintiff Jeannine Honicker is actually damaged by the nuclear fuel cycle, as are "her children and their children for generations to come."

After cross-examination, which was pretty boring, Judge Morton gets rather confused and asks, "show me what kind of jurisdiction I have." He then tells defense lawyer Kachinsky that this complaint should be taken directly to an agency to which Congress has given jurisdiction, (sound familiar?) Also, that Congress has specified that it wants district court to stay out of this controversy. Kachinsky replies that action was taken with those agencies, but nothing's been done. Judge Morton takes the testimony under advisement, thus ending the testimonial part of the book.

Through the years, scientists have learned more and more about the related health hazards of the nuclear fuel cycle. During this period of time, the U.S. government, hand in hand with the utility industry, has time and time again been dangerously desparate in their attempts to deceive the public in the facts of what is going on. As this information has been gathered, the industry/government has also become more and more dependent on this same nuclear cycle as well as upon each other, in terms of cover-up after cover-up investment after investment. An example of this is the Book's citing of Pres. Eisenhower ordering the Atomic Energy Commission to "confuse the issue" during bomb tests in Nevada and Utah. So we have brilliant scientists who dared to challenge the government/industry, as Sternglass and Gofman testified, subject to censorship and repression. We have numerous accidents and health hazards the public and environment are subjected to all the time. We have hearings, suits, complaints and yet more hearings with no progress. Then we have 3 Mile Island. Now we have more people who feel as Jeannine Honicker - and like we do - that the utility industry is willfully killing us, by its very existence. It is noted in the book that on January 12, Judge Morton dismissed the Honicker case for lack of jurisdiction. There were appeals filed, and upon publication, the whole matter was still tied up in agencies and the courts.

Shutdown is a good book to be familiar with for many reasons. The intro, which sites past nuclear accidents, the testimony itself from the hearing, and the background and perspective on the nuclear cycle. Also, there is a good bibliography for your reference, a map of U.S nuclear facilities, & a section on what we could do without nuclear power.

The end of the conclusion sums it up, "The overwhelming majority of the world's people still find their roots in the natural world. If the peoples of the world are to develop free and egalitarian societies, they must keep natur

free to support them. Modern peoples are sometimes proud of their scientific achievements; but even the most sophisticated technology rests on mere discoveries of the ways of nature. Ecological systems are a delicate balance of forces arrived at by a billion-year process of trial and error. With our cultural perspective of only a few thousand years, we upset that balance at our peril. Shutting down the nuclear power industry is one step in creating a world free of fear and intimidation, where men and women can walk the earth safely for generations, and children can be born into the world, grow up and develop normally. We must selflessly abandon the nuclear option for the sake of our children. We no longer have any viable alternative."

To order Shutdown, write to The Book Publishing Co., 156 Drakes Lane, Summertown, Tennessee 38483.

NEWS FROM ALL OVER

American Electric Power Co. (AEP) has been foiled again - at least temporarily - by a group of determined Virginia farmers fighting a 765kV power line in the southern part of their state. This March, the Citizens for the Preservation of Floyd County (CPFC) won what should be a 6 month delay in the construction of a 765kV line which Appalachian Power Co., an AEP subsidiary, is trying to put through Floyd County. The delay came when the National Park Service responded to a CPFC petition by announcing it will conduct an environmental assessment of the line's impact in crossing the Blue Ridge Park Way.

A full-blown environmental impact study could follow, and utility sources are saying that the line will not be completed until 1982, at the earliest.

THE POWERLINE, SEPTEMBER 1979

As we go to press, Wisconsin utilities are asking the Public Service Commission (PSC) for permission to pass on the costs of unbuilt nuclear plants to their customers. Northern States Power Company (NSP) wants to charge consumers the \$80 million that they spent on the proposed Tyrone plant which was rejected by the PSC last March. The Wisconsin Electric Power Company and its partners in the proposed Haven plant near Sheboygan are asking for \$37 million. This plant has been delayed 2 years partly because of questions raised from the accident at Three Mile Island and at this point haven't even received state or federal permits.

DEAD SERIOUS, VOL. 1 NO. 2

America's film hero, John "Duke" Wayne, died a victim of radiation from U.S. atomic fallout. His death and the deaths of his costars in the movie "The Conquerors", have been linked to an open-air atomic test explosion in 1953. The explosion took place shortly before the movie was filmed in St. George, Utah, the site of the nation's worst radiation fallout.

Wayne, costar Susan Hayward, Agnes Moorhead, Dick Powell, and the bulk of the top production people of the movie have fallen to forms of cancer following film work near the Nevada open-air testing range. The cancer and death rate is also very high for other people who worked on the film. The victims include members of an Indian tribe hired to work on the movie. The location of the movie was in the main fallout zone of one of America's first nuclear accidents - an explosion known as "Dirty Harry". "Dirty Harry" was one of 37 open-air nuclear tests conducted in the nearby Nevada test range between 1951 and 1962.

A sudden wind change before detonation at 5:05am on May 19, 1953 sent clouds of radiation over St. George and the cast of "The Conquerors". The radiation levels at St. George, were the highest ever recorded in a populated area, surpassing measurements in Japan after the delivery of 2 nuclear weapons during World War II. Although "Dirty Harry" was detonated atop a 300 foot tower, at 5:05am, documents show that test officials ordered no precautions for local residents until 9:25, hours after the fallout had settled in the area. Most people in the area were never warned at all because "it would create a disturbance" and "it would not take much to start wild rumors". The link to Wayne's death comes at a time when 700 longtime residents of St. George are filing lawsuits against the federal government over the effects of radiation fallout on their communities. NO NUKES NEWS, SEPTEMBER 1979

HOLD THAT LINE
LOWRY TOWN HALL
LOWRY, MN 56349

IS YOUR ADDRESS
CIRCLED??

If so, this will be
your last issue of
Hold That Line.
To have your name
reinstated on the
mailing list, all
you have to do is
write.

LETTERS

Just a note to thank you for
putting me on the newsletter mailing
list. I'm finally employed so shall
send some money in exchange as soon
as I am more solvent.

The nuclear industry is coming
down real hard on Saskatoon, which
has been honored with the name of
"uranium headquarters of Canada."
It's getting to be the truth. Just
recently the financial post organized
a prestigious and exclusive Resource
Development Conference here. Saskat-
chewan, you see, has just about every
kind of resource any multinational
corp. could ever dream of putting its
grubby little mitts on. And the gov-
ernment is investing in some of these
coops, and their activities and coll-
aborating in various development,
especially uranium, in the best inter-
ests of the people. One of the more
salient discussions at this conference
centered around a possible nuclear
power plant which would provide power
for the development of heavy oil. It
makes us feel real privileged to know
that we are being looked upon with
such rapacious favour. Anyway, it's
looking pretty scary, especially the
government's collusion in the whole
mess, and a lot of it is happening
up north where no one but the small
native population can see it and
they're being intimidated and pushed
into accepting it, even into wanting
it.

But people are starting to get
angry, and we're getting organized.
We don't have much choice. So while
things are looking terrible, they're
also looking hopeful.

I'm real glad I went to the
Black Hills. Learned a whole lot that
went pretty deep. Good luck to you!

Saskatoon, Saskatchewan, Canada

Dear Friend,

Your help is urgently needed.
Important developments are unfolding
on the energy front in Washington.
Some of the programs to speed the
development of synthetic fuels, now
before Congress, entail blatant dis-
regard for the environment and publi
health. Letters to your Senators and
Representatives can make the differ-
ence between an energy future based on
synthetic fuels and nuclear power --
or a future based on energy efficien
and renewable technologies. The Carl
Administration and Congressional lea-
ders have proposed the creation of an
Energy Mobilization Board and an En-
ergy Security Corporation to "cut red
tape" on "priority" energy projects.
Both proposals would place awesome
power in the hands of a few officia
in Washington. The Union of Concern
Scientists urges you to write immedi-
ately to your elected officials and
voice your opposition.

Washington D.C.

POWERLINE PROTEST NEWSLETTER OF CENTRAL MINNESOTA

By the time you receive this issue of Hold That Line, GASP's office will have its new phone! It was decided at the last November meeting of the Trustees that it's about time that GASP had a private line, so the phone will be installed the first week of December. Our new number is 283-5439. Do make a note of it so we can make the switch as easy as possible. Thanks!

MARK

You may remember that in our last issue we mentioned that GASP had sent a letter of support to Mark Hoium in Stillwater. Well, we just got a reply in the mail last week. Mark wants to thank everyone who signed the letter. He says, "I really am thankful for all of your support, you made my day today when I read your letter, it didn't make me feel so alone, deep down I mean. My support goes out 110% for all you people who stick up for your own rights, keep it up."

Mark also wishes all of you a very merry Christmas and a happy New Year. If you'd like to drop him a line, his address is: Mark L. Hoium, Box 55, #111509, Stillwater, Mn 55082. We also will print letters in the newsletter which Mark receives if you'd like to send it in care of HTL.

DECEMBER 14th

All of the state Senators and Representatives have received a letter which requests their presense at Lowry at 8pm on Friday, December 14th. From Lowry we will move to a site under the line a few miles west of town (out Pope Co. 28) on the Lida farm.

The purposes of this gathering will be to: 1) give the politicians an opportunity to listen first-hand to the experiences farmers have been having with this powerline; 2) provide the politicians and the media with visual demonstrations of the existance of the electromagnetic field; and 3) educate the politicians about existing scientific knowledge on the effects of the Extr High Voltage powerline on living things. See you on December 14th!!

COAL CREEK CAPERS

Intriguing developments continue to come out of North Dakota. Reliable sources working at the Coal Creek Station have informed our North Dakota contacts that when the Unit 1 generator is in operation at all (which is at irregular intervals) it is being run at 1/3 of its capacity, or less.

There are several possible explanations for this situation: 1) being as they're still burning a lot of oil out there (many tanker trucks are driving in and out of the plant), they're still fiddling around with their pulverizer, trying with less than satisfactory results to get their lignite to burn. 2) being as they tried to crank the generator up to capacity too quickly, things in the turbine and generator keep going kapoohy and they don't know how to fix it so it stays fixed. Or 3) they don't really need it anyway, maybe because the electricity is too expensive.

Equally interesting is the fact that when the generator is in operation, almost all of the electricity is being shipped into the grid through UPA's Stanton Station, rather than through our favorite powerline.

Either they're attempting an end run around the health/safety issues, or else the line isn't a very reliable source for electricity. It seems that more than a few insulators are missing out Dakota way. Problems, problems everywhere.

NEWS FROM ALL OVER

In a strongly worded statement released recently, Nancy Barsness of Cyrus the spokesperson for Determined Runestone Electric Association Members (DREAM) took sharp issue with reported vandalism figures on the controversial West Central Minnesota powerline. She also charged an aide of Gov. Al Quie with failure to release damage figures more favorable to powerline protesters.

Barsness said the cost of sabotage is a major issue because:

1. It is the issue most often used by United Power Association and Cooperative Power Association "in their attempts to turn public opinion against powerline protesters." The two organizations were partners in constructing the line.

2. UPA/CPA have been "very irresponsible in reporting the actual cost of sabotage, thereby attempting to use powerline protesters as a scapegoat for cost increases more related to management," and

3. Gov. Quie and his staff have "publically used the irresponsible figures put forth by UPA/CPA, but have remained silent now that more accurate figures from UPA/CPA have become available."

Barsness said that on July 6, 1978, the two companies released a statement blaming "West Central Minnesota protest activities" for \$139 million of "completely unnecessary" costs which would be added to consumer electric bills. In May of this year, she claimed UPA told the governor's office the cost had increased to \$142 million.

However, Barsness, who did research as a case study author for the Environmental Policy Institute of Washington, D.C.'s book, "Lines Across the Land," claims the real vandalism figure is actually closer to \$200,000. The book was released in September.

On Aug. 28, the governor released a widely circulated press release on the "serious and destructive situation" using the \$142 million figure, Barsness claimed. He added, "Quite obviously, the real victims in the matter are the consumers who will have to bear the increased costs. I am also calling on the public to cooperate with law enforcement officials to end the vandalism and eliminate the threat to public safety."

It was that report, says Barsness, that prompted her to set up a Sept. 13 meeting with Quie Special Asst. Robert Stevenson, "to clarify the 'vandalism' costs..."

Barsness says that Stevenson contacted UPA and CPA after their meeting and obtained a further report which was received by mid-October. That complicated report blamed most of the cost on "regulatory requirements," she says and that "even this report is questionable, as can be proven by other research and documentation which shows over \$2 1/2 million in security costs are also included under another heading, included among "regulatory costs."

Stevenson, says Barsness, admits the report is a "mishmash and manipulation of public relations," but denies the governor's office has issued any powerline related statements since May. -----Prairieland, Thurs., Nov. 29 197

* * * * *

On this note, also last week the GAO report was finally released. Different sources had warned protesters a few weeks ago that the report was indeed destined to be a basic whitewash, so we were prepared, but as always, hopeful as well. It is a good thing, however, that Rep. Nolan took the option of releasing the report himself, thereby giving notice to at least a couple of citings of mismanagement. If he had not released the report, the GAO would have and we all know what a disaster that would have been.

* * * * *

SLAM NEWS

The last hearing before the 3 judge panel on the southern line was moved at the last minute to Minneapolis from Mankato. HTL didn't receive a notice until the day of the hearing! Our friends from SLAM tell us that things are

frustrating as usual where court is concerned. Especially frustrating because SLAM has proven its case. The utilities have admitted that they don't need the line for anything but to fulfill their investment and wholesale plan for the CU Project. They've admitted that they didn't give landowners proper notice. Yet, they stand in front of the panel and say, well, ok, so we all make mistakes but you aren't going to block a large project like this just because we broke some of the rules.

Another frustrating aspect of this hearing procedure, is that the pres. is totally ignoring it. It's as if the whole thing were blackballed from coverage. So, our southern friends are worried that if they do lose the public won't even be aware of the many things exposed through this 3 judge panel. So it goes. The next hearing is scheduled for December 10th at 9am in Mankato. Unless ofcourse they change the local again. Good luck SLAM!

DREAM

There will be an organizational meeting for DREAM at the Barsness home on December 20th at 8pm, for anyone interested. Recently there was an advisor bill introduced to the House calling for an investigation of management practices and accountability of G & T electric cooperatives. John Muzik from Minnesota COACT Training will be there to give some organizing tips. There is no date set yet for the hearings on the bill, but DREAM will keep us informed. If you want more info on the meeting, call Nancy at 795-2708.

THE KANSAS CONNECTION

As you may recall, we've been in touch with folks down in Kansas who organized in the early fall to fight a 345 kV AC line that Kansas Power and Light wants to build. It seems that proposing that line is one of the worst things KP&L ever did - as far as KP&L are concerned, anyway. The initial proposal had the line crossing protected prairie lands, and the Bird Watchers called that to a screeching halt, so RP&L tried to move it onto farmers and ranchers. Things since then have been very interesting.

The first application had to be resubmitted due to improper notice of condemnation proceedings. But before that happened, a farmer filed suit against RP&L for having stockpiled material and started construction before the necessary legal procedures had been taken care of. Three KP&L attorneys in pinstriped suits (one very sad, one very nervous, and one very angry and confused) went up against a very well informed county lawyer. The angry and confused lawyer asked the court, "Well, just what constitutes a start?" The sad lawyer looked hurt and said, "KP&L just doesn't know what it can do and what it can't do anymore." The nervous one went outside and smoked cigarettes. The judge told KP&L that they couldn't build the line unless and until everything is in proper order.

Meanwhile, the people down there have a full head of steam. The lawyers are organized, regular meetings are being held which are attracting new people all the time from all along the line route, and nobody's signing easements. Not only that, but they're working with vets along existing line routes over health/safety issues and have successfully challenged and thus eliminated the late fees KP&L have been charging their consumers. Those folks have also got KP&L under investigation for their involvement in the Wolf Creek nuke, and are preparing for the day when KP&L next dares to stick its head above the muck. Such a deal!

LETTERS

Dear Folks,

Thanks for continuing to send the newsletter. I read it carefully every issue. I also want you to keep up the struggle you are leading, you are an example to the rest of us around the country and the world. It is becoming increasingly clear that the high power lines are the achilles heels of the centralized power systems. Barry

Commoner recently spoke at the University of Minnesota, in his talk he mentioned an interesting point which is, 70% of all the capital used to build a centralized power system goes for the powerlines. Please don't feel isolated, we think of your struggle constantly.

Mpls, Minn

Powerline protesters met in Lowry on the 4th, and the meeting was opened by reading and signing a letter which expresses our concern and support for the Scott Jenks family. Scott was killed in a tragic accident on his farm in late November. Scott provided powerline protesters with strong and courageous leadership during many critical and difficult times in our past. Our loss is great.

We also read the afore mentioned letter from Mark Hoiium who sits and waits in Stillwater. Mark says to hang in there and keep fighting, and that's just what we plan to do. With that in mind, there are a few other activities coming up, besides the action out under the line on the 14th. So, mark your calendars and call your friends and neighbors!

December 20th at the EQB

The Minnesota Environmental Quality Board is responsible for many of the powerline problems we have been facing out here, and the EQB continues to demonstrate a malicious and bankrupt attitude as far as those problems are concerned. The only thing that changes are the donkey orifices. Naturally, the ones who originally cleared the way for this aerial sewer are long since gone. But it is a good idea to remind the board that we still remain.

And so this is the plan: as many folks from protest country as possible will meet up with each other at 10am on Thursday, December 20th in front of the governor's office in the capitol down in St. Paul. That's because the EQB moves its meetings around quite a bit, but by then we will know where it is. We don't plan to stay too long, but we will let them know a few of the things which are on our minds.

In the event that the EQB decides to temporarily disappear (the EQB bureaucrats are not noted for courage when faced with integrity) we will pay our honorable respects to Uncle Albert. Now doesn't that sound like fun?

January Rally/Conference

The third event in the works is the rally and conference scheduled for January 18-20, 1980. GASP is working with Northern Sun Alliance and the Black Hills Alliance to set things up, and GASP is responsible for organizing the program for the demonstration at the Health Department in Minneapolis at noon and the rally that evening. The conference part on the 19th and 20th will be organizing for the Survival Gathering in the Black Hills in July, 1980. The demonstration on Friday, the 18th, though, will be for powerline protesters to relate our struggle to a lot of new and concerned people, and to present the State Health Departemnt with a list of demands which must be met if the Department is to fulfill its legal obligation to the people of this state.

To that end, a committee has been formed to draft that list of demands. It will then be brought before the General Assembly for ratification at our next meeting on January 8th, 1980. A committee was also formed to orchestrate publicity for the 18th along the line route, and to organize transportation down to the cities - a few busses probably. And the third committee is to set up speakers for the program on the 18th.

Most of the rest of the meeting was used to discuss the status of our work around the health/safety forms which are being filed by people who are hurting from the line. In the right circumstances, Dr. Marino from New York would be interested in testifying as our expert witness on the issue, and we are beginning to set up those circu,stances.

There was also discussion of the GAO report, and what to do about the fact that NCP is running around to public schools talking about the virtues and blessings of nuclear power and other centralized energy schemes. We are now talking about the possibility of bringing an alternative workshop on energy into the schools. One such workshop is described in the enclosed issue of Northern Sun News.

Our next meeting of GASP will be in Lowry on the evening of January 8, 1980. This will be an important meeting since it will be our last before the rally, in most likelihood, so hope to see you there!

At the end of the GAO report there is a "Chronology of the Coal Creek Project" starting with 1972. We thought you might be interested in a few selected items from that chronology.

1976

- April 2 - Certificate of Need issued by Director Minnesota Energy Agency. Note: Need was determined about 6 months after the corridor had been approved.
- August 11 - District Court Order prohibited CPA/UPA from doing any work or contacting landowners in Stearns County.

1977

- March 16 - American Arbitration Association Vice President held his first mediation session with a delegation of powerline opponents and power cooperative officials. An impasse was reached.
- March 22 - The three judge panel met to hear consolidated powerline cases. The panel ordered a halt to all surveying and construction on the CPA/UPA project in Minnesota.
- September 30 - Minnesota Supreme Court ruled unanimously in favor of the power cooperatives in the consolidated powerline appeals.

1978

- January - About 50 powerline opponents were arrested or cited for obstructing legal process, damage to property, etc.
- January 5 - Minnesota Governor authorized sending up to 175 State Troopers to Pope County.
- March 9 - CPA/UPA flew more than 90 people to visit a similar powerline in Oregon. Although invited, scant interest was shown by protesters or Minnesota legislators. As of this date, over 70 people in Minnesota had been arrested as a result of protest.
- June 12 - CPA/UPA engage private security force to guard line and equipment. At times this force numbered about 300 people.
- August 25 - Minnesota Governor requested FBI assistance in investigating the attacks on powerline towers.
- December - Between August 1978 and January 1979, 5 transmission towers were toppled and over 900 insulators damaged.

1979

- January 10 - Minnesota Governor stated that the eminent domain law needs to be modified.
- March 1 - A total of 3,155 insulators on the transmission line have been damaged.
- June 28 - Commercial operation of the Coal Creek plant delayed a month due to faulty operation of coal pulverizers. As of this date, about 5,500 insulators have been damaged, mostly by gunfire.
- August 24 - eighth powerline tower toppled by vandals.
- August 27 - Ninth powerline tower toppled by vandals.
- November 5 - Tenth powerline tower toppled by vandals.

If you are interested in possessing your very own GAO report, chronology and all, write to:

U.S. General Accounting Office - Distribution Section
441 G Street N.W. Rm. 1518 - Washington D.C. 20548

HOLD THAT LINE SUPPORTS CPA!!!

(6)

A recent resolution adopted by the CPA Board of Directors has come to our attention, and we would like to go on record as being in full support of the proposed action.

Resolution R79-11-32

Vandalism - Tax Credit

WHEREAS, significant generation and transmission taxes are paid by electric utilities, AND

WHEREAS, transmission lines are passive structures requiring few government services, AND

WHEREAS, law enforcement is one of the few government services which utilities can expect for taxes paid, AND

WHEREAS, Cooperative Power Association and United Power Association have experienced millions of dollars of damage as a result of vandalism to the CPA-UPA 400 kilovolt direct current transmission line and other related equipment, AND

WHEREAS, law enforcement has been insufficient in many areas along the route of the transmission line in west central Minnesota,

NOW THEREFORE BE IT RESOLVED, that the Board of Directors of Cooperative Power Association supports legislation that would allow a tax credit, plus interest, for the cost of vandalism against high voltage transmission lines to be applied against taxes levied, AND

BE IT FURTHER RESOLVED, that the Board of Directors of Cooperative Power Association supports that such tax credits are continued until the vandalism damages plus interest are paid in full.

For more information on how you can collect your tax credit, contact your local hardware store or write:

Tax Credit
Box 30-06
Tuktuyaktuk, NWT
Canada

****PLEASE NOTE****

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IS UNSUITABLE FOR FILMING. PLEASE REFER TO THE ALASKA
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Description:

NORTHERN SUN NEWS, DEC. JAN 1979-1980

Volume 3 Number 1

POWERLINE PROTEST NEWSLETTER OF CENTRAL MINNESOTA

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IN WHICH THE SOUTHERN LANDOWNERS ALLIANCE OF MINNESOTA (also everybody else)
GETS SCREWED, AND UPA/CPA ARE ENCOURAGED
TO SELL ELECTRICITY TO MILWAUKEE, KANSAS CITY, AND ST. LOUIS

Even the darkest clouds sometimes have a silver lining. Remember how much fun it was to chase surveyors all over the countryside back in the Winter of '78? Well, it seems 3 black-robed and licentious troublemakers remember those days with such fondness that they decided to do everything in their power to bring those exciting times to us once again. On December 7 the Scurrilous Honorables appointed by the Supreme Court found in favor of UPA/CPA and against S.L.A.M. in a most remarkable fashion. Maybe they even out-did the 1977 Supreme Court Powerline decision. It is the intention of S.L.A.M. to appeal this decision to the High Court too, and give that august body a chance to redeem itself a little bit. But we've all been there before and should the ruling be upheld, it will be curious to see how many fingers and thumbs, clamps, vices, and clothespins are used to plug the noses of the judges while they do their dirty work. Meanwhile, let us look at the ruling.

In their Findings of Fact, our 3 Muddle-headed Miscreants duely noted that notice of the Energy Agency hearings appeared in the St. Cloud Times, Lake Region Echo, Morris Sun, Independent Review in Meeker Co., Sauk Centre Herald, Pope County Tribune, Wheaton Gazette, Swift Co. Monitor, and the Benton News. Then they said "That notice was not published in the newspapers in counties along the 76 miles of the Wilmarth line, i.e. Wright, Carver, Sibley, Scott, LeSueur, and Blue Earth." They further noted that there was much official confusion between the E.Q.B. Corridor Hearings and the M.E.A. Need Hearings back then because of all the new laws being made by politicians

After citing vague and confusing news items tucked away in the back pages of the Crow River News, Rural Minn. News, Mankato Free Press, and Mpls. Sunday Trib., however, these Misbegotten Yahoos had the unmittigated gall to say, "That the landowners knew, or should have known, of the existance of the need hearings from newspaper articles published before, during, and after (sic) the need hearings." Bear in mind that they cite one article in each of those four papers between October and December, 1975, and the Trib article was on page 15, the Rural Minn. article on page 16, Crow River on page 39, and it was on page 41 of the Free Press. Ain't that something?

There follows a lengthy discussion, most of which is either meaningless or somewhere between amusing and absurd. The discussion is about who is entitled to what sort of notice when, and just what is "notice", anyway? "Notice", it seems, can be "actual express notice", or it can be "actual implied notice", or "constructive notice". Being as landowners along the Wilmarth line somehow had the above mentioned news stories "available to them", they had what you call "actual implied notice".

But these judges (for lack of a better term) say that none of that matters anyway. While the M.E.A. decides whether or not land will be condemned for these out-door facilities, the M.E.A. is not site specific. Therefore, they say, "Landowners would be entitled to no more notice at this stage than consumers of energy", whoever they are. (Somewhere in here it seems that the fact that the E.Q.B. has yet to establish an inventory of corridors, as is required by the 1973 law which created that batch of blathering Bureaucrats, somewhere that ought to enter in. It didn't, of course.) Anyway, even if the landowners hadn't received "actual implied notice", even if the only notice possible was one that was Divinely Inspired (as was the case), that would still be okey. As our Illustrious Idiots put it, "Only at the stage

at which there is a 'taking' is a vested right compromised; until then⁽²⁾ the exclusive enjoyment of the property rests in the owner. In the present case, therefore, due process is not violated even in the absence of any notice, since at the stage of a Certificate of Need determination, no process is due." Ain't that something? Might as well give your farm to Martin, Lennick & Co., thank them kindly for taking it off your hands, and head out for Tuktoyaktuk. But that's not the end of the fiasco. Not by a long shot.

Quite obviously, the issue of Need Hearing notice was important because if people would have known about the hearings, some very valuable information would have come out. Now, everybody knows that the public position of UPA/CPA is that the CU Project is to "supply energy to our consumer/members". But according to their own projections in Court, they could only document a load increase for the foreseeable future in that service area which could easily be handled by a 69 KV line. So why build a 345 KV line? There is simply no need for the thing.

Well, what do you think these Nobbling Nitwits went and did? They went and said, "That the Wilmarth line is an integral part of the whole facility, and no separate determination of need is required." The teeth are put into that little statement in the last paragraph of the Memorandum, where it says "...the Wilmarth line does provide a highly desirable link in the MARCA power pool grid to Kansas City, Milwaukee, and St. Louis..." Them consumer/members sure must move around with their irrigators and their barn cleaners an awful lot.

To add insult to injury, the three of them are currently trying to decide whether or not to give UPA/CPA a bigger easement for the line. Seems that 160' isn't quite enough considering some of the experiences UPA/CPA remember from out in this neck of the woods. (Tornadoes were also mentioned a bit.) UPA/CPA aren't asking for a additional 40' or 60' or even 100', however. They want the whole blasted farm. They want to be able to go anywhere they want, anytime they want, on any land contiguous to condemned easements. Curiously enough, none of the signed easements (some 40% of the affected lands) contain such provisions. That's only for those who choose to exercise their legal option of entering condemnation proceedings. None-the-less, our 3 Foolhardy Flunkies will surprise more than a few folks if, by some fluke, the easement is more restricted.

You and me, of course, are supposed to follow "duely established procedures" when we want to get something changed. And as far as easements for powerlines are concerned, that procedure is clearly defined as part of the job of the E.Q.B. But do UPA/CPA go to the E.Q.B. in their attempt to get the run of the place? No. They step right up there before a bunch of judges who can't tell the difference between a burro and their hole in the ground, and ask for the whole farm. Or the whole county, which ever is easier. Ain't that something? Oh well. Like we said in the beginning, even the darkest clouds sometimes have a silver lining.

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DEVELOPMENTS AROUND THE HEALTH/SAFETY ISSUE

The following letter was sent to Representative Fjoslien on December 11 from Dr. George Petterson, State Health Commissioner, and Rep. Fjoslien made it available to us at our meeting with State politicians on December 14:

I have reviewed some reports of our visit to the powerline and would like to correct any misinterpretation of statements I made at that time. I pointed out that the symptoms that were told to me were real symptoms, but I was careful to say that at this time it has not been established that the symptoms are in fact related to or caused by the power line.

I have met twice with the Environmental Health Division to discuss further studies which might be done. We have spoken with people in the

Energy Research and Development Agency of the federal government as well as with other scientists. At this time, a direction as to what should or can be done to gain answers to some of our questions is not clear. We are likely to pursue one of two suggestions. We will either convene a panel of scientists who would review facts which are known to this date regarding DC transmission or we would consult with recognized scientific experts on the same subject. Then, using this information as a base, panel participants or the expert consultants could help us design a future course of action necessary to address questions regarding the effects of high voltage DC current on humans and animals.

I would also like to remind you that in the spring we will be proceeding with the grounding studies as well as the electrical field studies as previously planned. Of course we will continue to monitor closely scientific literature on this subject of health effects of high voltage DC transmission lines.

Sincerely,

There must be a very urgent crisis to spur so much activity! Meanwhile, there are 201 Representatives and Senators in the Minnesota Legislature, and six of them were able to meet with us in Lowry on the 14th. We are grateful for their presence, but it was a struggle trying to figure out how to proceed with this issue. It seems that Dr. Pettersen isn't the only one from the realm of officialdom who is unclear about what to do next. A committee of people from G.A.S.P. was set up, however, to meet with interested politicians and our scientific expertise to discuss the possibility of some sort of legislative action. That meeting should take place within the next couple weeks, and the committee will report back to G.A.S.P. at the Jan. 8 meeting of the General Assembly about any possibilities which are before us.

It is interesting to note that after the meeting on Dec. 14, but before Representative Tony Onnen of District 22 B left that night, he said he had been instructed to do what he could to get protesters to cut out the sabotage. And he said going to the E.Q.B. on December 20 won't help at all, either. Those "instructions" help to explain some of the peculiar notions he kept sharing with us that evening. One wonders who gives the instructions in St. Paul. . .

* * * * *

DREAM NEWS

The organizational training session sponsored by CoACT has been rescheduled for Friday, December 28 at 8:00 P.M. at the Barsness home. Anyone interested in learning skills needed to run an effective organization is invited to attend.

The next meeting of DREAM will be held at the L & M Cafe, Lowry, on Thursday, January 10, 1980 at 8:00 P.M.

The two incumbant Runestone directors up for election this year refused to be nominated for re-election. DREAM member Glenn Bennett was nominated for District Four, along with two others. District One, northeast of Alexandria, has two unknown nominations. DREAM will be contacting all candidates Good Luck, Glenn!!!

A reminder that the DREAM 1980 membership fee for Runestone members is \$5.00. (\$2.00 memberships through the mail were grand-fathered in.) All Runestone members supporting our efforts, though inactive, are urged to send their show of support (\$5.00) to:

Ardell Miller
Rt. 1 Box 111
Farwell, MN 56327

Or better yet, attend our January 10th meeting. All ideas and suggestions are needed!

A preliminary survey by Westinghouse of the utility industry nationally indicates that the summer of 1979 failed to bring growth in peak demand. Locally (Missouri) Union Electric experienced a peak only 4 megawatts (MW)-less than one tenth of one percent-greater than their 1977 peak.

This year was the first in memory, perhaps the first time this century in which peaks failed to grow, and in fact the Westinghouse study reported in Utility World found a 1.3% decline in peak. Coming at a time when the industry is severely overbuilt, this seriously undercuts utility expansion plans, which are founded on assumed growth.

Utilities traditionally experienced an approximate 7% per year increase in demand, doubling generating requirements every ten years. In the period 1973-78 this rate declined to about half, averaging 3.46%. Now analysts are questioning if - with a concerted effort to become more efficient and shave peak uses - demand need grow at all.

The industry had been expecting significant increases in 1976 demand with estimates ranging from Westinghouse's 2.6%, through Edison Electric Institute's 4%, Electric World's 5.4%, to National Electric Reliability Council's 7%. The Westinghouse survey is thus sending shock waves through the already shaken power industry.

Traditionally utilities have forecast future demand based on past demand growth patterns. These methods have proven unreliable. UE has, since announcing plans for Callaway, reduced their 1984 load by over 2400 MW, an amount greater than capacity of both Callaway units. Still UE predicts yearly growth rates of 3.4% to 4.1%.

The most sophisticated methods for determining future demand rely on dividing electric demand into its component parts - disaggregating - and attempting to analyze which specific uses might demand more or less electricity as the result of changes both in the economy and technology, and also conservation. While more challenging, because they involve actually going out and looking at what real people are doing in their homes and businesses, these studies are more accurate than statistical projections which merely extrapolate past growth rates or trends in growth rates on a base and thermally sensitive basis.

In 1978 utilities had nationally a 37% reserve capacity sitting idle at peak. This compares with the 15-20% reserve margin recommended by the Federal Energy Regulatory Commission, and was the largest surplus reserve experienced since the Great Depression. The 1979 figures are not all in, but if the Westinghouse survey holds up, this year's margin will be greater than last's.

Besides calling into question growth, all this overestimating of demand and overbuilding of capacity is very costly. Literally billions of dollars in carrying charges are being expended on plants which are not "used or useful." Challenges are therefore expected by consumer groups in regions of the country where the excesses are most severe to exclude the costs of unneeded plants from the rate base. That's enough to make utility executives shudder.

-----Safe Energy News, Oct. - Nov. 1979

Commonwealth Edison, the nation's largest nuclear power company, has nowhere to deposit all its radioactive waste, but regulatory officials say that Com Ed has no one to blame but itself.

Due to the company's sloppy approach to packaging and hauling waste, officials said, Com Ed shipments have been banned in Nevada and South Carolina, two of the three states in the nation with "low-level" nuclear waste sites.

In the third state, Governor Dixie Lee Ray, former chief of the Atomic Energy Comm., ordered a total halt to nuclear waste burial on Oct. 4 after the state patrol stopped a truckload of waste from Com Ed's Dresden, Ill plant and discovered radioactive gravel and "granular material" spilling out of a plywood box.

This predicament only dramatizes the crisis in radioactive disposal, facing not only the nuclear industry but hundreds of nuclear research labora-

• tories, medical clinics, industrial users and the federal nuclear weapons (5) program.

The U.S. once had 5 "low-level" waste sites - Sheffield, IL, Maxey Flats, Ky, Beatty, NV, Hanford, Wa, and Barnwell, SC. All have been shut down, except Beatty & Barnwell. The state of Nevada is in the process of revoking the license for Beatty, and Barnwell is restricting out of state shipments.

Governor Riley, NV., cited unsealed drums and damaged casks of waste from Com Ed, and decided on Oct. 15 to bar any further shipments the same day.

No utility has a worse record for violating NRC packaging and shipping regulations than Com Ed, say South Carolina officials.

-----Bailey Alliance News, Oct. 1979

Current attempts at much-needed revision of the federal criminal code could end in a loss of civil liberties, rather than humanization of outdated and repressive laws.

Last year, Sen. Edward Kennedy introduced Senate Bill S-1437, an attempt at criminal code reform which was deemed so regressive that the House Judiciary Committee refused to vote out any revision of the criminal code. Despite the nation-wide protests of 1977 and 1978, Kennedy has reintroduced S.1437 into the present Senate as S.1722. Some alarming features of S.1722 are:

Criminal Contempt (1331): An individual would be guilty of an offense if he did nearly anything that would be considered to obstruct the administration of justice or resist any order of the court. The danger here is that a person could be considered guilty if he simply "resists" any order of the court; this could include anything from disagreeing with an order he felt was invalid, to physically resisting the order. This infringes upon the 1st Amendment right of free speech.

False Statements (1343): This section would make it a federal offense to make a false statement to a government official, whether under oath or not. Thus if a government official thinks a citizen has made a false statement, he can prosecute the person, and it's the citizen's word against the official's. There would be no presence of an attorney or oath given or similar safeguard for the citizen.

Mental Competency: By questioning your mental competence or by labeling you a threat to property, federal prosecutors can lock you up in "suitable facilities" without a trial during which time you will be subjected to psychiatric "treatment".

The bill could also make labor unions' strikes a criminal activity, and undermine our basic rights of the press, or free speech. Rights to demonstrate, to protest, to organize, and to criticize our politicians and military expenditures could be lost.

It should be remembered that S.1437 was rushed through the Senate before most of the Senators had even received copies of the book-length legislation.

The Greater Boston Coalition to Stop S. 1722 is urging everyone to contact their Senators as well as Sen. Kennedy, and demand that voting be delayed and regional hearings held. We cannot afford to risk tightening of already restrictive laws, and the loss of already precarious civil liberties

-----Boston Mobilizer, Oct. Nov. 1979

The "County Energy Plan Guidebook", by Jim Benson of the Institute for Ecological Policies, assumes the futility of waiting for a federal "soft-path" energy plan, assumes local citizens can do their own planning, and offers such citizens a practical manual on how to come up with a county-by-county energy plan. The two sections of the manual deal with topics such as, estimating county energy consumption and renewable energy. The IES sees this as the 1st step in a grassroots effort to build a national plan from the bottom up. For a copy, send \$7.50 to IEP, 9208 Christopher St., Fairfax, VA. 20031.

-----Powerline, November 1979

LETTERS

Here is a donation. Keep my letter coming! Power to the people. (Power to us).

Thorp, Wisconsin

Dear Hold That Line,

Enclosed is \$5 for a subscription to your publication. I am proud of your attempts towards making people aware of the many issues of injustice. United in solidarity, may peace and justice reign on this earth.

Chicago, Illinois

Dear Hold That Line,

Please continue sending "Hold That Line". We have been receiving it for some time and appreciate all the valuable information in it.

Ashland, Oregon

Friends,

Please enter my name on your subscription list. Thank you and keep up the good work.

Dent, Minnesota

Dear Hold That Line,

Please continue the subscription to your newsletter. The Citizens National Forest Coalition is behind your efforts all the way and I hope to be able to work with you more closely in the future. Because CNFC is so poor and I am a struggling student I am enclosing only \$1 for now and will try to send more later.

Chaska, Minnesota

Folks at Hold That Line,

I almost forgot to send you this check - thank you again for an informative paper. You are doing a very good service for the community. It is heartening to see a group of people like you keep going in good times and bad. I'm behind you!

St. Paul, Minnesota

Kind Folks at HTL,

From under a pile of paper and mounds of books comes a muffled cry, "Hurray for your work!"

Here's \$5 that I can afford now.

Grand Forks, N.D.

* * * * *

* A list of literature on the history of this powerline struggle, on health and safety issues created by powerlines, and T-shirts, buttons and bumperstickers is available upon request.

* The book Lines Across the Land is available for rent or sale.

* The next meeting of the General Assembly to Stop the Powerline will be at 8:30 P.M., Tuesday, January 8, 1980, at the Barrel In in Lowry.

See you there!

MERRY CHRISTMAS!!

HAPPY NEW YEAR!!

AUGUST MEETING OF THE GENERAL ASSEMBLY

There was standing room only at the Barrel In in Lowry on the 21st of August as the General Assembly held its monthly meeting. It was the largest business meeting of powerline protesters (there have been bigger parties) since March of 1978. There were folks at the meeting from S.L.A.M., from the Twin Cities Northern Sun Alliance, and there were people from along the line route who haven't been involved with the protest before. There were also a couple self-proclaimed "peons" from the State Health Department named Larry Gust and David Grey.

The meeting started with Gust telling us that he know all about farmers seeing as how he has family out by Hoffman somewhere. Then the peons proceeded to describe the fabulous job our Health Dept. is doing to protect us from bad things all over the State, and all the studies and monitoring programs they have planned for us on this powerline. They kept saying things like, "We really don't have much knowledge about the biological effects of these things," and "We've got to make all our information good and scientific." They probably should have worded it a bit different, because it came out sounding a whole lot like "guinea pigs". While the peons, of course, wouldn't admit that they said any such thing (they had strict orders not to) even some of the calmer protesters became a little irritable. So people started talking about why they were upset. People talked about the terrible things they feel happening to their bodies which are new since the powerline was turned on last October. People talked about their livestock loosing control of bodily functions, about wildlife disappearing from along the line route, about the extreme arrogance displayed by the Health Department when people call in to report problems (they've said things like "It's all psychological" and "You're probably just allergic to some weed"), and about scientific information that these bureaucratic peons have either been too stupid to know about or else have been ignoring.

Gust and Grey put on a brilliant display of shameless buck-passing. The Health Department in general and our pusillanimous peons in particular are able to do very little, it appears. They're willing to take your name and address if you have a complaint. They even volunteered to take our mailing list if that would help at all. But they aren't willing to go from farm to farm to check things out with people, or to distribute information to those who are being affected so they will know what to look for before it's too late. They couldn't call a press conference to say that powerlines cause health problems because "We don't do that." They couldn't do the necessary studies five years ago before the line went up. They couldn't pay for the transcripts from the June 25 Sauk Centre Health/Safety Hearing which would provide them with plenty of complaints. They couldn't say what type of destruction must be wrought by the powerline before they will take action (but whatever it is the destruction must be "scientifically documented"), and even if they were to take some action, it would be of the grovelling sort. They couldn't shut the line down. What they would be able to do in that event would be to petition the E.Q.B. to revoke the permit. No kidding. The E.Q.B. has refused to do just that a few times already, most recently about a week ago. The Health Department is sitting right in the middle of a nice, neat Catch-22.

The peons took about an hour and a half of our time and it was the most educational 90 minutes they'll ever spend. After that folks took care of business. It was agreed to submit a proposal to host a Rural America Energy Conference next Spring. That proposal has been sent. The most important item was approving an election process and nominating people for the next G.A.S.M. Board of Trustees. Both were accomplished in fine fashion, and the list of nominations not only re-affirms the tremendous job the present Trustees have done for this Movement, but it also insures a very strong organization for the coming year. Nominated for the Board of Trustees are:

| | | | |
|----------------|-----------------|-------------------|------------------|
| Russel Kvam | Darus Ehlers | Henrietta McCrory | Gene Quinn (2) |
| Wayne Anderson | Sharon Pederson | Duane Vossberg | Matt Woida |
| Patty Kakac | Virgil Fuchs | Kenny Thurk | Stephen Pederson |
| | Tony Bartos | Dwight Nelson | |

Think about who you want to be on the Board for the next year, and come to the September General Assembly meeting prepared to vote for seven of the above people. That meeting will be held on Tuesday, September 18 at 8:30 pm in Lowry at the Barrel In. Mark it down on your calendar!

Perhaps we can look at the August meeting of the General Assembly as sort of a turning point in this powerline protest. On the one hand, as far as the public knows the line is in commercial operation, and protesters have every reason to be tired and discouraged. After five and six years of fighting, we ought to be ready to roll over and play dead. But that meeting did not sound tired or discouraged! It sounded angry and ready to make some moves. There were more people together than we've seen for a long time. People were there because they will not be used and hurt like this without fighting back, and because they know we got a bit of organization here that is perfectly capable of fighting back. And we're gonna get a whole lot better at it. . .

SEPTEMBER 4 TRUSTEE MEETING

While we're on the general topic, the Trustees will be meeting Tuesday evening, September 4 to discuss (among other things) financial policy in deciding how the Trustees should be spending Defense Committee money. In short what is the defendant's responsibility, and what is the Committee responsibility for defending ourselves. Anyone with ideas to share about this question is urged to be present at that time.

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THE PRICE OF POISON AND THE ANTIDOTE

By 1991, CPA members alone are scheduled to have paid \$1,427,363,000.00 just for debt services and interest expenses on the CU project. By then, only \$43 million will have been paid on the principal. These costs have already caused electric rates to more than double in the past 2 years. In 1977 CPA sold bulk power for 14.53 mills per Kilowatt hour, and it is up to 29.38 for 1979. CPA projects rates will double again by 1981, and by 1990, they aim to sell electricity for 30 mills per Kilowatt hour.

According to CPA, the more they charge for their electricity, the more CPA members will use. Following such twisted logic, CPA tells us that these tremendous rate increases will somehow stimulate ever greater electric consumption. Even though there was virtually no increase in CPA's peak demand in 1978 over 1977 (489 Megawatts to 488 MW), and even though the 1979 peak is likely to be decreasing, CPA still project a total requirement of 593 MW for 1979! By 1991, it is all the way up to 1373 MW! That is a whopping 181% increase over a 13 year period! CPA's projections for total energy sales are almost as incredible, increasing from 2,259,000 MWh in 1978 to 5,500,000 MWh in 1991. While CPA's projections reach to the sky, the national average growth rate has already leveled off so dramatically that the manufacturers of centralized power generation equipment are severely depressed.

Beyond that, one method of measuring the efficiency of an electrical generation and distribution system is looking at the ratio between peak generation capacity and the total amount of electricity sold. In this day of "rapidly improving technology", it is surprising to find that this is one area in which CPA has actually planned for a 6% decrease. Using this ratio, CPA's system will be 6% less efficient in 1991 than it was in 1977. Quite naturally, the only ones who stand to benefit from this type of an energy development scenario are the few who already control the centralized sources of energy.

The source for most of the above numbers is CPA's "Power Cost Study and Financial Forecast, 1979 - 1991". Wonder what UPA and NSP have planned. . .

While the few stand to maintain their control and make a lot of money if the above scenario is played out, if the rest of us can even afford to participate in that grand design (and at 50 to 80 mills per KWh, that is not likely) it will kill us. The critical costs of centralized electrical systems are not measured in dollars. The continuing disaster at Three Mile Island is fresh in our minds. The Mpls. Star prints stories about the acid rains which are falling because too much coal is being burned. The rains are already killing the land and dissolving property in Northeast Minnesota. The immediate danger through Central Minnesota comes from the 800 KV DC powerline.

In 1977, Battelle, Pacific Northwest Laboratories prepared a report for the Energy Research and Development Administration, and for the Electric Power Research Institute. E.P.R.I. is the research and development arm of the electric utility industry, and E.R.D.A. is part of the Federal Government. The report is entitled "Biological Effects of Static and Low-Frequency Electromagnetic Fields: An Overview of United States Literature." In that Overview, the authors state, "There is currently a lack of unanimity by U.S. scientists as to whether or not 60 Hz electric fields associated with (A.C.) transmission lines produce any adverse biological effects. Results from earlier studies are somewhat conflicting and contradictory. The need for additional biological research to clarify the situation has been recognized."

Results from the experiments on plants, animals and people summarized by the overview include: 1) Decreased body weight, 2) A wide variety of blood chemistry changes, 3) Changes in the chemical compositions of many different types of cells, 4) Lowered levels of hormones which are essential for utilization of glucose and carbohydrates. The metabolism of the body is altered, and fatigue results, 5) The ability of the body to utilize proteins is altered, 6) A decrease in arterial and pulse pressure with increased heart rate, and 7) Reduced egg production in exposed hens.

The report also focuses on effects produced by a static electrical field the type of field produced by a DC powerline. The report states, "Little meaningful biological research has been conducted that simulates exposure to such a (DC) system. Factors in addition to the static electric and magnetic fields must be considered, such as ion currents, air ions, and possibly ozone. In the work which has been published on bioeffects of DC fields, there are similar reports of: 1) Blood and body chemistry changes, 2) Chromosomal abnormalities, 3) Secondary glaucoma (blindness), 4) Increased electrical brain wave activity, 5) A decrease in the brain's ability to control bodily functions, and 6) A depressed ability of the body to produce antibodies. The report concludes "There is a need for additional research on the possible bioeffects of exposure to static fields, particularly with respect to exposure to DC transmission systems. For the latter studies potential sources of bioeffects need to be identified and appropriate exposure systems need to be designed to stimulate in the laboratory the environment under an extra-high voltage DC transmission line."

Not included in the overview are bioeffects of air ions and the products of corona discharge, ozone and nitrogen oxides. It is common knowledge that overexposure to positive ions causes headaches and depression, while too many negative ions bring on a state of drunken euphoria. Symptoms of ozone and nitrogen oxide poisoning are similar to each other, but the oxides of nitrogen are about 10 times as toxic as ozone. The effects of poisoning from either are cumulative, which means that there will be long-term effects which will cause sickness and death in coming years. Columnist Jack Anderson is discussing "the potentially lethal effects of ozone poisoning" in the Aug. 25, 1979 St. Paul Pioneer Press-Dispatch, "The symptoms", he says, "include severe chest pains, shortness of breath, rapid heartbeat, vomiting, coughing up blood, dry throat, swollen glands, burning eyes, blurred vision, diarrhea, clammy skin, dehydration, nausea, dizziness, faintness, loss of appetite and forgetfulness. Long range effects include lung and heart damage and even, some scientists believe, possible injury to chromosomes that could cause birth defects." Sinus trouble, sore throats and conditions similar to an asthma attack are usually the first noticeable symptoms of the poisoning.

Anyway, this overview is not a back shelf dust-catcher. It was prepared to set the record straight for an exchange program between U.S. and Soviet scientists on the bioeffects of electromagnetic fields. It is both scientifically and politically important. Considering the importance of the overview, its content, and the fact that it is over 2 years old, only stupidity and incompetence could have caused it to be overlooked. While the people at UPA/CPA say things like, "The State licensed the line, the State wouldn't license it if it wasn't safe, so it's safe," it would be extremely charitable of us to conclude that they are just boobies who ought to be retired to nice soft padded cells before their blundering hurts any more people.

More likely, the overview was ignored. More likely, UPA/CPA personell knew very well that they would be subjecting people and animals along the line to sickness, long term biological damage, and an early death. More likely our ill-reputed public servants, from the bureaucrats in the MEA, MEQB, and the Health Department to the administrations of 3 governors also knew it. They knew it, but they all dance like puppets for the amusement of multinational energy corporate executives. In that case, our local boobies here have been putting up quite a smoke screen for a barbaric pack of lying cut throats. The whole lot of them are operating outside the limits of acceptable social behavior and have subjected themselves to trial for crimes against humanity. Perhaps they have already been convicted and sentenced. Perhaps they should be worrying about such possibilities.

They are worrying about their powerline which has already been tried, convicted and sentenced to fall. Part of it did just that sometime before 7:1 am on August 24th. It was a big juicy Stearns County corner tower, and everyone agreed that the job looked "very professional". By the time the BCA boys showed up, there were a couple of well travelled roads out to the worn out tower. Many local citizens wearing big smiles turned the affair into a gala social occasion, and the BCA boys got all excited because there were so many people right there for questioning. The agents even came up with three different ways to ask, "Who done it?" all by themselves without any help at all. They were real proud of the tricky way they figured out where one agent walks nonchalantly up behind one farmer and another agent sneaks up behind the suspect. The nonchalant agent whispers, "Pssst, did he do it?", out of the corner of his mouth and jerks his head in the direction of his sneaky partner who is pointing vigorously at the unsuspecting suspect. Then both agents watch to see if the first farmer nods "yes" or "no". When they ran out of farmers, they started in on the workers who were trying to anchor adjoining towers to keep them from being pulled over by the tension of the line. One agent spent the better part of an hour looking for yellow snow (he was kinda stupid and the other agents were just trying to get him out of the way), and Don Jacobson from UPA was trying very hard to hold back the tears and be on his very best behavior. He kept asking the agents in a hopeful sort of way if they caught anybody yet. But mostly he just babbled incoherently, something about his lost tractor or something and wondered about looking confused and lonesome.

That afternoon the sun came out for the first time in weeks. The score is now: Traverse Co.-1, Pope Co.-3, and Stearns Co.-4. No word from Uncle Albert yet.

All this tower business seems to have overshadowed the fact that the line was not in very good operating condition in the first place. The utilities say that they need to do about 10 days of "routine maintainance." What they need to do is patch up all the holes in the conductor cable. On this line, that job will continue to be about as routine as lice on a rat, and this hor. rat had better get used to itching. While we're at it, they say the power plant out in North Dakota is also shut down for "routine maintainance". But there is still no reason to believe that UPA/CPA have gotten their dirty, cheap, wet lignite to burn. What they are probably doing is chipping out the fire box again. When they speak of having "gone comercial" with the CU proje no doubt what they are talking about is the media commercials they're buying in an attempt to sucker people into believing protesters are responsible for electric rate increases.

There'll be a bit of action coming up on the court scene beginning Friday, Aug. 31 in Willmar when Bill Hansen of Wadena will be sentenced at 1 pm before Judge Lindstrom. Bill was convicted last June, and there will be an appeal to the State Supreme Court. Since the conviction, charges against one of his co-defendants, Matt Woida, has been dropped for lack of evidence. Charges will be dropped against another co-defendant, Tony Bartos by the end of the first week of September unless somebody walks into the judges office with some new evidence.

On Tuesday morning, Sept. 4, Mark Hoiium is scheduled for trial in Glenwood. Mark is facing 6 felony charges as a result of Burns Security running amok in Eastern Pope County about a year ago.

Not all the news is so depressing. The Wheaton 2, Darus Ehlers and Dwight Nelson were informed that their charges of Agg. Assault were dropped last Tuesday, only 2 days before the rescheduled omnibus hearing. We would like to give you a little info on what would have happened at that omnibus hearing if the State would have been foolish enough to press charges.

You see, the night D&D were so rudely and abruptly snatched by the BCA, there was a great deal of confusion on the part of the authorities as to why they were busted, and what to do with them once they were. It all started out rather suspiciously with the BCA running around the countryside spying on people through binoculars. That led to the agents freaking out and arresting D&D, who were eventually brought to the jailhouse, and the prosecutor was called down. The prosecutor told the agents that D&D would have to be turned loose for lack of evidence. The agents didn't like that idea at all, and before long they were screaming at each other. "You need some evidence before I can hold them!" yelled the prosecutor. "Tell us what kind of evidence you need, and we'll go find it!" shouted back the agents.

So the agents tried to figure out how to get some evidence, and our hero D&D groaned and rolled their eyes to the ceiling. "We need a search warrant" said the agents. "You don't have enough evidence to warrant a search," said the local judge. "That's why we need a search warrant," said the agents, "Maybe we should ask Judge Claeson." So they did. "You don't have enough evidence, and turn them loose," said Judge Claeson. Instead, the agents called up the Attorney Generals office and asked, "What do we do now?" "Do whatever you want to do," said the Attorney Generals office. So they did. The agents went and searched vehicles and fields until they found some guns. "Guess what?" said the agents to Judge Claeson. "We found some guns!" "Oh," said Judge Claeson, "\$5000 bail each."

Now it was time to get the story straight, which in the long run proved to be an impossible task for our fearless BCA boys. The first time through, the Traverse Co. Prosecutor talked to them one at a time. The agent who had the binoculars said he wasn't sure what he had seen out in the field, whether it was a shovel, a gun, a stick, or what. But the agent without the binoculars has very good eyes, and he said it was a gun. The second time through they were both together, and they pointed to each other and said, "He saw a gun." The Prosecutor told them to write up their statements. The third time through BCA squad leader Least Earnest got involved, and this time everybody agreed that everybody had seen a gun. It all got fixed up just by adding a little "what appeared to be a gun" on each of the statements so they would look good together side by side.

But the Traverse Co. Attorney became increasingly insecure with the idea of prosecuting a case that had the consistency of a very wet paper bag. He was also becoming increasingly insecure in the thought that he, himself was a witness to the BCA's shenanigans the night of the arrests, and the defendants knew about it. So, as we stated in our last newsletter, the Co. Att. resigned from the case in order to be a witness for the defense, and the Attorney General's office was thrown the proverbial hot potato.

Feeble Fabel, after reviewing the shady events surrounding the arrests, after reviewing 2 judges flat denials for a search warrant, the tampered statements of the BCA, the fact that the County Attorney wouldn't touch the

case with a ten foot pole, and after reviewing the fact that the only (6) convictions that would be forthcoming should proceedings continue through the omnibus hearing would be convictions of perjury against three (3) agents of the Bureau of Criminal Apprehension, after all that, Feeble fabel decided to send the case back to the County Attorney who inturn dropped charges. How about that? Perhaps a few cop types listening out there could at Least try to be a little more careful next time? Perhaps a few cop types out there aren't out of the woods yet. After all, we still have the sworn statements, you little liars.

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PARTY

PARTY

PARTY

Dont forget the Party, Saturday Night, September 1 !!! 2 miles north and 1 mile west of Elrosa, sorta close to where that big corner tower went down early on August 24 (got to keep them streight!). Look for the bon-fire if you get lost. Bring your own instruments! See you there

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S.L.A.M. BANGS THE POWERLINE

The Southern Landowners Alliance of Minnesota was organized to stop the 345 KV AC powerline scheduled to run from Dolano to Mankato. S.L.A.M. has temporarily achieved its purpose!!! While condemnation proceedings went unchallenged in Wright County, the proceedings have been stopped in Blue Earth, LeSueur, Sibley, Scott and Carver Counties. Now everybody is waiting upon the Supreme Court to decide whether or not there should be a trial on 1) need for the C.U. project, 2) due process of law seeing as how there were no published notices of necessary public meetings, and 3) peoples' rights in regard to the Environmental Rights Act. The Supreme Court will hear the arguements at 2 pm on Monday, September 10. Ken Tilsen is representing S.L.A.M. in these proceedings.

The utility lawyers Miller and Draws are becoming less stable as time passes and more work crews are becoming idled because of their ineffectuality. They are slowly moving beyond the shouting, hair-pulling stage, which is good and are reportedly spending more and more time muttering incoherently to each other and giggling as they take turns counting the little holes in the telephone receivers. Between the two of them, they counted 37 receivers one day.

S.L.A.M. had a fundraising party down in Hanburg on August 24. There wa something around \$1000 raised, and everybody was real happy to hear about the tower that fell over. There was some mighty fine music, spirits were high, a good time was had by all, and it is doubtful if UPA/CPA will ever get their powerline through that neck of the woods.

* * * * *

ALCOHOL

Folks don't necessarily need more oil, what folks need is liquid fuel. Alcohol is a clean, safe, cheap(or) renewable liquid fuel, and there are a lot of people getting involved with producing it. Even some in Protest Country. The government has a few miles of red tape for anyone making the stuff, bu' the Feds told several local people to go ahead and put the still together, and then someone will come and check it out. The Sept. Northern Sun News has a good article on producing alcohol, and more information is available at:

Alcohol Information
Southwest State University
Marshall, MN 56258
1-300-622-5234

Ethyl Alcohol For Fuel Use
Dept. of Treasury Stock # 048-012-00045-1
Bureau of Alcohol, Tobacco & Firearms
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Department of Treasury
Bureau of Alcohol, Tobacco & Firearms
230 South Dearborn St. 15th Fl.
Chicago, Ill. 60604

Making Alcohol Fuel
Recipe & Procedure
Rutan Publishing
P.O. Box 3585
Mpls, MN 55403

The National Council of Churches, the nation's largest ecumenical organization, has called for a new national energy policy that would replace dependence on nuclear power with a shift towards conservation and renewable energy sources. By a 120-26 vote, the Governing Board of the NCC supported a deemphasis of nuclear development because of unresolved waste problems, the possibility of catastrophic nuclear accidents which would permanently contaminate large areas of land, and the possible "irreversible damage to the environment and to the human genetic pool."

The decision came only days before a similar vote by the National YWCA Convention held May 17-22 in Dallas. At that convention, overwhelming support was expressed for a ban on new nuclear construction until adequate safety precautions have been implemented, the nuclear waste problem solved, and transportation of such waste safely carried out.

While the council of 32 Protestant and Orthodox church bodies refrained from urging an immediate shutdown, NCC President William Howard sees the policy statement as a call for "serious moves beginning immediately" to achieve "the complete cessation of dependence on nuclear fission as a source of energy."

Though passage of the policy statement may not immediately effect the nation's nuclear programs, it should serve to build new safe energy constituencies and provide new forums for public debate. In fact the 11 page document ends with a call for all church members to "join with others to monitor utility and energy industry regulatory agencies" in order to "bring business practices into harmony with the values of sustainability, fairness, and participation."

Copies of the statement, The Ethical Implications of Energy Production and Use, are available from NIRS, 1536 16th Str. NW, Washington D.C. 20036 for 50¢. The National Council of Churches has also compiled an NCCC Energy Packet available for \$6 per copy. The packet includes seven publications of use to groups attempting to foster ties with religious organizations in their community. Orders should be sent to the NCCC Energy Project, 475 Riverside Dr. (Rm. 572), New York, NY 10027, (212) 870-2385.-----GROUNDSWELL, JUNE, 1979

The Senior Citizen Coalition of Northeastern Minnesota has beaten back the third straight Minnesota Power & Light (MP&L) rate hike request in a row and won on lifeline and CWIP issues to boot. In an April decision, the state PSC granted only one-half of MP&L's requested \$52 million increase, decided to continue the 350-kilowatt/hour lifeline rate instituted in 1977, and excluded CWIP from residential rates. MP&L has tried for two years to include CWIP in the rate base; this year, they were allowed to assess the local taconite industry for half the requested amount. Significantly, the PSC also ordered MP&L to reimburse the Coalition for intervention expenses. The Coalition had requested this in their petition, basing their request on a precedental setting decision of the Colorado Public Utility Commission in November, 1977 and also on the requirements of the Public Utility Regulatory Policies Act of 1978 (PURPA).

* * * * *
In the latest developments in the Black Hills
we have Union Carbide making an entrance in
* all its destructive splendor. They've built a *
shaft in Craven Canyon that is 10x12 feet and
2000 feet deep. The only problem is that they
* did it illegally without a permit. Union Car- *
bide thought a "gentlemens' agreement with
the state was enough." Won't these guys ever
* learn? Well, the Black Hills Alliance has *
filed criminal charges with Union Carbide, so
we'll keep you posted.
* * * * *

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

COURT CAFERS

On Thursday, August 31 at 1pm in Willmar, William Hansen Sr. appeared in front of our old friend Judge Lindstrom for sentencing. Bill was given 2 years on each count, to be served concurrently instead of 2 consecutive 2 year terms. The sentence is stayed pending appeal, so we have another crack at the case through the Minnesota State Supreme Court, to determine if Bill has to serve any time at all.

On Tuesday, September 4th the legal team showed up in Glenwood to see what they could see about just who was going to trial; Mark Hoium or Tony Bartos. Well, Tony Bartos' charges were dropped, making him the 2nd of the Villard 6 to have his charges dismissed for lack of evidence. 2 down, 3 to go

Meanwhile, jury selection began for Mark Hoium that morning after preliminary meetings in chambers, Judge Willett presiding. Willette surprized us a little bit by giving the defense much more room to move in jury selection than any judge has prior to this case.

We went through 7 prospective jurors on Tuesday, each one taking anywhere from 5 minutes to 1 hour. The 5 minute ones were folks who never even made it past the judge's questions before they said they'd heard about the case, they made up their mind, they didn't see how they could change their mind and that all there is to it! Others talked for 1/2 hour when questioned before they'd say they couldn't be fair because of their feelings against the line. Looks like there're still deep-rooted feelings in Pope Co.

On the morning of September 5th, Mark was offered a deal. If he would plead guilty to 1 count of damage to property and 1 count of aggravated assault the 4 other felonies against him would be dropped. The defense team met for 3 hours discussing the pro's and con's of such an offer, needless to say it was a difficult decision for Mark to make. We know from prior experience, that guilt or innocence is not always a factor where the courts are concerned. We know the difference between the law of the land and the law of the state. We also know that our victories have never been in the state and corporations' playground known as the courts, but in the fields - and that it's dangerous to think in any other terms when you're talking about 30 years of someone's life. So, at noon that day, the decision was made to take the offer.

There will be a pre-sentence investigation, so the date for sentencing has not been set. The defense will be pushing for reducing the charges to misdemeanors. We'll keep you informed as to the date of sentencing, as soon as the defense is contacted.

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On Monday, September 17 at 8pm at St. Francis Catholic School basement in Benson there will be a meeting of the Minnesota Citizens Action group. This organization started out of the Power To The People conference which took place last May. It is a grassroots organization working for peoples' rights to have a say in the decision making process which will determine our energy future.

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SHOW AND TELL

The BCA is really getting around these days it seems. Rumor Control has it that agents are "just happening to be in the neighborhood, and thinking they'd drop in." So far most of those reports have told us that folks tell the BCA to take a walk. It's very clear that the BCA and the state are much more interested in spying on and threatening local people, than they are in watching their precious powerline. If approached by an agent, remember you have no legal obligation to talk with them and are completely within your rights to ask them to leave. If you have any complaints of harassment by the BCA, or questions concerning their activities, contact GASP.

On August 23, a crew was supposedly working on the downed tower in Stearns County and wandered on to Gene Bieringer's land; a neighbor. So, Gene thought he'd go see what they were doing on his land being as the downed tower was $1\frac{1}{4}$ miles away. Well, on his way out to see the work crew, the BCA stopped him on the road. So, Gene just told them that he wanted to know what those guys were doing out there and was going to have a talk with them. The BCA didn't see it that way, and told Gene that he couldn't go out into his field. But Gene went out there anyway, since all he was worried about was why these guys in hardhats were driving through his alfalfa. Seems simple enough. So anyway, Gene went out there, found out they were just anchoring the tower, attempted to leave, and got stopped again. This time the BCA said they wanted to have a little talk with him. Well, Gene didn't quite see it that way, so he told them, "I live in that house over there. I didn't come out here to talk to you and I'm not going to talk to you now. If you want to see me you go over to that house." And he left. Then the BCA showed up at his house and asked Gene to get into their car so they could have their little talk. Well, once again Gene didn't exactly see it that way and he told them that he wasn't getting into any car and what's more if they want to talk to him they can stand right there. Needless to say, the BCA didn't like that at all; they got huffy, said Gene would get something in the mail, and left.

Low and behold, a week and a half later Gene got a mail order arrest for simple assault and failure to obey. Wonders never cease!

* * * * *

For those of you who haven't heard the bacon frying, the two downed towers are now up and running....they think. By the way, hats off to the Wright County farmers who have grinned quite a bit over the last couple weeks. What goes up, must come down!

* * * * *

SLAM

SLAM has intervened through its lawyer Ken Tilsen in condemnation proceedings in 5 of the 6 counties along the 345kV powerline which branches off the CU project's 800kV line. In none of those counties has land been condemned. Condemnation has either been stayed or continued until there is a ruling of the Supreme Court of Minnesota on Sept. 10 at 2pm in St. Paul. The principal issues raised are:

- 1) Do landowners involved in an eminent domain proceeding have a right to a full hearing to contest the taking of their land as necessary and in the public interest?
- 2) Were the landowners deprived of their constitutional rights to due process of law through lack of notice which denied them a chance to be heard at the Need hearing for the line?
- 3) Did the State Agencies have the jurisdiction to Certify the Wilmarth line in light of irregularities in their proceedings especially lack of notice that denied public participation and orderly process?
- 4) Are landowners prevented from challenging a project because of a previous Court ruling which did not address the same issues now being raised?
- 5) Do landowners have the right to a hearing on the terms of the easement? For example, what worth are hearings on health and safety if the easement does not provide assurances commensurate with the findings of those hearings? Or, is it reasonable and necessary to grant the utility the unquestioned right to enter the easement from any place on the farm and use the whole farm in construction and repair of the line?
- 6) Where the issues are common to the 5 counties, should the hearings be

We believe that in order for the Supreme Court to deny SLAM a hearing on any of the issues would amount to a declaration that "The need for the line is so clear that people's constitutional rights to due process of law may be violated in this case"

With a full hearing on the issues, SLAM intends to put on a landmark case that will influence all future electrical energy projects in Minnesota. We will show that such projects are ill conceived and too costly both financially and socially to justify their possible benefits and do not represent an approach to the energy crisis that emphasizes general human needs and purposes above special interests and privileges in resource use. Our arguments are particularly strong in light of the changing energy projections and perspectives.

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IMPORTANT NOTICE

Over the years this Powerline Protest Movement has proven its ability to grow and change to meet new challenges and to take advantage of new opportunity. This ability has enabled us to survive, to grow strong, and to join with others all across this nation who are faced with problems similar to our own. Our ability to survive (along with the blundering of UPA/CPA and the State) insures our victory over the Powerline. It is becoming clear that we will win, but it is not quite so clear just how long it will take. Maybe a couple months. Maybe a couple years. Maybe more, but if we survive we will win, and the longer it takes, the stronger we are capable of becoming. That is why it is important that we look towards long-term organizing, particularly now, when several opportunities are before us.

With that in mind, the following developments are in the works:

1) Update the HOLD THAT LINE Mailing List.

After 1½ years of operation, it is time to sort duplications, out-dated and incorrect addresses, and people no longer interested out of the mailing list. This process will be started in the next issue of Hold That Line. A card will be included in that issue, and if you want to remain on the mailing list, you will have to return the card with your address on it to us. There will be a reminder of this process in the issue following the sending of the card, which will be mailed around Oct. 8, and we will mail only to the revised List starting October 22. Being as Hold That Line costs about \$5 per year per subscriber, we'll be asking for a donation at that time.

2) Working with the Northern Sun Alliance.

As you know, Hold That Line comes out every 2 weeks to about 1900 addresses, and the Alliance publishes Northern Sun News once a month and distributes over 20,000 copies. There is an idea on how to work more together with these publications after we get our mailing list sorted out. The idea is simply to put every other issue of Hold That Line into the Northern Sun News. So once a month Hold That Line will come to you as it has in the past and once a month it will be mailed to you from the Northern Sun Alliance as part of their newspaper. If we do it that way, we will keep many more people informed about the powerline struggle without losing much of the "local flavor". Such a change would also save some paper expenses, and save a bit of time and energy on mailing, too.

3) G.A.S.P. staff pledge drive.

The other thing we got going is a pledge drive. We are trying to raise enough money to pay a staff to do the work that needs doing without draining the Defense Fund. Already there is more work that needs doing than can possibly be done with resources currently available, and an office of some sort is quickly becoming a necessity, as well. Get in touch if you're interested in making a monthly pledge.

Environmental groups see in President Carter's proposed new energy supply mobilization policies a "centralization of power in the hands of a few" that threatens people's rights as well as their environment. These policies were condemned in such strong language at a news conference held by environmental leaders on July 20th that some reporters were left wondering if the environmental community might not be hearing a political break with Jimmy Carter, whom environmentalists generally supported in 1976.

At the news conference, Brock Evans, head of the Sierra Club's Washington office, presented a statement for 11 groups that included nearly all of the major national environmental organizations, plus the League of Women Voters. "We are here to warn you that the President's plan would, if implemented, pose the strongest kind of threat to the laws now protecting the rights of the public."

Another speaker, Richard Ayres, an attorney with the Natural Resources Defense Council, was more specific. He said that the President's proposal to establish an Energy Mobilization Board and an Energy Security Corporation were "the most extraordinary authoritarian measures." Ayres said that Carter was putting "very serious pressure" on his ties with environmentalists, adding, "If the President passes this (mobilization package), he will be remembered for his destruction of the environment." -----SCIENCE/VOL. 205 AUGUST, 1979

GENOA

The 5 Coulee Region Energy Coalition Members who were arrested on March 29 and April 2 went on trial last month in Viroqua, Wisconsin. The 5 were among the hundred or so demonstrators who were objecting 2 shipments of high-level radioactive waste from the LaCrosse Boiling Water Reactor (LACBWR) at Genoa, Wisconsin to a temporary storage facility in Morris, Illinois.

On March 29, 4 people stood in front of the police car that escorted the truck. The 4 were arrested. On April 2, 2 men, including one who had been arrested on March 29, tried to chain and padlock the gate. They were both arrested and charged with disorderly conduct.

The district attorney, Larry Seigar made a motion at the pre-trial hearing that testimony should be limited to the events of the arrests. He said no evidence should be admitted concerning health effects of radiation, the safety of the Genoa plant, or the safety of the transport. Stewart Richter, defense attorney protested the motion and argued with the judge, who refused to listen and upheld the motion.

Next, a utility lawyer made a motion to quash the subpoenas of the Genoa plant officials, even the subpoena of Richard Shinschock, the plant manager who witnessed the arrests. The judge cut off Richter's protests and upheld that motion as well.

The judge also swept the defense of the Genoa 5 out from under their feet by not allowing the testimony from expert witnesses. At one point in the trial, attorney Richter asked the judge to allow the defendants to plead that they were acting in self-defense, and in defense of others. The judge did not allow the plea. The jury was out for 45 minutes and found the Genoa 5 guilty. The judge sentenced 4 of the members to 3 weeks in jail and handed down a 6 week sentence to the 5th member. None of the Genoa 5 had previous criminal convictions and all are residents of the area. In the courtroom, the people cried out appeal.

NATION'S WORST RADIOACTIVE SPILL

New Mexico Environmental Improvement (EID) officials estimate that approximately 100 million gallons of radioactive waste and 1,100 tons of tailings solids were released into the north fork of Rio Puerco when an earthen dam was breached leaving a 20 foot wide hole.

The earthen dam of the 18 acre United Nuclear Corporation (UNC) mill tailings pond was breached at about 5am on July 16, 1979 and remained open until 7:30am when UNC employees put up a temporary dike behind the broken dam

The mill was ordered closed after the accident by EID's acting director, Cuba Clayton.

Originally, EID said that 325 million gallons of radioactive water had breached both an earthen dam and a secondary holding area, and was headed down stream to the Little Colorado River and eventually to Lake Mead.

The figures were later revised and the flow stopped 50 miles down stream between Navajo and Chambers, Arizona. However, as Doug Barber of EID said, "We may never know exactly how much water and solids were released."

"At a ph of 3 or 4," Barber said, "heavy metals are dissolved in the water. We are most concerned about arsenic, selenium, vanadium, molybdenum, zinc and uranium." Barber forgot to mention thorium and radium, both cancer causing agents and likely contaminants. Robert Triviso of EID's Gallup office said samples taken of the spill showed radioactivity readings more than 6,000 times the drinking standard. EID has advised people to "not water their livestock, swim or use water from the Rio Puerco," because the Puerco's high acidity readings indicate a possible health hazard.

Over 1700 people live in the Church Rock area. While EID is monitoring all community wells within 200 feet of the Rio Puerco, United Nuclear Corporation will provide bottled water for human consumption and livestock to area residents affected by the tailings release.

Todd Miller, UNC's environmental director, said this will continue "until we see a reversal of contamination of the river."

Miller added, "this is not a free lunch." Every request for water presented by the chapter will be evaluated to insure the person is located in an area that might have water contamination.

"This is not an isolated incident," said a Church Rock resident. "We Navajo people are essential partners to nuclear development and power. The companies have an obligation to be responsible and accountable to the community," she said. -----excerpt from THE BRIDGE, SEPT-OCT, 1979

UPCOMING EVENTS

The following is a list of events coming up in the next week:

- September 10 - Initial arguements before the Supreme Court.
- 11 - Press tour-along powerline route
Trustees meeting 8:30pm, Lowry
- 12 - Demonstration in front of CPA at noon
Panel discussion on powerline, Burnsville high school, 8pm
- 17 - Minnesota Citizens Action mtng, 8pm Bense
- 18 - GASP general mtng, 8:30pm, Lowry

GENERAL MEETING

GASP's September monthly meeting will take place on September 18 at 8:30pm. Among the items on the agenda will be:

- 1) A proposal by the GASP Board of Trustees dealing with financial guidelines and policy in distributing funds to those who need them.
- 2) A genral discussion on the idea of an office and staff for GASP as well as sharing thoughts on where we want to go from here in our organizational work.
- 3) Further discussion of the election process followed by voting for the Board of Trustees. The list of nominees for the board of 7 are:

- | | | | |
|----------------|-----------------|-------------------|----------------|
| Russel Kvan | Darus Ehlers | Henrietta McCrory | Gene Quinn |
| Wayne Anderson | Sharon Pederson | Duane Vosberg | Matt Weida |
| Patty Kakac | | Kenny Thurk | Stephen Peder: |
| | Tony Bartos | Dwight Nelson | |

See you on the 18th in Lowry!!!!!!!!!!!!

A FUNNY THING IS HAPPENING ON THE WAY TO A FORUM

We thought maybe we were going to have a Public Energy Forum on electricity sometime in November. During the August 10 meeting between the Coalition of Rural Environmental Groups (CoREG), and Utility and Government personnel, a format was agreed upon and a tentative date was set. The agreed upon format simply called for a few opening remarks by Uncle Albert and then the Minnesota Energy Agency (MEA) would tell us about their plans and policy. The Utilities would critique the MEA from their perspective and give us their plans and policy, and then representatives from CoREG would comment on the positions of the Government and the Utilities, and offer a few alternatives. There would then be time for rebuttal, questions from the floor, general discussion, and some provisions for follow-up work. Fair enough, don't you think?

But when our bureaucratic flunky friends and the Utility lackies reported back to their respective Masters about the things they had agreed upon with CoREG, you can believe that there was much consternation in the Great Halls of the Powerful. It is easy to believe that the wrath of these Masters of Deceit was nigh on boundless seeing as how they were threatened with a terrible scandal. The depraved whoring between corporate executives and public servants was about to be exposed. Something had to be done!

So at the September 7 Forum Planning Meeting, the State sent in the top-dog from the Energy Agency who simply had to buy more time, and the Utilities started blowing smoke while looking for a back door big enough for them to slither through without getting stuck.

The Utilities managed to find themselves a tiny little door out to the alley alright, but they haven't quite decided yet if they want to be left out in the cold should they actually survive the risks of leaving. You see, the Utilities are claiming that this Public Forum isn't public enough. Really. These demented perverts have had years to initiate such a forum, and obviously they have not chosen to do so. But now things are suddenly different. Now that a Forum is finally being forced upon them by concerned (enraged?) citizens, the Utilities have suddenly developed a remarkable interest in "the public". "We feel that the whole issue of public input has been passed over too quickly and must be discussed again", they say.

These Yellow-bellied Yahoos not only have the gall to say that this forum isn't public enough (even though everybody is invited to come and bring their cousin's aunt along), but they also have a nice list put together about just who "the public" really is. And such a Public! Names from this list, they suggest, should be put in a hat, and those that are drawn get to participate in the forum. Their list includes the Minnesota Rural Electric Association, Minnesota Chamber of Commerce, Minnesota Association of Science and Industry, Minnesota Urban League, National Association for the Advancement of Colored People, Isaac Walton League of Minnesota, Upper Midwest Council, and the Health Department. No Kidding. This nonsense was presented as a "new proposal", and everyone was actually expected to take it seriously because otherwise "we just might pick up our marbles and go home." Other than this "proposal", the Utilities had very little to talk about during the course of the meeting. It is becoming clear that the Utilities need plenty of their "friends" around for this kind of stuff, because they are very much afraid that otherwise things will be getting out of their control. The blind arrogance of these molting turkeys is exceeded, it seems, only by their cowardice. Not Public Enough. What a scream.

While the Utilities limited their participation to the issue of "public input", the smooth talking top-dog of the MEA named Johnson (but you can call him . . .) seems to be a great believer in the idea that it doesn't matter so much what you say, just so long as you keep on jabbering. Speech after stirring speech came out of this guy, and he was chock-full of disjointed platitudes such as "WE are a nation of LAWS", "It is criminal that there is no

national energy policy", "In Minnesota, we have a lot of plans, (7) but we have no policy. We are powerless and we have no control of the energy situation at the MEA", "It is a reactive process that we have here at the MEA", and "I certainly hope I don't have to go to jail for circumventing the Law." He also said that COREG people have a poor understanding of the Law governing the Minnesota Energy Agency, but that he wasn't about to talk about those Laws because he isn't a lawyer. Uncle Albert picked a real winner here.

Then he got going on something about how COREG "wasn't seeing the Forest for the trees", so he was politely informed that a tree here and there was on fire, and it might be wise for him to make a little note to himself that the fires just happen to be in his little forest. And he was also told that the things he had just been so eloquently stating were exactly the things the people of the State have a right to know about the MEA. Say that stuff at the Forum, Mr. Johnson, and we will all have a very constructive learning experience which will help us devise our energy policy.

Now that kinda shook old Mr. Johnson up a bit, because what he was supposed to be doing was buying time. So then he really started to blather on about how understaffed and over-worked and underfinanced the MEA actually is "Why, we don't even have a planner at the Agency," he said. Anyway, it seems that there is just so much to do and so few people to do it that it is not possible for the Minnesota Energy Agency to tell the people of this State in November how it decides whether or not to grant a Certificate of Need for a facility proposed by the Utilities. While they can't tell us how they make such decisions, they assure us quite adamantly that they will continue making decisions about such Certificates. This is a good spot for some more name calling. . . .

So this guy Johnson claims that he is not easily embarrassed, but the fact remains that he is struggling just as hard as he can to delay as long as possible before he has to walk out on stage with his pants down. "By January", he says, "But not in November." The Pollution Control Agency is taking bets on whether or not he can figure out how to dress himself in 2 extra months.

Where it stands now is that there might be some sort of a Public Forum in November as long as everybody promises that nobody will say anything about anybody else. Lawrence Welk will be host and tea will be served by the Daughters of the American Revolution. Bring your own instruments.

The next planning meeting for the Public Forum is supposed to be on Monday, September 17 at 2:30 pm in room 125 of the State Capitol.

* * * * *

UNCLE ALBERT STEPS OUT (again)

Two towers went bump in the night towards the end of August, so Uncle Albert got sore and decided we were once again the Top Priority of the BCA agents who are now "blanketing the area". Chants of "We're Number One!" could be heard floating on the country breezes. But Uncle Albert really ought to be ashamed of himself. While people out here are literally frying under a powerline that isn't needed in the first place and is just too expensive in the second, this Knee-jerking dolt we have for a governor says in the Mpls. Tribune that he is, "calling on the public to cooperate with law enforcement officials to end the vandalism and eliminate the threat to public safety (sic) and the needless destruction of property." Maybe he should get some sort of a prize for that one.

But the Utilities simply decided to up the ante. Now there's a \$100,000 bounty. Add another \$150,000 to that and we're right in there with the IRA. But be careful, folks, that kind of money has attracted some bounty hunters, and they try to make up the rules as they go along. Maybe we should auction off Martin & Lennick just to keep things from getting too lop-sided..

LIT & OTHER STUFF

- THE POWERLINE WILL AFFECT YOU - 25¢
MAPP & THE CU PROJECT - 25¢
POWERGATE - 25¢
ELECTROPOLLUTION - 25¢
WHAT IS PURE COAL? - 25¢
PHYSICS RELATED PROBLEMS OF COAL FIRED
POWER PLANTS - \$1
NORTH AMERICAN COAL CAPER - \$1.50
POLLUTION BY ELECTRICAL TRANSMISSION-\$1
ELECTRICAL POWER RESEARCH INSTITUTE'S
RESEARCH PROGRAM ON BIOLOGICAL EFFECTS
OF ELECTRICAL FIELDS - \$1.50
RUSSIAN STUDY - \$1.50
RUSSIAN STUDY & RELATED COMMENTARY-\$2
ELECTRICAL WIRING CONFIGURATIONS &
CHILDHOOD CANCER - \$1.50
EFFECT OF EHV LINES ON CATTLE
REPRODUCTION - 50¢
T-SHIRTS MINNESOTA STATE TREE - \$6
GASP - \$6
NIGHT RIDERS LIVE LONGER - \$6
BUTTONS IF YOU KILL OUR FARMS - \$1
USE ALTERNATIVE ENERGY - 50¢
BUMPERSTICKERS - NO POWERLINE - 75¢
DECENTRALIZE ENERGY - 75¢
UNSAFE/UGLY - 75¢
FARMLAND FOR FOOD - 75¢

Send all orders to HTL, Box 5, Lowry,
Mn 56349.

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LETTERS

Dear folks at Hold That Line,

I am really sorry I have neglected you for so long. A lot has happened in the last few months. I got married and found a new job. More than likely I'll be able to make more financial contributions to you in the future, as I'll earn more money. I am way behind with your news. Please send me your newsletter Hold That Line. Here's my new address. Good Luck to You!

St. Paul, Mn

Dear Hold That Line,

Just to thank you for sending Hold That Line so regularly from everyone at No Nuclear News. If you ever have newspaper clippings you would like us to print, we very much want to do that. Enclosed are a couple more Uranium Special issues and a copy of Tribal Peoples' Survival put out by the American Indian Environmental Council, as the uranium industry seems to have its eye on Minnesota, we thought people might like to read up on the stuff. No Powerline!!!

Cambridge, Mass

I have been referred to you by Northern Thunder, Eau Claire, Wisconsin for some information concerning powerlines. I'm told that you may have information concerning health, social and possible environmental effects of powerlines. And you may have suggestions for keeping a line off certain routes or altering the route. The line I hope to alter or avoid is to be from Alma, Wis to a Crystal Cave substation to the north of Alma. It's a 161kV line that passes through ag land, wood land and across rivers (the Chippewa at least). A call today to the Wisconsin PSC reveals that the line is not under their jurisdiction because it is owned cooperatively (though not by a REC as far as I know) and was planned before 1973. Being a landowner along this route I have received no word from anyone on health effects of powerlines, though I've heard of studies being conducted in Russia & at MIT. Can you send me any info on effects of powerlines? I am thankful for any assistance you might offer.

Madison, Wisconsin

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

DON'T COUNT YOUR CHICKS WHEN YOUR EGGS ARE
BEING WALKED UPON!!!!

According to a recent CPA publication, CPA will experience a peak demand of 551 megawatts (MW) this year. By 1992 it will be 1274MW, which works out to be something like 10% a year. Never mind that such a figure is 3 or 9% higher than the national average for the past couple of years, and never mind that CPA experienced virtually no increase in 1978 over 1977 while UPA actually declined. And never mind that the healthiest chunk of this increase is scheduled for the more urban and suburban REA's.

Cpa also has it all worked out so that they know exactly where those additional 723MW are coming from. 7MW will come from hydro power (between 1979 and 1980), and all the rest will come from coal fired and gas fired generators. That's because the Tyrone Nuke got knocked out. At CPA, they figured out that if there's fuel in the ground, somebody must own it and they will be delighted to sell it, and CPA is in a perfect position to spend your money to buy it. There just doesn't seem to be any other way.

After CPA figured out how much more they NEED, and where that increase will come from, they figured out how much it all will cost. CPA is very good at figuring out costs. Interest expenses increase from \$36, 156, 000 in 1979 to \$102, 604, 000 in 1991. Naturally borrowed funds are to be repaid over 34 years with 7 years of deferment on repayment of principal. Curiously enough, while the load demand is projected to increase by a factor of 2 1/3, accounts receivable are scheduled to increase by a factor very close to 6, from \$5, 732 000 to \$34, 273, 000. Accounts receivable has something to do with your bill.

Your bill might also find some sort of a reflection in a category under a column called "Funds Provided By:". The category is called "General Funds - beginning of year". In 1979 it shows \$756,000. By 1991 it is up to \$125, 338, 000. That is an increase by a factor of over 165!!! And on and on the numbers go. We'll probably end up digging into these figures a bit more in the future.

Just so you don't go thinking that these figures floated in upon some phantom fairy ship, Bob Sheldon, PR boy wonder for CPA said in the Pioneer Press that they snuck the powerline into commercial operation last July 2, (didn't want to attract attention you know), and beginning August 1 their heroic effort to make the CU project pay for itself is marked. Phantom fairy ship indeed. More like a leaky old barge that got caught out at sea in a gale and is slowly sinking. Every time a bit of the old crate rises briefly from beneath the waves, the boy wonder gets all excited and they all make plans of what to do with all their riches when their ship comes in. Fat chance.

Anyway, the article says they've been on line since July 2, all \$1.2 billion worth. Other sources which are a bit more reliable, however, say that all that happened on July 2 was that they managed to get the plant back in good enough shape to burn oil (after an unfortunate development with lignite) and it wasn't until late July that the lignite pulverizer was semi-functional. Considering how many times the line has not been on during the past 10 days, it is still highly unlikely that they're burning anything but oil.

So the St. Paul Pioneer Press has Sheldon smirking quietly like the Cheshire Cat while he proclaims the advent of this out-moded aerial sewer in a very subdued manner. Then the Pioneer Press sort of tiptoes into the back pages with a follow-up the next day. The whole thing reminds one of a half drunk grownup who has a very troublesome small child he wants to go to sleep as soon as possible because there's a party going on downstairs. But the kid is subject to fierce temper tantrums, so you gotta be kind of careful or you'll be up there all night. Oh well. Listen to us snoring. Pretty soon the half drunk grownup gets up, stumbles softly out the door, and turns out the light. Now wasn't that fun?

Some reports of the current situation are a little more realistic, however. In the Washburn, North Dakota Leader, out where the powerplant is, for example, there's a story dated August 1 with the headline, "Nothing's Going

to Cross Their Counties, After Three Years, Farmers' Rage Continues in (2)
Minnesota Counties". The third paragraph reads in part, "Only now, the
protest is bigger, more organized, involved in more issues, and using more
advanced techniques to publicize their crusade." (We ought to look into those
advanced techniques a bit more!) It is encouraging that there are people in
the media who are capable of touching reality from time to time.

* * * * *
Charlie Anderson is your CPA president. While
* he has been busy looking out for your energy *
needs, he has also found it necessary to
* spend about \$32, 845.27 to landscape his love-
ly countryside home on the lake.

* * * * *

COCORP GETS INVITED OUT

The Consortium for Continental Reflection Profiling is an outfit operating out of the Dept. of Geological Sciences, Cornell University, Ithica, NY 14853, (607) 256-7165. A Dr. S. Raufman is involved along with Princeton, Wisconsin, Houston and Texas Universities in using a seismic technique. They study "mountain building, earthquakes and basin formations, as well as resource emplacement," according to literature given to West Central Minnesota farmers by work crews in the area. Just the type of information energy corporations like to know; everything from water, oil and uranium data to possibilities for nuclear waste storage facilities. Interestingly enough, once the data is compiled, it is public information (they claim) which is pleasing to the corporations. Interestingly enough, all the work crews are Mexican people and all the boss men are white. Interestingly enough, none of them are in this part of the country anymore because it got too expensive to stick around. Much of their equipment turned up missing and their miles and miles of wires got cut up real bad on a couple of occasions. West Central Minnesota it seems, is not for sale.

S.L.A.M.

Ken Tilsen continues to make the rounds of County Court along the route of the southern branch of the CU project, arguing that: 1) The taking is not necessary, 2) the proceedings are in violation of due process and lack necessary regularity, and 3) the proceedings violate the Environmental Rights Act. On August 3 in Sibley County Court, the whole thing was continued for a few weeks, but the Judge for LeSueur County wouldn't even stick his neck out that far. There are three court hearings left.

Drawz, Perdue and the utilities take the position that all of this is redundant nonsense, and to prove it, they are just nasty enough to force a hearing in every county rather than agreeing to consolidation. On the other hand, the Supreme Court has already agreed to hear the arguments for Blue Earth County, and we are hopeful that the Supreme Court will also agree to a consolidation. Hearing date before the Supreme Court is scheduled for Sept. 10. A favorable ruling from those arguments could force a trial on the need for the project.

Don't forget the S.L.A.M. benefit Friday, August 24 at the Hamburg Community Center. Hamburg is east of Glencoe and a couple miles south of Hwy 12 on state Hwy 5.

G.A.S.P. FUNDRAISER

Scrap metal is being collected at the Villard Elevator Company in Villard, Minnesota. Remember, no tin or wire please. We'll be collecting the metal for the next few months, and don't forget to drop a line to the politicians about saving the railroads.

Hold That Line needs your support, and we appreciate whatever help you can send our way. In an effort to economize the newsletter, there's a move afoot to weed out all the dead weight on the mailing list. We'll let you know what we need in the next newsletter.

There is gonna be one of those famous Stearns County parties you may have heard about come Saturday, Sept. 1. Go a mile north out of Elrosa on US 71, then go west a mile. The bonfire should be visible for quite a distance. Folks from the cities are bringing their instruments too!

COMING EVENTS

August 21: There will be a general meeting of G.A.S.P. at 8:30pm in Lowry at the Barrel In. Nominations for trustees for the legal defense committee will be open and the election will take place at our next meeting after that. We also need to be going over problems dealing with finances so be sure and come with your ideas and/or complaints.

There's also some other things that will need to be decided on. "Rural America", an organization set up to help rural people have a voice in public affairs and policies is planning on a training/organizing workshops conference someplace in the Midwest. They want it held in communities that have been affected by energy development projects and are talking about \$4000 available for setting up the conference. If people are interested in working on something like this, then we can send our application in.

Some of you probably remember talk about "Dicky Johns", whether they work or not under the line. It seems someone from EQB is interested in testing one on someone's land. We need to talk about what conditions we'll agree to if the test will be of any value. Bring your ideas to the meeting.

While we're on the subject of the EQB, things are once again slithering around in regards to the UPA 230kV Benton-Milaca powerline. There are folks in the area who think that the whole idea is screwed up, and they could use our support.

Informational meetings will be held at 7pm August 13 at the Milaca City Hall and at 7pm, August 14 at the Foley Elementary School Auditorium.

The hearings are scheduled for the Foley Elementary School Auditorium on August 23 at 10am and 7pm, and August 24 at 10am. Hearings at the Milaca High School Theater are for August 27 at 7pm, and on August 28 at 7pm and 10am at the Milaca City Hall.

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There will be a gathering of a different sort on September 12. There will be a rally/demonstration in front of CPA offices in Edina on that day, an event we hope to turn into the first of a long series of picketing actions. People from the Northern Sun Alliance are excited about the opportunity to get back into the thick of it, and anyone who can be with us on Sept. 12 is asked to meet at 11am in the parking lot behind NSA offices at E. Franklin and Bloomington Ave. in south Mpls. We'll have more on this event next time, but get ready!!

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The workshop by the National Jury Project, Minneapolis chapter, is scheduled for 7:30pm Thursday, August 16th at the Twilight Cafe in Lowry. Those who expressed interest in such a session can look forward to a very informative evening on legal perspective.

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Sorry! We had "News From all Over the Place" all ready to go this week, but ran out of room with our special insert on acid rains in Minnesota. We promise to have that column back as usual in our next issue!

* * * * *

About 75 people gathered at the Ron Barsness farm Saturday night to celebrate a DREAM come true - the ruling by the court that the mail ballot system is indeed illegal. The instruments that were brought proved to be in working order and the music and dancing lasted late into the night. But mostly people sat around and talked about how coops have been breaking the law for many years and all they have to do is say "we won't do it again".

It took a lot of hard work and determination on the part of DREAM people to accomplish what they have, but the work's not over. DREAM will be continuing to meet and work to make Runestone a coop that is truly run by the people.

Meanwhile, it seems Dreamers aren't the only ones keeping late-night hours these days. The past couple of weeks it's been a game of musical agents in powerline country with everybody trying to figure out who everybody else is, especially the BCA. Vehicles scampering around like confused ants on the wrong anthill, mysterious calls from unidentified parties asking directions to peoples' houses, and a very busy airplane zipping back and forth up to 10 miles away from the line attempting to find out which way civilization is running amok.

Last week a couple people nonrelated to the protest were stopped near the line by men identifying themselves as the FBI. By identifying we mean they said they were, but no actual identification was produced. Also, Rumor Control has it on good authority that there are some outside agitators running around out here pretending to be agents of one sort or another, complete with identification. It's hard to say exactly who is putting on such a charade - but as far as why is concerned, there is a lot of \$\$\$ in rewards available for any interested bounty hunter from coast to coast.

Well, whether we're dealing with the FBI, opportunists playing dress-up or the same old boring BCA, it seems in order to do a quick refresher on what to do if you run into one or all of the above. So here's a little quiz to rate your knowledge of how to deal with agents, pretend ones or not.

- (1) If an agent comes to my door, I should
 - A) Invite him in for coffee and cake
 - B) Tell him I don't know anything or anybody
 - C) Pick the lint off his suit
 - D) Tell him I have no legal obligation to talk to him and he should leave the premises immediately

- (2) If I get a strange phone call, where it seems like someone's just trying to get some information, I should
 - A) Put the receiver in my fishtank
 - B) Lead them on to see who they are and what they're after
 - C) Simply hang up
 - D) Tell them who they could talk to get the info they want

- (3) If I run into a rather suspicious stranger in a public place with 10 antennas on his car, who just "wants to know what's going on and who's involved", I should
 - A) Give them Phil Martin's phone number
 - B) Talk about the issues involved in the powerline and keep to the subject
 - C) Dump a pitcher of beer over his head
 - D) Demand to see some identification, and simply don't talk to him if not satisfied

ANSWERS

- (1) If you answered A to #1, you are contributing to our lawyers' migraines and don't deserve any points at all.
If you answered B, you're inviting trouble by making a statement they could prove wrong, 0 points.
If you picked C, and if you keep your mouth shut, since he'll probably leave anyway you got 4 points.

- If you answered D, congratulations. You get 20 points for paying (5) attention and doing the only thing you should.
- (2) If you answered A to question #2, you really should learn to calm down about such matters and call Ma Bell to get your phone fixed. 2 points for imagination.
 If you picked B, you're trying to beat them at their own game, which is foolish and dangerous, -2 points.
 If you chose C, good for you, 20 points for playing it smart.
 If you answered D, you'd better hope whoever they call knows how to handle it better than you did, 0 points.
- (3) If you picked A for #3, you're even more resourceful than we expected, 5 points.
 If you answered B, you're playing with fire and may get burned, -10 point
 If you answered C, and still haven't taken your receiver out of the fish-tank, do so, and clean up the beer. 0 points.
 If you answered D, you're playing it safe. Safe will keep you and others out of trouble. 20 points and a job well done.

If you scored a total of:

- 60 points - you're doing fine, keep it up!
 20-40 points - you're on the right track, but better review #1-D, #2-C and #3-D.
 10 or under - you haven't been paying attention and better start doing so for everybodys' sake.

COURT CAPERS

OR

THE PARTICULARS OF A PECULIAR PREDICAMENT

The omnibus hearing for Darus Ehlers and Dwight Nelson, the Wheaton 2, was scheduled for August 6 in Traverse County court, and it all started out at 10:30am with the County Prosecutor, to his everlasting credit, trying to remove himself as far as possible from this premeditated miscarriage of justice. Evidently the prosecutor has some information on the course of events the evening of the arrests, and the peculiar predicament whether that information should be part of the prosecution's disclosure to the defense or if the prosecutor should reveal that information to the court as a witness from the witness stand. The County Prosecutor wants to do it from the stand so that he doesn't have to be the prosecutor. The judge said o.k., and the whole works was continued to August 23 at 10:00am in Wheaton at which time Feeble Fable is supposed to send out a flunky from St. Paul to play prosecutor.

These St. Paul prosecutors continue acting like pretty slimy characters. In a particularly peculiar move, they went and scheduled two separate trials in Pope County Court, both to begin on the morning of September 4. Mark Wernick represents both defendants, Tony Bartos and Mark Hoium. The reasoning behind such nonsense undoubtedly has something to do with the fact that the prosecutors don't expect to be able to bring Tony Bartos to trial. They also don't want to be left in their usual position of holding an empty bag. This way they hope to avoid that predicament. Steps are being taken, however, to rectify the situation.

So the dates we know about are August 23 at 10am in Wheaton and something is likely to happen September 4 in Glenwood. As yet, there is no word from Judge Lindstrom on the William Hansen case.

A PERSONALLY REQUESTED NOTE - * * *
 XXXXX, Hi ya big BCA Boys!!! You
 Sweeties! Kissy Kissy!!!!
 Your ever loving,

Pretty Sunflower

XXXXXXXXXX000000

* * *

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Send all orders to HTL, Box 5, Lowry, Mn 56349.

* * * * *

LETTERS

Dear Sir,

Could I please receive Hold That Line newsletter? I would like to be more informed on the latest news up there. I'm behind you all the way!

Appleton, Mn

Thank you, thank you, thank you from the Southern Landowners Alliance of Minnesota for the generous check received from G.A.S.P. Not only because we do need the money, but because we feel like David against the giant conglomerates power companies Goliath.

So your support was a great morale booster.

Mankato, Mn

What can I say? You are a continual inspiration and the newsletter is as informative and entertaining as any publication I've seen. Many thanks.

Monomonie, Wisconsin

Greetings,

Please add the Prairie Alliance of Champaign, Illinois to your mailing list. I have been passing your newsletter along. Keep up the fight!

Urbana, Illinois

Hold That Line,

We sympathize with the injustice many of the citizens have suffered and the personal distress to their homes and lives.

Enclosed is a check for \$5 for postage.

St. Paul, Mn

Dear Hold That Line,

Please find some money to help along a little. Keep up the fight for our rights. It will help when civil war starts, the less than 1% won't be so dictatorial. We must spoil the dictator dream.

You ought to figure out what it costs per newsletter, so that each one who wants it can send it in quarterly to keep the treasures balanced.

Browerville, Mn

We are receiving your newsletter. Enclosed find a check.

Dumont, Mn

* * * * *

Threat from acid rain worsens



Star Map by Kurt Carlson

Increased acidity in precipitation over natural concentration

By ROBERT OSTMANN JR.
Minneapolis Star Staff Writer

DETROIT—The entire Great Lakes region, including large sections of Minnesota, faces irreparable environmental damage from acid rain much sooner and on a scale much larger than had been expected.

Scientists at a meeting here of the international body charged with monitoring the environmental health of the Great Lakes said Tuesday new research indicates that:

- More than 50,000 lakes in the United States and Canada could be virtually devoid of fish and other life forms by the year 1995.

- Vast areas of prime forest land could be rendered economically unproductive for decades.

- Drinking water and food-fish supplies for millions of people could be contaminated by poisonous metals—such as lead, mercury, copper and aluminum—extracted from water pipes or rocks and sediment by acidified waters.

- Many lakes in Minnesota previously considered safe from acid rain could suffer large fish kills when acidic snowpacks melt into

“
At this very moment,
we are ready to take
a step backward.”
”

—Charles Ross,
commission member

them in the spring.

Most depressing of all, several scientists said that widespread destruction of animal and plant life by acid rain is inevitable in eastern North America in as soon as 10 years unless the amount of coal burned to generate electricity is reduced immediately.

Ironically, the revelations came just before President Carter's administration is expected to announce wholesale relaxation of clean air laws to allow a drastic increase in the burning of coal.

“At this very moment, we are ready to take a step backward,” said a chagrined Charles Ross, a U.S. member of the International Joint Commission, which received the report.

Automobiles and coal-fired power plants are the main sources of the two types of chemical compounds—sulfur and nitrogen oxides—that are converted in the air into sulfuric and nitric acid. Each

Rain

Turn to Page 2

over



Tuesday, July 17, 1979

MIDWEEK

A complimentary weekly publication

The Minneapolis Star

Threat from acid rain worsens in lakes region

(Rain, from Page 1)

day, tons of acid are produced by a single large coal-fired power plant, such as Northern States Power Co.'s Sherburne County facility northwest of the Twin Cities.

When the acid molecules are formed, they drift on the wind—sometimes hundreds of miles—before they are washed to earth in rain or snow.

Canadian and U.S. scientists told the commission that all parts of the Great Lakes region are being soaked with 5 to 40 times the natural amount of acid in rain and snow each year and that the amount has been increasing rapidly.

Rainfall over northeastern Minnesota contains 5 to 10 times the natural amount of acid.

Although some of the acid that falls on Minnesota comes from factories and power plants in the state, most is thought to drift in from the more heavily industrialized areas to the east.

Lake death in 10 years

Robert Slater, a top Canadian environmental official, said the only way to avoid acid rain disaster in the Great Lakes region is to immediately reduce energy consumption in both the U.S. and Canada, and to reduce the amount of coal burned.

Using more pollution control equipment might slow down the increase in emission of chemicals that form acid rain, but that won't be enough, he said.

If the emissions are not reduced, Slater said, the most vulnerable lakes will die within 10 years and

the others within 15 years. It is not yet known when soil and vegetation will have visible signs of destruction.

And while the Great Lakes themselves are not expected to become acidified in the near future, the scientists said, damage to lands and waters draining into them eventually could cause ecological changes.

The acid rain situation is so urgent because damage, once caused, might never be repaired.

George Hendrey, an acid rain expert at the Brookhaven National Laboratories in New York, said that lakes in Ontario and in the Adirondack region of New York already have been killed by acid rain. Even in areas where amounts of acid in the air have decreased, Hendrey said, there has been no sign that the acidified lakes have improved at all.

In Minnesota, the most critical areas are in the wilderness lake country north and east of Duluth. There, the thin soil and granite-bottomed lakes contain very little of the minerals that can neutralize acid.

As acid continues to pour into the lakes year after year, the "buffering" capacity of the calcium and other minerals in these lakes will be used up and the water will rapidly become too acidic for fish and most other forms of life to survive.

This apparently has already happened in some lakes in the Boundary Waters Canoe Area. But Hendrey told the Detroit meeting that

new research suggests that lakes in other parts of Minnesota, lakes which supposedly have adequate supplies of acid neutralizers, also will have extensive fish kills.

Industrial expansion and increased electricity use have not been the only causes of the spread of acid rain, however. Ironically, pollution control efforts of the last 15 years have also been to blame.

Control of power plant emissions—and even the wording of clean air laws—has tried to reduce pollution near its source. In both Canada and the U.S., the result has often been an "out-of-sight, out-of-mind" solution, such as tall smokestacks.

Instead of reducing pollution, the smokestacks just spread it over a wider area, something like throwing the garbage into someone else's yard.

Preliminary studies have shown that sulfur dioxide fumes from Ohio Valley smokestacks, for instance, end up as acid rain in Wisconsin and Minnesota.

And as the acid clouds have spread wider and wider, they have covered important farming areas.

THIS ARTICLE appeared in full in a recent Minneapolis Star.

"HOLD THAT LINE"

JULY 30 - AUG 12

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

GENERAL ASSEMBLY OUTRANKS CORPORAL POWERLINE!!

The General Assembly to Stop the Powerline met in Lowry on the evening of July 24 to discuss the situation, and it don't look too bad. The meeting was attended by about 80 people from across the state, and several key decisions were made. The first item of business was a review of our finances since March, 1978, and that was high-lighted by a presentation of \$5,500 to the defense fund. \$750 came from the collection taken at the big Washington D.C. anti-nuke rally last spring, and the rest was raised July 5 in St. Paul at the Civic Center Concerts. Before the evening was over, G.A.S.P. donated \$1,000 of those funds to help Indians organize against the energy corporations, and \$100 to show solidarity and support of our friends fighting the 345 KV line in Southern Minnesota. We know who the enemy is, and we know our friends, and we are confident that we shall see a return on these investments many times and in many ways.

We also reviewed a couple legal developments with quiet satisfaction. First, there was a ruling in 7th District Court which upheld a 1957 ruling and the resulting State law which prohibits mail ballots for electing directors of all cooperatives, and that is a major victory for the DREAM people who brought the suit against Runestone management. While the ruling does much to validate the Determined Runestone Electric Association Members who have been trying to turn Runestone into a democratic and cooperative organization these past year, it still leaves a bit to be desired. There will be no new election, for example, so they get away with it. And there is nothing but an organized membership which can keep them from doing it again, because it seems that members are the only ones who can enforce cooperative law. The Attorney General does not have to enforce all the laws of the State, only certain ones.

None-the-less, it is important to note that mail ballots have been used extensively by REA management over the years (and against the law) to insure that the "right" directors were on the boards. And we have seen the wonders that "right" directors are capable of performing. Maybe that's why mail ballots are supposed to be illegal.

The second bit of good court news relates to condemnation proceedings along the route of the 345 KV line proposed for Southern Minnesota. Eminent domain was not challenged in Wright County at the northern end of the line, and will become effective there August 1. But it was challenged by the Southern Landowners Alliance of Minnesota (S.L.A.M.) at the south end in BLUE Earth County, and awhile back a district judge granted a court order to UPA/CPA giving them power of eminent domain. On July 23, that order was stayed by the Minnesota Supreme Court in order to allow time for arguments on the question of whether or not legal and adequate notice had been given by the Minnesota Energy Agency (MEA) for their public hearings on the need for the facility. Briefs will be submitted in August and oral arguments before the Supreme Court will be held in mid-September. If the Supreme Court decides that in fact there was no legal notice given for the Need Hearings, the path will be cleared for a trial on the public need for the CU project. Cost factors and alternative sources of energy - maybe even the needs of our Mother the Earth will be considered in that process, and meanwhile, the condemnation process on the southern part of that line is stopped. Oddly enough, the MEA and the utilities do not deny that there was no notification given as required by law. They're saying that citizens have no Constitutional rights to such notice.

So construction could start along the northern part, and except for this ruling, it could have started from the south, too. The protest is perhaps strongest in the middle, and UPA/CPA haven't really started to move on those folks yet. Their idea was to catch them in the middle and block all court action by saying that everything else on either side is done, all that money is spent, now get out of the way! Might not turn out that way, though. Ken Tilsen is representing SLAM in these proceedings. Congradulations! We are encouraged!

Among the decisions made by the General Assembly was the decision to meet on a monthly basis. So Note Your Calendar for the next (2)
GASP Meeting at 8:30 PM, Tuesday, August 21, at the Barrel In in Downtown Lowry. One of the business items to be conducted at that meeting, the General Assembly decided, will be nominations for positions on the GASP Board of Trustees. Current Trustees may be re-nominated and re-elected, but there are people on the board who would like to step aside, and it's about time for another election anyway. So nominations will be made on August 21st, and the election will be held at the September meeting. Sometime towards the end of the meeting somebody said something about having a trap-shoot the following evening.

And so, on the following evening there was a trap shoot. Mother Nature was also busy brewing up a thunder storm that evening, and it never really did clear up until a couple days later. That makes it quite difficult to figure out just exactly what went on during that period of time, but it seems to have gone something like this: Sometime in there (exactly when it all started is unclear) there were many loud and booming noises and pieces of pigeon were falling all over the field. That made the blackbirds angry, and angry blackbirds are a terror to behold. Particularly when they are organized. When they get into such a state, it seems they usually attack the tallest thing around. Well, it didn't take them long to figure out what that was! The vicious assault which followed set off so many sparks and flashes that Mother Nature took it all for a challenge and decided to flash back. There were even some glorious streaks across the sky, and some time later, a couple tourists claim to have found chunks of sky-lab in the area. But Mother Nature played fair, and left the tower for the birds. If you need proof, just go look at the conductor cable. Kinda hard to say what else went on ... BCA seems interested ... They've had quite a bit to be interested in this past 2 weeks. If Uncle Albert was supposed to eat crow for every hole that got put in the conductor, he would have to caw for help, and them cut-worms have been munching away like they was steel hungry. More than a dozen legs have been banded, and there have been several temporary restraining orders issued by duely constituted authorities of the more natural sort. They really should give it up because while the world is changing, we are not together with them, and they are not in control . . .

* * * * *

Assistance For The Black Hills Alliance

One of the more difficult undertakings of the Black Hills Alliance is bringing together people who are not used to working with each other. But if the Hills are to be saved, ranchers and Indians and everybody else will need to work together, and the Alliance is looking for organizing tools to help that happen. In the past, ranchers from the Black Hills area have shown a lot of interest in the fight of Minnesota farmers against the powerline when we've been able to get together. And those exchanges have been helpful in organizing the Black Hills Alliance. But it's not possible for us to all get together too often, so folks from the Alliance say it would be helpful to them if folks from around here could be writing short statements to the Black Hills Alliance about why you are fighting this line, what you have learned in the process, how long you are willing to fight back, and so forth. If you can, please take a few minutes to write down your thoughts on these matters and send them to:

Black Hills Alliance
Attn: Winona LaDuke
Box 2508
Rapid City, South Dakota 57709

* * * * *

Conservation Is Contagious

There was a news item over the wires on July 26 which stated that the average use of electricity in Florida during June, 1979 was 999 KwH. In June, 1978, it was over 1100 KwH. That is not only good, it is necessary!!

S.L.A.M. BENEFIT DANCE

(3)

Southern Landowners Alliance of Minnesota is having a fundraising, free drawing beer drinking benefit dance with Bluegrass and Old Time Music, at 7P.M., Friday, August 24. The dance will be at the Hamburg Community Center. Hamburg is east of Glencoe and a couple miles south of HWY 212 on State HWY 5. There will be a \$2.00 Donation and tickets will be sold at the door, 5 for \$5.00. If you can't make it, your money could be very useful anyway!!

* * * * *

GOODIES FROM THE GOODIE BAG

They had the CPA Board meeting in Sauk Centre on July 5 & 6, unbeknowns to everyone else. That was the first time they had a meeting anywhere close to the powerline, and wouldn't you know it, at least one of them got sick overnight. Powerlines do that sometimes. It pays pretty good, though, \$100 a day plus expenses, the proposal is, and being as the August meeting has been scheduled for Bismark for some strange reason, they decided to throw in a fee of 25¢ per mile too. Good business, you know.

Falkirk Mine received much attention at the July 5-6 meeting. While Falkirk continues to suck thousands and thousands of dollars off of CPA, a guy from the North Central Area REA office says that the Falkirk Coal Sales Agreement is under investigation by the REA to make sure everything is on the up and up. This guy says the Falkirk Operation is also under scrutiny by the GAO people, and warns that, "CPA must emphasize internal unity and also must prepare to combat any adverse publicity which will result from the GAO report. No one knows what that report will contain," he says, "but the assumption must be made that CPA and UPA will have to defend some decisions made in the past." You don't say!

This guy from the REA says that CPA's application for funds to finance a new 8 million dollar office building has been approved and guaranteed by the REA. Most curiously of all, he also said that CPA will be notified in writing that there has been a "50% depreciation on the DC line." We can only speculate about the meaning of this development, but what the heck. Perhaps UPA/CPA are in a very tight financial bind because of their mis-adventure with the CU project, and it is critical that REA or somebody find a bit of slack for them. Being as REA put up the money for the line, REA is in a position to say how much the line is worth. By reducing the powerline's value by 50% CPA/UPA will be liable for only half the township, county, state and/or federal taxes which would otherwise need to be paid. That is a bit of slack. Tough luck, all you guys who thought this thing was such a good idea because it would reduce your taxes!

The CPA Directors also decided that it would be good to hire an outside security force to protect the Coal Creek Station rather than use CPA employees for that purpose. Bismark Mandan Security was presented as a possibility. And speaking of outside forces, have you ever heard of a deep fried, half baked, fork tongued, self centered whore named Paul Harvey who prostitutes his very soul in the name of powerlines, nuke plants, A-bombs, corporate rip offs or what ever else is determined to be in the interests of multi-national corporations? Well, Paul Harvey does all those disgusting things because corporations pay him very well to do them. Even little CPA has paid for his services in the past. CPA decided to continue paying for his services to the tune of \$7,500 for the year 1980.

Such services, however, are proving to be less enticing than they once were. It gets old, you know, when there is no love in it. So if UPA/CPA were absolutely flabbergasted when they discovered that landowners would not sign easements for this big powerline, and condemnation proceedings had to be quickly concocted, imagine CPA's chagrin when they found out that they must resort to condemnation proceedings to route a couple 65 KV lines, and even a 34.5 KV line. Must be that people know that what is good for CPA is either worth a whole lot more to them, or else it is just plain bad. At any rate, it is true that them good old days are gone, and CPA is pretty much alone (if you don't count UPA) in a changing world.

IMPORTANT NOTICE FOR ALL YOU ROWDIES

(4)

The job of the GASP Trustees is to manage the money in the Defense Fund. It is not always an easy task to discover the fairest and best way to use that money, and mistakes can lead to hard feelings, mistrust and confusion. In order to help make the best decisions possible, the trustees got a policy together at their last meeting which requests that all persons who get arrested and have to go to court due to powerline charges should meet with GASP Trustees and together decide what the Trustees can do financially and legally for people facing charges. The idea is that the more communications there are between all the people involved, the less chance there will be for mistakes.

* * * * *

COURT CAPERS

The Omnibus hearing for Darus Ehlers and Dwight Nelson is still scheduled for 10:30 AM on Monday, August 6, in Wheaton. Mark Wornick and Bill Mauzy are representing Darus and Dwight, who are charged with aggravated assault. This could turn out to be a very curious hearing.

On the good news side, after sitting on his thumbs for about a year, Stearns Co. prosecutor VanHeel decided to drop charges of agrivated assault against Gerry Woida. Last summer, the utilities and VanHeel made up this cock-and-bull story about Gerry and a shot gun so that protesters would be in St. Cloud trying to get Gerry out of jail while the tower tops were set on the Woida farm. Evidently, neither the interests of the utilities nor of Van Heel were being served by maintaining those charges, so justice was finally allowed to prevail. Better late than never.

Speaking of being late, Judge Lindstrom is taking his time to rule on the dismissal or re-trial motions for William Hansen. Lindstrom left on a lengthy vacation without deciding the matter and no one knows when he'll be back.

Now for the bad news. Judge Claeson ruled against Mark Hoium and Dean and Bob Oeltjen on their motion for dismissal due to discriminatory prosecution, and he ruled against them on all the other pre-trial motions as well. Claeson says that there couldn't possibly be any discriminating going on because except in a very few instances, the only people who got arrested got arrested because they were seeking arrest as a form of "civil protest", and besides, Ira's Sheriff Department isn't big enough to discriminate against anyone. We'll keep you posted on upcoming dates.

* * *

JURY PROJECT PROPOSAL

There was enough interest expressed at the GASP meeting so that we're planning a workshop with the Jury Project People to train local people in the skills of jury selection. This will not only save us money, but will also increase our ability to pick good juries. The meeting will be held sometime during the 3rd or 4th week of August.

* * *

AUGUST 12 RALLY

General Assembly to Stop the Powerline

Northern Sun Alliance

Black Hills Alliance

Women of All Red Nations

West Bank Auditorium

Sunday, August 12, 1979

7:00pm

University of Minnesota, Mpls.

Speakers from the above organizations will share their ideas on our common goals and problems. There will also be music and theatre. You are invited!

The Dakota Resource Counsel won some improvements in North Dakota's Energy Facility Siting regulations from the state Public Service Commission (PSC), but overall the PSC seems intent on leaving landowners and tenants whose property will be directly affected by transmission facilities, such as powerlines and pipelines, with little advance notice in which to express their concerns.

According to a draft of the final regs which DRC recently obtained, the PSC expanded public notice procedures to include direct mailings to the chairpersons of County Commissions in counties directly affected, and to the state legislators in districts directly affected. The Commission also lengthened, by ten days, the amount of time allowed for a concerned party to show good cause for a public hearing on transfer of permit and waiver of proceedings applications after notice of opportunity for such hearings has been published.

Although these changes in the regs represent some improvement over what the Commission had originally proposed, the PSC refused to reinstate certain landowner notification provisions which it had stripped from the regs a year and a half ago.

DRC Chairperson Evelyn Newton, who presented testimony at the PSC's public hearing on the regs in late May, also expressed great concern about the PSC's failure to attend the hearings, sending their staff instead. "I don't think we could find a better example of their attitude toward citizens' concerns than their failure to even come and hear, personally, the concerns raised by North Dakotans about an issue that will have such wide sweeping impacts on this State," she said. Over 1200 miles of new high voltage electrical transmission lines are projected to be constructed in North Dakota from existing conversion facilities by 1986.-----DAKOTA COUNSEL, JUNE/JULY, 1979

The Price-Anderson Act, originally passed in 1957, governs nuclear insurance. It has several provisions; the key one is a limit on liability of only \$560 million for damages from nuclear power accidents, even though the government itself admits damages could be in the tens of billions of dollars.

This limited liability - which the nuclear industry has stated it needs in order to exist - carries two important messages for Americans. FIRST, it is a very strong indication that the nuclear industry does not believe its own claims about nuclear safety. The paradox is obvious; on the one hand we hear the reassuring claim that chances of a nuclear accident are "one in a billion", or the even more extravagant "it can't happen", but on the other hand we see the industry scrambling to protect its own assets from the accidents it claims will not happen.

SECOND, limited liability exists because the insurance industry refuses to insure nuclear plants for full liability. This means that insurers do not believe the safety claims of the nuclear industry. If they did, they would be anxious to sell as much insurance as utilities would buy - insurance companies like to collect premiums against claims that will never be made.

It is reasonable to assume that insurers are the best risk-assessors in society; if they were not, they could not stay in business. When our best risk-assessors demonstrate that they do not believe nuclear accidents will not happen, shouldn't Congress and the rest of society pay very close attention? Nuclear power advocates use several arguments to promote Price-Anderson all of which can be easily answered. Here are just two:

1) "Price-Anderson protects the public, because of its nofault provision." It is true that Price-Anderson says that nuclear victims do not have to prove injury. However, the limit on liability means that in a bad accident there might only be 3 or 4¢ available for each dollar in damages. What good does it do to prove injury if the perpetrator has no legal responsibility to full compensate victims? Further, there is a 20 year statute of limitations for claims, even though some cancers might be latent for longer than 20 years. And since cancers do not sprout flags announcing their cause, it could be difficult to ever prove which specific injuries (cancers) were caused by radiation exposure.

2) "We need the limit on liability to attract financing. If you oppose (6) limited liability, you oppose nuclear power." This argument is, in the final analysis, correct. However, not all opponents of limited liability oppose nuclear power. For example, Rep. Jonathan Bingham (D-NY), who sponsored a bill to suspend limited liability several years ago, has supported further nuclear development. Some people support removing limited liability because they think it will encourage more attention to safety in the industry - as opposed to stopping nuclear power.

In 1975, when Price-Anderson was up for renewal, an amendment to remove the limit on liability because they think it will encourage more attention to safety in the industry - as opposed to stopping nuclear power.

In 1975, when Price-Anderson was up for renewal, an amendment to remove the limit on liability failed by only 41 votes in the House; had just 21 members changed position, the amendment would have passed the House. With the anti-nuclear movement so much larger now, we just might be able to get a repeal law passed.-----THE CONNECTOR, JUNE, 1979

In May, Basin Electric Power Cooperative issued a siting study which examines potential sites in North and South Dakota, Montana and Wyoming for placing 4 500 megawatt (MW) coal fired power plants, the first of which is estimated may be on line by 1986.

Based on a 1976 Power Requirements Study, Basin projects a demand for an additional 1000 MW of electricity on each side of their service area, which is divided into 2 power grids which encompass the Dakotas, eastern Montana, Nebraska, Minnesota and Iowa on the east, and the remainder of Montana, Wyoming and Colorado on the west. Basin already has projects under construction in Beulah and Laramie, WY which will add 1,514 MW to the 700 MW produced by their existing facilities.

The siting study deals primarily with economic and engineering considerations, paying little substantive attention to socio-economic and environmental concerns.

In the final analysis, based solely on economic considerations, the study picked the existing power plant sites at Antelope Valley and Leland Olds as the first choices for one new 500 MW facility each. St. Anthony, Hottinger, and Selby, S.D. each followed successively as top choices for the siting of 2 500MW facilities.

Curiously, the study places Dunn Center at the top of the list based on economic factors. Basin has announced that they have received an "attractive offer" for extensive lignite reserves in the area from an unnamed party. However, because whatever deal is being cut there apparently hasn't yet been firmed up, and because the site has been identified as having potential air quality standards on new sources (the Health Dept. has turned down Natural Gas Pipeline Co.'s proposed gasification facility there because the added pollution would degrade the air in Theodore Roosevelt Park beyond presently acceptable limits), the authors of the study register their opinion "that this site not be considered as a preferred site at this time."

At least two major concerns about Basin's projections for additional demand can be raised at this time. First it is highly unlikely that the demands of the rural, agricultural areas served by Basin are growing at such an accelerated rate. This implies that the increased demands are more likely the result of Basin's expectations to increase their service to industrial and commercial customers. Second, the 1976 Power Requirements Study over-estimated the demand for electrical power by 88 MW for the '77/'78 winter peak demand, and by 147 MW for the '78 summer peak. The accuracy of their forecasts for demand ten years down the road would have to be doubted when errors of this size are found in the second year.

-----DAKOTA COUNSEL, JUNE/JULY, 1979

Investigation of the latest leak of radioactive liquid at Windscale has revealed that the spillage of an unknown amount of contamination occurred some 20 years ago. Friends of the Earth said yesterday that it was still not known how much activity was involved. -----GUARDIAN (UNITED KINGDOM), APRIL 24, 1979

Hey There Yankee Doodle, Stick A Feather In Your Hat!

(7)

Johnny Carson and the media call them the Georgia Mafia, and one Sunday, the Dixie Godfather came down from the Mountain to deliver us from Oil. "Coal," he said, but his ways are mysterious and full of suspicion. Even as the word "Coal" passeth between the shinny teeth of the Dixie Godfather, it is "Corporate Control" which is clenched in the fist that he pounds dramatically on the table. The Dixie Godfather is trying for a New and Craven Image.

So it is no surprise that the Voice from the Top of the Mountain spoke unto certain paltry executives whom we know quite well and who are sore afraid because of the enemies they have made, saying unto them, "Harken unto me, for I am thy Dixie Godfather. If thou needst a crackling line to strike fear into the hearts of thine enemies, causing their noses to bleed and their skin to be covered with blotches, and if thou needst a crackling line to cause the cattle of thine enemies to become barren, and hostility against you to wilt, and if thy line will not crackle because thy lousy lignite won't burn, even so shalt thou accomplish these things, for thou shalt fire thy boilers and crackle thy line with Oil. For verily I say unto you, it has been ordained by the Tri-lateral Commission that thou shalt inherit the earth."

The paltry executives took heart and were exceedingly glad. "We are not forsaken!" they cried one to another. With one voice they proclaimed, "We give thee thanks, O Great Dixie Godfather! Such an Oily crackling is exactly what we need, we think, maybe, anyway." The paltry executives were never too sure about anything for very long. And so the crackling of Oil came to pass.

In that time there were throngs gathered in lines throughout the land to receive their portion of the Precious and Holy Fluid, and there was not always enough. There was speculation about Fluid for the coming season, and Cults were formed to protect and venerate the Fluid. And it came to pass that rumors of this crackling Oil reached the scribes and lesser bureaucrats of the Cult in a Northern Province of the Land of the Dixie Godfather, which was also the nest of the paltry executives. Among those Northern lesserlings is a certain boisterous Priestess of the Cult of the Precious and Holy Fluid who is deeply in love with the Dixie Godfather. Yet she knows him not for what he is and when she heard those rumors, she was enraged by the thought of such wasteful spending of the Fluid of her Passion. To her horror, these rumors were verified by the paltry executives. The wrath of the Priestess waxed furious and many a curse and oath was sworn, and the fate of the paltry executives looked bleak. For such wastefulness was an odious and loathsome sin.

It was only then that the word of the Dixie Godfather which was spoken to the paltry executives was revealed unto the Priestess, and his word stilled her anger, and her duties to the Fluid went unfulfilled because of his revealed word. But the days of the Dixie Godfather were troubled and in the end the Priestess never did amount to much and the people of that Northern Province made the Dixie Godfather and the paltry executives an offer that could not be refused. So there, Yankee Doodle, stick a tower in your hat!

* * * * *

G.A.S.P. FUNDRAISER

Remember that old pile of scrap metal laying around out back? Well, now is the time to turn all that junk into money for your favorite Powerline Protest. Just separate the steel from the cast iron (no tin or wire, please, and easy on the galvanized!) and cart it off to the Villard Elevator Co. They will weight it in, put it on the stockpile, and give you a weight ticket for you to turn into G.A.S.P. at Box 5, Lowry, MN 56349. 3 ft. lengths are ideal, and machinery should be taken apart first. If you need transportation, call a protester and something will be arranged.

Arnold Tank, who runs the Elevator Co., has a small favor to ask of us in return. The railroad is trying to abandon him, and he asks that you write your Congress person and Senators and tell them to save this country's railroads, 'cause we're going to need them.

While we're on the subject of money, Hold That Line is desperate for your financial assistance. Please help us out, and thank you.

Available, ~~...~~ & Other Stuff

- The Powerline Will Affect You - 25¢
- MAPP & The CU Project - 25¢
- Powergate - 25¢
- Electropollution - 25¢
- What Is Pure Coal - 25¢
- Physics Related Problems of Coal
Fired Power Plants - \$1.00
- North American Coal Capers - \$1.50
- Pollution by Electrical Transmission \$1.00
- On Effects of Extremely High Voltage
Transmission \$1.50
- Electric Power Research Institute's
Research Program on Biological
Effects of Electric Fields
(This is the Industries version
of health and safety problems) \$1.50
- Russian Study, 23 - 06 \$1.50
- Russian Studies and Related Commentary \$2.00
- Electrical Wiring Configurations and
Childhood Cancer \$1.50
- Effect of EHVLine on Cattle Repro-
duction 50¢
- Additional Information On The Health
And Safety Questions Of Powerlines
Is Being Prepared.

- T-SHIRTS MINNESOTA STATE TREE - \$6
- G.A.S.P. - \$6
- NIGHT RIDER - \$6

- BUTTONS IF YOU KILL OUR FARMS, YOUR
CITIES WILL DIE - \$1.00
- USE ALTERNATIVE ENERGY - 50¢

- BUMPERSTICKERS NO POWERLINE - 75¢
- DECENTRALIZE ENERGY - 75¢
- UNSAFE/UGLY - 75¢
- FARMLAND FOR FOOD - 75¢

Send all orders to Hold That Line,
Box 5, Lowry, Minnesota 56349

* * * * *

Victory Party Barn Dance For Dream People & Friends! - - Sat. Nite, Aug. 4
Bring Own Refreshments & Pot Luck Lunch! Come One, 8:30 pm
Music Provided, But Bring Instruments Anyway! Come All!!
Ron Barsness Farm, 3 miles north of Cyrus, then 1/2 mile east on Co. Rd. 24

LETTERS

Dear Folks,

Here's a contribution for your efforts and newsletter. Please send two NO POWERLINE bumperstickers also.
St. Paul, MN

Dear HTL,

Here is \$30.00 for the newsletter defense fund or whatever is best. Our roofing crew sends this because we enjoy hearing about poor Phil and Uncle Albert. You know poor Phil Martin is now Chairman of MAPP (the Peter Principle strikes again!) so that he can manuever CPA/UPA's new powerline into the grid. I hope he likes his new responsibilities and his new white D.C. elephant, because no one else wants them not even NSP.

But NSP likes Uncle Albert. They helped get him elected. Uncle Albert has solutions (BCA) to problems (Powerlines) like President Ford solved the swine flu with shots. Maybe Albert wants to be President. When will government help the people not fight them?

St. Cloud, MN

Dear HTL,

The enclosed check is to support your continued publication.

Thank you for adding me to your mailing list, and for continuing to send Hold That Line despite my tardiness in offering to pay my way.

St. Paul, MN

Dear HTL,

Could you ask Charlie Graff (he is the Stearns Co. Sheriff) what happened at 8:21 pm on July 23?

Belgrade, MN

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

COURT CAPERS

HE CRIED AND SIGHED AND EVEN LIED,
BUT FEEBLE FABLE PROVED UNABLE TO
KEEP THE TABLES GLUED AND STABLE,
OH YAS!!!

The tables began to turn and twist in a most alarming manner a couple of weeks ago, and finally the whole shebang came unglued and fell right on the noggin of Feeble Thomas Fabel, fabled prosecutor for the State of Minnesota. And just when things were looking so promising for the ambitious young attorney from St. Paul. Feeble Fabel thought he was well on the way to busting up a very troublesome powerline protest movement by getting some convictions. Now that's the sort of thing reputations are made of! The big-wigs notice those things, and young Feeble wallows in their attention like a sow in the mud on a hot summer day. "One down, five to go," he'd say to the crooked face in the mirror as he'd shave in the morning. He even made up a little tune about it which he'd hum to himself when he thought no one was listening. The tune didn't mention anything about peoples' rights or truth or justice or honor or or glory or things like that. It was more of a "I got me one, gonna get me two, and I don't care how, and it may be you" sort of tune. It was all so fun and exciting that you can just imagine how angry Feeble became when things started falling apart.

This is how it went. With William Hansen Sr. convicted, Feeble planned to move on William Hansen Jr. for tactical reasons. Problem was that Matt Woida moved for a speedy trial some time ago, and it was prosecute Matt now or never. Feeble tried a few motions to get around it, but didn't find the judge dumb enough to fall for it - not that there wasn't a fight. So Matt's up for trial and Willette, another of the infamous 3 judge panel is the judge Ken Tilsen is the lawyer. Feeble gets nervous.

Next question is where will the trial be, and Feeble wants it everywhere and anywhere than Pope and Stearns Counties. So they have a big fight about that too, with Feeble claiming that it shouldn't be in Pope County cause protesters are threatening the State witnesses and jury selection took so long. It seems that if someone doesn't do what Feeble wants them to, the only reason Feeble can understand for it is that they were threatened by someone nasty. That's probably because Feeble thinks his life is threatened because he's such a jerk himself. Well, the judge did not agree, and also found that the prosecutor's claims about jury selection were rather exaggerated, (that's a switch). So the trial was kept in Pope. Feeble got more nervous and started swearing under his breath, not daring to say those naughty words out loud.

While all this was going on, the attorney for William Hansen Sr. managed to arrange a pre-sentence hearing before Judge Lindstrom about possible irregularities and incongruities in the Hansen trial. Feeble ranted and raved about how it is absolutely essential that Hansen be sentenced before the Woida trial went to jury, but Lindstrom was starting to think about the hole he dug for himself during the trial and he decided to take a little more time before jumping in and covering himself up. So Lindstrom continued the sentencing indefinitely and has taken motions for either dismissal or a new trial in the Hansen case.

Feeble started getting frantic, and things got even worse when he figured out that he had a very difficult choice to make. Being as no witnesses were talking, it was suppressed evidence that somehow got admitted which convicted Hansen. But that evidence would not be available against Woida, and there was no reason for Feeble to suspect that folks who had refused to testify against Hansen would testify against Matt Woida. So Feeble had to decide if he wanted to lose by parading witnesses and evidence before a jury for everyone to see without proving anything, or if he wanted to lose by dropping charges before the trial started. He decided to avoid a large embarrassment, and in spite of the fact that the five key state witnesses were arraigned on criminal contempt charges stemming from the Hansen trial the day before the Woida trial was

scheduled to begin, charges against Matt Woida were dropped the day (2) before trial. What a win! While Feeble says they can recharge Woida as soon as he gets some evidence, that is not likely to happen. It is also not likely that any of the other defendants will come to trial, and it is not likely the Hansen conviction will stand. What do you say, Feeble? Chances to make it in the big leagues don't come everyday. Too bad you just lost it. Did you know that frustrated ambitions and ulcers usually go together?

Anyway, the charges were dropped the day before trial and there was quite a party that night. The BCA boys got very excited! And Least, (remember Least Earnest?) was worse than usual. Least chases people all over the place out here, but this time Least thought he was being followed by people returning home from the party. Least was very paranoid. He and his little side kick stopped people behind him by blocking off the road with his super van, jumped out, and threatened the occupants of the vehicle he stopped with guns drawn. Least better not do that too often. Least is lucky he's still least.

HEALTH/SAFETY TRANSCRIPT

It appears that Representative Rich Nolan will provide for the transcript of the June 25 Health/Safety hearing at Sauk Centre, and get a summary of the hearing read into the Congressional Record. That is good. Rep. Nolan is being helpful in another way as well. Anyone experiencing symptoms which may result from exposure to the powerline, and anyone experiencing livestock problems which may result from exposure to the powerline, should get statements from doctors and/or veterinarians! Keep a copy of the doctor's report, send one to G.A.S.F. Box 5, Lowry, and send one copy to Rich Nolan, Federal Office Bldg. 715 W. St. Germain, St. Cloud 56301. Nolan's office will put them on the public record and forward them to appropriate parts of officialdom.

PUBLIC ENERGY FORUM

The idea of a Public Energy Forum is moving closer to reality, and the politicians and the bureaucrats seem to be shook up enough so that it might even be a worth while experience in some vague sort of way. There was a meeting down in St. Paul on July 3 to start setting things up. The Coalition of Rural Environmental Groups (CoREG) was well represented, Robby the Governor's flunky was there and so was the chief big-wig from the MREQB, Al Jaisel. The industry has yet to show its ugly face, but everytime Robbie mentioned the industry, he looked over to Jaisel and smiled understandingly. That caused Jaisel to become quite irritated and defensive.

Focus for the forum will be on the 10 point program CoREG raised last winter, including the questions of conservation, alternative sources of energy, land use questions, and the matter of who will decide our energy future and how will the decisions be made. The powerline controversy is NOT to be the focus, and the officials seemed to be willing to agree to almost anything that will keep the powerline out of the picture. So the way it stands is that the forum will take place in St. Cloud and the moderator will either be a priest from west central Minnesota, or a priest from southern Minnesota. Exactly when it will happen depends upon the availability of Amory Lovins, energy expert and author of Soft Energy Paths, who will help CoREG present its case. The Minnesota Energy Agency will start it off by describing the states energy policy (or rather, the lack there of), and then the utilities get to complain about all the bureaucrats' red tape they have to put up with and talk about how responsible they are to the environment, stockholders and consumers alike. After all that, CoREG people will have the opportunity to discuss the current state affairs as well as describe how nicely things could be working if only we had a brain.

While we're on the subject of CoREG and the utilities, the utilities' response of the CoREG 10 points provides some useful insight as to why we have the problems that we have. According to the industry, we live in the best of all possible worlds, the only problems we have are the unavoidable trade-offs we as a society have all decided to make, and the industry is already doing everything that can possibly be done to improve the situation. These

turkeys brag about their conservation programs while advertising for (3) electric resistance heating and have the gall to say they know of no subsidies to conventional suppliers of electricity. Rather, solar energy development gets all the subsidies, they say, and it still won't be available for many years. No wonder there's an energy crisis.

The document is over 20 pages long and is available upon request (along with a little ☺) for those with a strong stomach or a very wierd sense of humor.

* * * * *

There will be a G.A.S.P. meeting on Tuesday evening at 8pm on July 24 at the Barrel In in Lowry. Purpose of the meeting will be to review G.A.S.P. finances, discuss a couple of fundraising ideas, and figure out a few details on what to do next. Call your friends and neighbors, and mark your calendar! We'll see you on the 24th!!!

* * * * *

SENSIBLE POWER LIBRARY

We are starting something new for our readers, a library. The books will be rented out for a period of 2 weeks for \$2. This \$2 charge may be subtracted from the purchase price if you decide you wish to buy the book. Proceeds after postage, will go towards enlarging the library, also if you wish to donate a publication, it will be greatly appreciated. Send all orders to, Library/HTL, Box 5, Lowry 56349. Books now available include:

- | | |
|--|--|
| "PRACTICAL GUIDE TO SOLAR HOMES" | "PRODUCING YOUR OWN POWER" |
| "THE COMPLETE SOLAR HOUSE" | "HANDBOOK FOR HOMEMADE POWER" |
| "SUNSET HOMEOWNERS GUIDE TO SOLAR HEATING" | "DESIGNING AND BUILDING A SOLAR HOUSE; A PLACE IN THE SUN" |
| "30 ENERGY EFFICIENT HOUSES YOU CAN BUILD" | |

Also, if you are interested in some local info on alternative energy, try getting in touch with one of these addresses:

DAKOTA WIND AND SUN LTD
PO BOX 1781
ABERDEEN, SOUTH DAKOTA 57401

ALTERNATIVES SOURCES OF ENERGY
RT 2
MILACA, MN 56353

ENERGY ALTERNATIVES INC.
819 BROADWAY
ALEXANDRIA, MN 56308

* * * * *

RECENT DEVELOPMENTS

CPA and UPA are worried that bringing the CU project on line will be a very traumatic experience, and they have been busy making preparations to ease the shock. Some of these preparations have been a bit frantic, and out in N. Dakota, they're showing signs of chronic paranoia. Somehow the utilities got wind of protester plans to invade and destroy the power plant. Then the media picked up on the idea and articles about the coming invasion began appearing throughout the land. Fargo Radio even called up to see when we were leaving. They were told that the phone is no place for such a discussion.

While utility spokesmen could come up with nothing specific on which to feed their paranoia, security has been tightened almost to the point of strangling the plant and mine. Matter of fact, it's like an armed camp out there, the North Dakota National Guard is ready to move at the drop of a hat, and local residents who are expected to host the invading forces are being watched, as he said, "Like rabbits in the cabbage patch by 3 to 5 people who are recording our every move. We laugh and laugh and laugh!" According to reports from the area, security personell are worried because protesters only had a permit to protest on June 30 but no one showed up then. Now they don't know when it will happen. When it does, they hope it will all be peaceful without blood-

shed, but they're prepared for anything. They think. Oh my goodness! (4)
They even went and cancelled the big open-house tours they have every year
out there for fear of protesters.

Preparations on the Minnesota side have not been quite so frenzied, but
are just about as desperate. Seems that UPA/CPA figure they have a lot of
explaining to do, so electric rates will have to double just to pay for the
media blitz folks have been enduring. Pick a radio station, and you'll get to
listen to these turkeys tell you how this is a changing world, progress is be-
ing made, and the squeeze you'll get from your electric bill is for your own
good. And you can hear it 5 to 10 times a day. The newspaper ads are even
worse. "THE POWERLINE IS YOUR LIFELINE" they say, and proceed to justify the
boondoggle on the grounds that we're all addicts who never had it so good, and
cut out that vandalism stuff. Even the Minnesota Historical Society picked
this particular time to give its salute to Minnesota Rural Electric Coops.
They go so far as to invoke the spirit of F.D.R. on behalf of the utilities,
and extoll the progress made in rural electrification these past 45 years.
The Historical Society ought to be ashamed of itself (maybe indicted) for us-
ing tax money to pay for such propoganda, and folks ought to tell them so.

On the other hand, there are still some problems. There is a lot of oil
still being shipped to the plant, and on this side, the BCA boys couldn't
stand the pace for too long. Their big push netted them 2 very dubious felony
charges against protesters. (NOTE: the Omnibus Hearing for Darus Ehlers and
Dwight Nelson will be at 10:30 am in the Traverse Co. Court House on Aug. 6)
The BCA is still around, but seems to be trying to rely more on informants.
They are having no more luck than when they had an agent under every bush,
and now some of the insulators are wilting for lack of attention. The towers
must need watering or something. Looks like lightening has been striking at
the conductor cable as well, and they're pretty messed up every so often.
Rumor Control has learned that such strikes are drastically reducing the ef-
ficiency of the line, perhaps by as much as 60%. Oh well. We've known all
along that it is not nice to trick Mother Nature!

* * * * *

BLACK HILLS ALLIANCE

Over 7000 people met in Rapid City S.D. to hear problems and solutions to
the problems of the Black Hills, and to listen to some real good (and loud)
music. The following day about 4000 marched 18 miles into the hills in support
of the Black Hills Alliance. That night folks had the privelege of listening
to Native Americans tell about the place of the Black Hills in their culture.
It is sacred land. It will be defended. There were workshops on Sunday to dis-
cuss what is happening to people not only in this country, but all over the
world. We all have the same problem - the giant multinationals taking advantag
of the land and the people. Many examples of misuse of resources and of ignor-
ing the law were sighted, all of course, for the money-making ways of the cor-
porations. We all have concrete evidence, names, times, and places, but no one
person or group can do anything substantial to stop them. Once again, the peo-
ple must get together, regardless of race, religion and social status, and
call a halt to this corporate rape of our earth. Along with educating oursel-
ves and the people we associate with about the nature of these corporations
and their subsidiaries, and the danger of centralized energy development, the
multinationals will be challenged in the courts, at public hearings, at the
polling booth and in the fields. Big doings are being planned by the Black
Hills Alliance for the summer of 1980, and there will be activities between
now and then. We'll keep you posted.

* * * * *

July 21

You Are Cordially Invited To The Party!!

July 21

Seeing as how we've had more than a few social gatherings of protesters in the
Popc/Stearns Co. area in the past little while, and seeing as how a party out
Traverse Co. way might be really nice, and seeing as how it just happens to be
Dwight Nelson's birthday July 21, we're having a PARTY! Go north of Wheaton
on US 75 to 1st crossroad. Go West 1 mile, North 1 mile, and you're there!!

The Environmental Protection Agency (EPA) has apparently decided to back down on regulations concerning pollution control requirements for new coal-fired electrical power plants, after intense lobbying by the coal and utility industries and coal state senators. EPA Administrator Douglas Costle has decided to require the removal of 70 to 90 per cent of sulfur pollutants from the emissions of new coal-burning plants, depending on the sulfur content of the coal burned. The EPA had originally planned that all new coal-fired plants remove 85% of the sulfur from emissions. The EPA backed down, according to a Washington Post source in the U.S. Senate, after "hardball arm-twisting" by Senate Majority Leader Robert Byrd (D-W. Va.) and other coal state senators.

The Clean Air Act Amendments of 1970 required the EPA Administrator to set standards of performance for major new sources of pollution ("New Source Performance Standards", or NSPS). 1977 amendments to the law directed the Administrator to require new sources to meet a percentage reduction requirement for sulfur pollutants, in addition to the emission limit on pounds of sulfur per million btu's (btu's measure the heat content of coal or other fuels). According to the law, the Administrator must require new sources to install the "best system of continuous emission reduction, taking into consideration the cost of such emission reduction".

In September, 1978, Adm. Costle announced a proposed NSPS rule requiring 85% emission reductions from all new coal-fired electrical power plants. It was not until after the public comment period on the proposed rule had closed that Costle was apparently convinced to back down.

The decision will allow some new plants--those burning "low sulfur" western coal--to emit three times as much sulfur dioxide as the original flat 85% NSPS would have allowed. The argument for allowing the extra sulfur dioxide emissions is that a flat percentage would "discriminate" against low-sulfur coal, because it would be harder to remove 85% of the sulfur from low-sulfur coal than from high-sulfur coal. Unfortunately, the sliding scale will encourage burning of western coal, which is lower in heat value than eastern coal. Under the new rule, a 500 megawatt plant burning "low sulfur" western coal may well emit more sulfur dioxide than a 500 megawatt plant burning "high-sulfur" coal. The new rule may also frustrate the intent of Congress. In passing the Clean Air Act Amendments, Congress expressly intended to encourage the use of local coal. The new rule may encourage eastern utilities to burn western coal in new plants.

The EPA has also apparently dropped plans to lower the current NSPS emissions ceiling of 1.2 pounds of sulfur per million btu's to 0.8 pounds. Ironically, Senator Byrd and other coal state Senators argued that the more stringent emissions standard would discriminate against eastern high-sulfur coal--after they had argued that the proposed emission reduction requirements would discriminate against western coal. Much western coal, however, is actually high in sulfur content, when the low heating value is considered. The fact is that there is both high and low sulfur coal in the east and west, when adjustment for btu values is taken into account. The discrimination argument is somewhat surprising, because the purpose of the NSPS emissions ceiling is to discriminate against high sulfur coal, and to encourage the burning of cleaner fuels and the development of pollution controls that will allow new plants to burn high-sulfur fuels with minimal sulfur dioxide emissions.

As with other debates over air pollution control, only one kind of cost was mentioned by the coal and utility industries and by coal state senators: namely, the cost of pollution control equipment. Energy Sec. Schlesinger, who testified in 1977 in favor of stringent NSPS in Congress, is now arguing that stringent NSPS and clean air are, somehow, inflationary. The difference in costs of required scrubbing equipment under the flat 85% NSPS and the 70-90% sliding scale NSPS is small. The more lenient NSPS could cost the customer 95¢ a month by 1995, as compared with \$1.50 under the 85% removal NSPS. With hundreds of new coal-fired power plants across the country planned by 1995, the increased emissions--and increased costs--of sulfur dioxide under the relaxed rules could be staggering.-----THE PLAINS TRUTH, MAY, 1979

LETTERS

Dear People,

I have recently moved into the Glenwood area and have learned about your powerline. I support what you've been doing and would like to help. I am sending a small contribution to help with your operating expenses. Plus, I would like to volunteer my services. I have plenty of free time and would like to help out in any way I can. Please put our name on your mailing list, so we can hear what you're doing. Keep up the good hard work.

Glenwood, Mn

Hold That Line,

Can't you do something about those towers falling down? Enclosed is a donation to aid you in your efforts. Keep up the excellent work you're doing, we appreciate it.

Crystal, Mn

Dear Folks,

We enjoy your letter much. Here is a help for keeping it coming.

Villard, Mn

Hold That Line!

Keep up the good work, enjoy your paper. Here's a check to help you keep the newsletter coming.

Hewitt, Mn

HTL,

Hopefully this will help. Feel like a little fish in the ocean. Here is another small donation, but as they say, every penny helps.

Elbow Lake, Mn

I think Hold That Line is the most important part of our protest. Keep up the good work. Thanks for all you're doing.

Glenwood, Mn

Dear Sir:

I read a copy of your paper. I think that it is very good, especially about that judge.

Will you send me some back issues and future ones. Thank you.

Anoka, Mn

Gentlemen:

Please send me more information about your organization. Thank you.

Rogers, Mn

Enclosed find an article from Free Press, Mankato, about condemnation hearings at Le Sueur County. We feel quite hopeful, and are all set to go to Carver County condemnation hearing. We do appreciate your printing our actions here in southern Minnesota. Do wish we could donate money at this time. But we have big expenses with our lawyer fees and court costs. Thank you.

Mankato, Mn

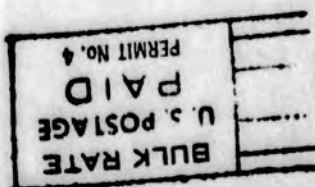
Hello;

Good issues of Hold That Line keep coming our way in Wisconsin. Our strength is growing as more of us in Wisconsin read your paper.

We have started a paper here in southeast Wisconsin called Dead Serious. We are sending you ten copies to distribute around your group. Keep the wire worms fed.

Milwaukee, Wis

* * * * *
Our folks handling the T-shirts say they can't cut it with postage costs, so please add a dollar on to your payments. Thank you, see you the 24th
* * * * *



40
HOLD THAT LINE
WRY TOWN HALL
WRY, MN. 56349

The Environmental Protection Agency (EPA) has apparently decided to back down on regulations concerning pollution control requirements for new coal-fired electrical power plants, after intense lobbying by the coal and utility industries and coal state senators. EPA Administrator Douglas Costle has decided to require the removal of 70 to 90 per cent of sulfur pollutants from the emissions of new coal-burning plants, depending on the sulfur content of the coal burned. The EPA had originally planned that all new coal-fired plants remove 85% of the sulfur from emissions. The EPA backed down, according to a Washington Post source in the U.S. Senate, after "hardball arm-twisting" by Senate Majority Leader Robert Byrd (D-W. Va.) and other coal state senators.

The Clean Air Act Amendments of 1970 required the EPA Administrator to set standards of performance for major new sources of pollution ("New Source Performance Standards", or NSPS). 1977 amendments to the law directed the Administrator to require new sources to meet a percentage reduction requirement for sulfur pollutants, in addition to the emission limit on pounds of sulfur per million btu's (btu's measure the heat content of coal or other fuels). According to the law, the Administrator must require new sources to install the "best system of continuous emission reduction, taking into consideration the cost of such emission reduction".

In September, 1978, Adm. Costle announced a proposed NSPS rule requiring 85% emission reductions from all new coal-fired electrical power plants. It was not until after the public comment period on the proposed rule had closed that Costle was apparently convinced to back down.

The decision will allow some new plants--those burning "low sulfur" western coal--to emit three times as much sulfur dioxide as the original flat 85% NSPS would have allowed. The argument for allowing the extra sulfur dioxide emissions is that a flat percentage would "discriminate" against low-sulfur coal, because it would be harder to remove 85% of the sulfur from low-sulfur coal than from high-sulfur coal. Unfortunately, the sliding scale will encourage burning of western coal, which is lower in heat value than eastern coal. Under the new rule, a 500 megawatt plant burning "low sulfur" western coal may well emit more sulfur dioxide than a 500 megawatt plant burning "high-sulfur" coal. The new rule may also frustrate the intent of Congress. In passing the Clean Air Act Amendments, Congress expressly intended to encourage the use of local coal. The new rule may encourage eastern utilities to burn western coal in new plants.

The EPA has also apparently dropped plans to lower the current NSPS emissions ceiling of 1.2 pounds of sulfur per million btu's to 0.3 pounds. Ironically, Senator Byrd and other coal state Senators argued that the more stringent emissions standard would discriminate against eastern high-sulfur coal--after they had argued that the proposed emission reduction requirements would discriminate against western coal. Much western coal, however, is actually high in sulfur content, when the low heating value is considered. The fact is that there is both high and low sulfur coal in the east and west, when adjustment for btu values is taken into account. The discrimination argument is somewhat surprising, because the purpose of the NSPS emissions ceiling is to discriminate against high sulfur coal, and to encourage the burning of cleaner fuels and the development of pollution controls that will allow new plants to burn high-sulfur fuels with minimal sulfur dioxide emissions.

As with other debates over air pollution control, only one kind of cost was mentioned by the coal and utility industries and by coal state senators: namely, the cost of pollution control equipment. Energy Sec. Schlesinger, who testified in 1977 in favor of stringent NSPS in Congress, is now arguing that stringent NSPS and clean air are, somehow, inflationary. The difference in costs of required scrubbing equipment under the flat 85% NSPS and the 70-90% sliding scale NSPS is small. The more lenient NSPS could cost the customer 95¢ a month by 1995, as compared with \$1.50 under the 85% removal NSPS. With hundreds of new coal-fired power plants across the country planned by 1995, the increased emissions--and increased costs--of sulfur dioxide under the relaxed rules could be staggering.-----THE PLAINS TRUTH, MAY, 1979

LETTERS

Dear People,

I have recently moved into the Glenwood area and have learned about your powerline. I support what you've been doing and would like to help. I am sending a small contribution to help with your operating expenses. Plus, I would like to volunteer my services. I have plenty of free time and would like to help out in any way I can. Please put our name on your mailing list, so we can hear what you're doing. Keep up the good hard work.

Glenwood, Mn

Hold That Line,

Can't you do something about those towers falling down? Enclosed is a donation to aid you in your efforts. Keep up the excellent work you're doing, we appreciate it.

Crystal, Mn

Dear Folks,

We enjoy your letter much. Here is a help for keeping it coming.

Villard, Mn

Hold That Line!

Keep up the good work, enjoy your paper. Here's a check to help you keep the newsletter coming.

Hewitt, Mn

HTL,

Hopefully this will help. Feel like a little fish in the ocean. Here is another small donation, but as they say, every penny helps.

Elbow Lake, Mn

I think Hold That Line is the most important part of our protest. Keep up the good work. Thanks for all you're doing.

Glenwood, Mn

Dear Sir:

I read a copy of your paper. I think that it is very good, especially about that judge.

Will you send me some back issues and future ones. Thank you.

Anoka, Mn

Gentlemen:

Please send me more information about your organization. Thank you.

Rogers, Mn

Enclosed find an article from Free Press, Mankato, about condemnation hearings at Le Sueur County. We feel quite hopeful, and are all set to go to Carver County condemnation hearing. We do appreciate your printing our actions here in southern Minnesota. Do wish we could donate money at this time. But we have big expenses with our lawyer fees and court costs. Thank you.

Mankato, Mn

Hello;

Good issues of Hold That Line keep coming our way in Wisconsin. Our strength is growing as more of us in Wisconsin read your paper.

We have started a paper here in southeast Wisconsin called Dead Serious. We are sending you ten copies to distribute around your group. Keep the wire worms fed.

Milwaukee, Wis

* * * * *
Our folks handling the T-shirts say they can't cut it with postage costs, so please add a dollar on to your payments. Thank you, see you the 24th

* * * * *

"HOLD THAT LINE"

July 1 - 15

POWERLINE PROTEST NEWSLETTER *** PRESS RELEASE

URGENT

PLEASE NOTE:

Hold That Line has learned that the Bureau of Criminal Apprehension, along with assistance from UPA, is currently paying people on a weekly basis for any information on the activities of anybody who might be a powerline protester. This is happening all along the route in Minnesota. It seems that the utility industry nationwide is also running scared of this protest to the point where the industry is putting up some pretty big money, more than the \$50,000 we've been hearing about, to get the information they need. BE CAREFUL WHAT YOU SAY. BE CAREFUL WHO YOU ARE TALKING TO. JUST BE CAREFUL! Well folks, it sorta looks like we've made it through all the elimination rounds and into the finals, don't it.

* * * * *

THE CASE KEGS OF THE UN-LINE POWERLINE PARTY

Originally, the project should have been done a couple years ago. The line was completed (sorta) 9 months ago, the last few bugs were recently ironed out of the power plant (they thought) and Phil Martin was all set and ready to experience the thrill of his life. He even went and found the little pointy hat his mommy gave him. That sounds like party time, and sure enough, party time it was. Only Phil didn't show up, the cops had the good sense to keep a distance (with a few duely recorded exceptions), and for the time being, the commercialization of the CU project is as real as the white elephant in Phil Martin's wet dreams (see page 5).

But was there ever a party! Folks came from as far away as New York and New Mexico, Wisconsin, Farwell and North Dakota. Over 400 of them. The weather was perfect, or else there would have been even more - make hay while the sun shines, you know. By all the laughing and dancing and shouting and singing that was going on you could have sworn there wasn't a powerline larger than 69 KV within a thousand miles.

Seems that not everybody was so happy though. You know how rumors are. Well, somebody went and started a rumor a while back that said that on June 30, with or without a full moon, there would be hundreds upon hundreds of mean and angry, low down gun toten bomb throwin cussin and swearin fire breathing mad anarchist farmers descending like a hord upon the Coal Creek Station with destruction in their hearts. The authorities responded to the emergency quickly and efficiently, however, and so all was not lost. A brave but frightened security force of only 60 agents has been patrolling the plant with military precision. Some of them were more frightened than others, though, because they had to climb up to the top of the 658' smokestacks so they could see better what was going on. Seeing as how the thing isn't on line, they should probably stay out there for awhile yet because things got delayed a bit on this end too . . .

* * * * *

COURT CAPERS

Matt Woida will go on trial on Tuesday morning, July 10, in Glenwood. Matt faces destruction of property and conspiracy charges stemming from an incident that happened 15 months ago. Judge Willette, who also was on the three judge powerline panel will sit on it.

Bill Hansen, who was convicted last month will be sentences in Glenwood on Monday, July 16 at 9:00 a.m.

Also at 9:00 a.m. on Monday, July 16 is the arraignment of Darus Ehlers and Dwight Nelson on charges of aggravated assault.

LIKE THE CHARGE OF THE LIGHT BRIGADE, THE LEGISLATURE SWINGS INTO ACTION (2)

We got a letter from Representative Fjoslien the other day about House Advisory Bill #27. The bill is to study the powerline conflict, and calls for a special subcommittee "to investigate UPA's failure to comply with all the conditions and mandates . . . for the construction permit..." Television and telephone problems as well as any "new information regarding adverse health effects" should be considered too. The committee is also to look at problems with land values and survey mistakes, and the objective of their investigation is to find solutions to these sources of conflict. Then they are to report back to the legislature. Just in the nick of time! Why oh why didn't somebody think to do something like this before?

Quite naturally, the utilities don't like the idea at all. As far as they're concerned, they did everything that is humanly possible to minimize impacts, adequately clean up, follow the construction permit, and generally insure that the very best interests of everybody had been superbly defended. As a matter of fact, the only problems out here result either from peoples' own imaginations or as a result of their unwillingness to cooperate with the utilities.

So if anybody wants a copy of House Advisory Bill #27, or has some comment on it, Representative Fjoslien is interested:

Representative Dave Fjoslien
387 State Office Building
St. Paul, MN 55155

* * * * *

DREAM MEETING

JULY 11

8:30 p.m.

The Determined Runestone Electric Association Members will be having a meeting Wednesday, July 11. Hopefully, there will be a judgement on the law suit involving mail ballots by that time, and future activities will be discussed. The meeting will be at the Ronald Barsness home, 3 miles North of Cyrus.

* * * * *

FIVE MORE CHARGES BROUGHT AGAINST POWERLINE PROTESTERS

Five people refused to testify for the State in the Bill Hansen trial last month. All were charged with civil contempt of court and three of them went to jail and had to stay there until the end of the trial. Harold Fischer was in jail almost 2 weeks because of that. But now that the Matt Woida trial is approaching, the State is more anxious than ever to get some testimony. The prosecution decided that the best way to get that testimony would be to charge all those who refused to talk before with criminal contempt of court. So on Monday, July 2, our little Pope County prosecutor, who is learning very quickly how to be a good little lackey, put his name down at the bottom of the papers charging those five people with criminal contempt. That is a 90 day misdemeanor. Hearing is scheduled for 8:00 a.m. on Monday, July 9, in Glenwood.

* * * * *

ALTERNATIVE ENERGY IS ON THE WAY

While the Carter Administration and the Utility Industry vows to continue plunging full tilt down the centralized energy path, the March 26 Chicago Tribune reports, "The dream of using sunlight to supply all the electrical energy needs of an average house could be achieved within three years" That according to scientists from RCA and a little outfit called Energy Conversion Devices. The industry calls such development "exotic" and the government says it ain't possible until 2000. The Jan. 1979 Popular Science Mag. reports a 2000 KW wind generator at work in Denmark. It costs about \$360 per KW, compared to something over \$1,250 per KW for the Coal Creek Station.

Speaking of MONEY, Hold That Line needs your support. Please contribute

Congressman Nolan and his staff sponsored a hearing in Sauk Centre on June 25 where people living in the vicinity of the powerline had a chance to testify about their experience with health and safety problems related to the powerline. Over 200 people were present. More than two dozen folks described problems they have had to a couple doctors from the State Health Dept., and to Mr. Charmichael who's doing the GAO investigation. Quite logically, many of those who testified are powerline protesters. But it is significant that testimony came from all across the state and from more than a few folks who have had nothing to do with protesting.

Complaints included problems we've been noting in Hold That Line for the past half year or so, plus a couple additional ones. While some people were able to be much more specific about the time of incidents than others, the Mpls. Tribune reported a correlation of over 85% between when people said they had trouble and when the line was on. Certain days were particularly bothersome. Complaints included headaches, skin rashes and itching, waking up in the morning bloody from nose bleeding after exposure to the line the night before, fatigue, sinus trouble, constricted breathing, dizziness, and steril animals, as well as the familiar interference with communications systems. The good doctors Peterson (who says he is a good listener) and Dean took a few notes and asked a few questions and even stayed awake the whole time.

A substantial amount of experimental data on the effects of powerlines was also introduced in writing, and it is a bit disconcerting to note that the symptoms and effects which have been observed in field studies and experiments are the same as people were reporting in Sauk Centre. For example, charged particles, or air ions are known to cause headaches. The people responsible for the Minn. Dept. of Health Powerline Study of 1977 are on record saying that very little is known about the effects of air ions from direct current powerlines, and this is definitely a major problem area. Dr. Hirsh from the University of Minnesota Morris, who is one of the world's top authorities on corona discharges from electro-magnetic fields was at the hearing and said that people near the powerline are correct when they say they are guinea pigs. And the really stupid part of the deal, according to Dr. Hirsh, is that the experiment is so poorly designed and loosely monitored that the experimentors have no way of knowing what is happening to their guinea pigs. On the other hand, the utilities take the position that all these people out here are just so angry and frustrated that either we've all become pathological liars or else we're all crazy and imagining things.

So, towards the end of the meeting the guy from GAO said he was glad to be present, thank you kindly for an interesting evening, but our investigation does have limits of time and space, you know, and we can't just wait around to see how long it takes you folks to get sick or whatever. Then the good doctors Peterson and Dean said how impressive peoples' statements were and how these problems are of a very serious nature and much more research is needed and we don't have anywhere near all the answers which are necessary. BUT there is nothing here that would cause Uncle Albert to shut down the line. Nobody is in any immediate danger, we could have listened to similar complaints anywhere else in the state, you can't expect powerlines to cure colds, and maybe in a decade or so we'll know a lot more about the long term effects of these things, thank you very much, wasn't it good of us to come all this way out here? So much for the Hippocratic oath. Very little is sacred anymore. The good doctors were informed that they'll have to get their experimental data from someplace else. But if anyone has complaints which they'd like to register, here's one more place that you can send them:

Mr. Larry Gust
Division of Environmental Health
Minnesota State Health Department
717 S.E. Delaware
Minneapolis, Minnesota 55414

(612) 296-5325
or
(612) 296-5508

or

YOU CAN TAKE THE BCA BOYS OUT OF THE CITY,
BUT YOU CANN'T TAKE THE CITY OUT OF THE BCA BOYS, OH YEAH

There are enough agents running around out here so that if they all wore fancy uniforms and drove in squad cars, there would be big news coming out of Powerline Country. It would be big news if the Troopers were back. Instead, we have a most unseemly collection of moral derelicts trying very hard to be sly and sneaky. That's because Albert the Governor made this powerline business the #1 priority for his boys from the Bureau of Criminal Apprehension. Thus we have one more wrinkle in this sordid triangle involving government, big business, and the CU project. Taxpayers once again are paying the bill as the State babysits for corporations. And the free press, that bastion of a free people, is eloquent in its silence while civilization runs amok before its very eyes. That is, of course, assuming that these would-be cops bear the hallmark of civilization!

Anyway, these agents are thick all the way from the North Dakota line to Delano, even though most of them are still a little bit wet behind the ears. They'll probably dry out by the fire. They usually have on bullet-proof vest over their cute little farmer disguises, they are armed and to be considered dangerous, and they drive around in a very wide variety of vehicles (some without proper lighting) with 4 or 5 or 6 or 7 antennas sticking out. So be careful. Even though they get lost a lot and can't quite seem to keep track of who they're supposed to be watching, they do have a burning desire to get a pat on the head and maybe even a lollipop from their Uncle Albert. Substantial amounts of money are also at stake, and these guys will do what they can get away with to get the goodies. They have a remarkable record over the past few weeks.

Included in the antics which are rather commonplace and which folks out here may or may not continue to put up with, are flashing spotlights on peoples' homes, driving around in their yards, or discharging rifles over buildings in the early morning hours. Or conspicuously following motorists of Central Minnesota, flying airplanes low overhead at irregular and frequent intervals sometimes many miles from the line, and obnoxious questioning of employees at restaurants in the region.

Yet these turkeys have done some damage. That is almost unavoidable considering that there are as many as 120 of them slithering around making people angry. (More than a dozen BCA vehicles were seen refueling at the same time at an Alex gas station, and similar situations have been noted elsewhere.) People have had their cars stopped and searched by agents for no apparent reason. That could turn into an instant problem sometime. Several days ago, agents started chasing a vehicle some 10 miles north of the powerline. After chasing it for 7 miles they decided to pull it over for speeding. Before the ticket was written, the car was searched, the driver was interigated about powerline activities and threatened when no information was forthcoming. Worst of all (so far) two people were arrested and held a few days on felony charges for, BCA boys say, pointing a gun at them with intent to commit great bodily harm. Aggravated Assault is the charge, max.: 5 years and \$5,000. Seems these agents can spot things like that at $\frac{1}{4}$ mile, yet they have some problems being more specific.

It is not necessary for them to be more specific. Such arrests are designed to destroy opposition to the powerline, not to serve justice, law or order. They are designed to scare people away, immobilize others, and drain the resources of everyone else. But there seems to be a few flaws in the design. Perhaps scare tactics no longer work, and speaking of resources how long does Albert think he can afford (spiritually as well as physically) to keep his goon squad out here chasing shadows? On the other hand, how long can farmers wait? (That's called Strategy!) Let's face it. Trying to bust up a movement is a long and nasty business.

Long and nasty maybe. But there is no reason why it has to remain so anonymous and impersonal. After all, we all are sort of "business associates" out here, you might say, and so we might at least make an earnest attempt to get to know each other. Kind of up close and personal, or something. Now we've been compiling quite a bit of information on some of these guys, and we would like to introduce you to one of the "supervisors", a great big _____ who prides himself on his ability to follow orders and make snappy decisions. He is, however, easily confused and doesn't always know if you're just joking. We shall call him "Least Earnest" and any similarity between this jerk and the actual jerk who is running amok out here is strictly confidential. How 'bout it, Least?

Least graduated from Alex High back in '64. His pop was the sheriff of Douglas County at the time, a fact Least appreciated more than once. But at least Least graduated. The preacher's daughter wasn't so lucky. Least knocked her Earnestly up and she got kicked out of school on that account. Least got kicked out of sports. Sexism was big back then. Shortly thereafter, Least got caught trying to steal his uncle's boat early one morning. His uncle heard the commotion and laced Least with buckshot. Least was also caught stealing gasoline north of Ferada and there were some Earnest fingers pointing at him in a matter involving some disturbed gravestones. Least was very happy that his daddy was the sheriff. But just to prove that he was Earnest about this stealing thing, he also managed to get himself kicked out of sports at Hamline for ripping off basketballs. Just think. Now we get to have this kind of a sullied pervert making decisions which are critical to the lives and perhaps the deaths of Minnesota citizens. That's Up Close and Personal, folks.

* * * * *

THE CASE OF THE UN-LINE POWERLINE

We've had to listen to the utilities say for the last four months that July 1 is that magic moment when the CU project will be commercialized. Phil Martin even went so far as to say that each person in the UPA/CPA system would have to pay an additional \$25 in July to buy 16,780,344 gallons of oil at a total cost of \$3,042,674 if the project was out of order, and Uncle Albert echoed him like a parrot when he was giving excuses for sending out his thugs. Well, if Albert is going to keep his thugs out here until the project comes on line, they'll have to tough it out for at least another month. On June 27 the utilities announced that it will be late July or early August before it's ready to go. While Albert tries to figure out why he's sawing away like a dummy on the wrong side of the limb, this latest development does raise some interesting questions and invites a bit of friendly speculation.

First of all, it appears that members will avoid higher rates in July because the commercialization date has been postponed. The postponement means UPA/CPA will be able to buy electricity as they have in the past and not have to rely on expensive replacement power. Which means that the base load electricity was available all along. Which means that those who concocted the CU project are a gang of cheaters, liars, and mismanagers. The way they handle it, the act of signing a piece of paper saying this project is complete is the thing which determines how much electricity is being generated in the Upper Midwest! And the thing which determines the cost and source of that electricity is whether or not that piece of paper is signed! No wonder there is an energy crisis! This development, particularly in view of Martin's statements, should do much to prove what we've been saying all along: the CU project is not needed, and the electricity from the project will cost too much.

In the second place, the reasons given by the utilities for the delay are worthy of note. Up until about 10:30 a.m. of June 27, Don Jacobson of UPA was making the announcement over the radio. Ol' Don was blathering on about how it was sawed off tower legs, damaged conductor wire, missing in-

sulators, and the type of thing that generally gets the ECA boys all ex-⁽⁶⁾
cited. That may all be, but a whole month worth? Then at about 11:00 a.m.,
Bob Sheldon, boy wonder PR for CPA comes on and there ain't nothing about
sabotage. Now the problem is in the coal pulverizer. Then a few days later
word of the real cause was intercepted by Rumor Control. It seems the utiliti-
es got word of our June 30 party and decided they'd be better off if they
just put the whole thing off for a while. Out in North Dakota, you see, they
are very frightened of an invasion of angry Minnesota farmers.

But just maybe Sheldon was telling the truth, and the pulverizer isn't
pulverizing so good. Maybe they just burned out the bearings a few times. On
the other hand, maybe they tried once again to get their lignite to burn an
ended up coating the fire-box of the boiler with oil and lignite powder.
That mess takes about a month to chip out with cold chisels. It also would
explain why the pulverizer has to pulverize the lignite into smaller particles.
But seeing as that lignite is 40% water to begin with, maybe it won't be
small enough in August, either.

Meanwhile, a few other juicy tid-bits have come our way. It seems that
the directors of UPA and CPA went and got themselves divided up into some
sort of committees. Before that, they were already divided up into Yes Men
and No Men. But now all the Yes Men are on the Executive Committee which
does all the "research" and makes all the major decisions in the back room,
and the No Men get to sit and twiddle their thumbs until the Yes Men are
ready to vote a decision at the board meeting. Then the Yes Men vote Yes and
the No Men vote No and the Yes Men win. Recently all the Yes Men have gotten
together with the head honcho of the Federal REA program to talk about why
UPA and CPA spend so much time and energy calling each other dirty names.
Seems that all this petty bickering could be eliminated by getting UPA and
CPA consolidated into one big happy family. At least that's the idea of the
head honcho from Washington D.C. We'll be hearing more about this, no doubt.

Beyond that, the Yes Men from CPA have allocated well over \$200,000 to
Falkirk Mining for things like construction equipment, payroll computers, and
parts inventory. It looks like Falkirk snatched the Sugar Daddy's credit
card and thinks there is no tomorrow. Speaking of Falkirk Mining, while
Falkirk is wholly owned by North American Coal Corporation, a bunch of other
outfits like Aetna Life Insurance, Teachers Insurance, Annuity Assn. of Ameri-
ca, American National Bank and Trust, and Marquette National Bank of Mpls,
and some leasing companies also get a bit of the action. All them corporatio-
ns are involved with the financing for the great big draglines they have out
there. Plenty of money for everybody in this business.

CPA's management has learned a few lessons from the past few years, how-
ever. Recently an outfit called Allied Power approached them with a proposal
to share a power plant down in South West Iowa. But due to the fact that the
capital costs plus the transmission costs due to the plant location being a
great distance from the load center, CPA decided it would be better to get
involved with a Minnesota based unit. Live and learn. . .

* * * * *

THE CLAMSHELL VS. THE SEABROOK NUKE

There has been a lot of action around the Seabrook Nuclear plant out in
Mass. these past several years, and most, if not all of that action has been
geared towards forcing the government or the industry to halt the project.
Neither the government nor the industry seems to be the least bit interested
in changing their ways and acting responsibly. They should know better.
Now they'll have to learn the hard way, and the Clamshell Alliance is moving
into the next phase of the fight against Seabrook. The Alliance is gearing
up to shut down construction at Seabrook by their own direct actions. We
salute our sisters and brothers of the Clamshell Alliance. We support you
and encourage you in your coming confrontations!

BLACK HILLS NATIONAL GATHERING

(7)

The Black Hills Alliance invites you to be present at Rapid City, S.D. during the weekend of July 6, 7, and 8. This is the Midwest Regional - National Action against nuclear power - with a focus on the beginning of the Nuclear Fuel Cycle - Uranium Mining. The Black Hills Alliance is an organization of Native and Non-Native peoples who have banded together because of our understanding that plans by several large, energy-developing corporations threaten to destroy our part of the country. The whole Northern Great Plains Region surrounding the Black Hills, in fact, has been designated a "National Sacrifice Area" to energy development by a Trilateral Commission Report.

Consider the following facts:

- ** Nuclear Energy begins with Uranium mining.
- ** Uranium mining and milling constitute one of the largest health hazards of the nuclear cycle.
- ** Over 50% of all uranium is on Native lands.
- ** Only 10% of the uranium in the Grants Mineral Belt of New Mexico has been mined. Already many miners are dead - much land and water permanently destroyed.
- ** The Black Hills region of the Upper Great Plains is rich in uranium deposits.
- ** More than 70 polluting coal fired power plants are planned for the western slopes of the Black Hills.
- ** More than 25 multi-national corporations are preparing to exploit approximately one million acres of the Black Hills.
- ** The water of the entire region is expected to be gone in 35 years. A desert will remain.
- ** The Black Hills have always been sacred to the Native peoples.
- ** The Black Hills are a beautiful, 2 billion year old formation, guaranteed to Native Peoples 'forever' by the 1368 Ft. Laramie Treaty.
- ** If we are to stop the nukes, we must do it here - at the beginning - NOW.

The program for the three-day action in July is as follows:

- July 6th -- Friday. Save the Hills Symposium. Program of speakers and music to be held in Rapid City. Featuring Jackson Browne, Bonnie Raitt Jim Page and others. Local community speakers and also speakers on the economics of uranium mining and the effects of low-level radiation.
- July 7 -- Saturday. Walk through the hills to the edge of the contaminated areas. Speakers from the Lakota Nation. Evening programs including short talks from the various regions and groups represented.
- July 8th -- Sunday. Large gathering and rally. Workshops and planning towards the Black Hills Survival Fair of 1980.

Information and answers to whatever questions you may have can be obtained by calling the office of Northern Sun Alliance in Minneapolis, MN 1-612-374-1540. N.S.A. is also arranging transportation.

* * * * *

Meanwhile, there's trouble everywhere. Nuke plants are leaking radioactive water up to 90 gallons an hour in Florida, around Chicago, Michigan, Maine, and Connecticut. We won't even mention Harrisburg.

And inspite of a growing awairness of health and vegetative hazards of High Voltage Powerlines, along with all the other problems they bring with them, folks out in North Dakota can expect aver 1200 miles of these things in the next 10 years, according to the Public Service Commission. Half of them are to take power out of or right on through North Dakota. It should be noted, however, that these estimates are conservative.

Available Lit. & Other Stuff

LIT. THE POWERLINE WILL AFFECT YOU-25¢
MAPP & THE CU PROJECT-25¢
POWERGATE-25¢
ELECTROPOLLUTION-25¢
WHAT IS PURE COAL-25¢
PHYSICS RELATED PROBLEMS OF
COAL FIRED POWER PLANTS-\$1
NORTH AMERICAN COAL CAPERS-\$1.50

T-SHIRTS MINNESOTA STATE TREE-\$5
G.A.S.P. -\$5

BUTTONS IF YOU KILL OUR FARMS YOUR
CITIES WILL DIE-\$1
USE ALTERNATIVE ENERGY-50¢

BUMPERSTICKERS NO POWERLINE-75¢
DECENTRALIZE ENERGY-75¢
UNSAFE/UGLY-75¢
FARMLAND FOR FOOD-75¢

(Send all orders to HTL, Box 5,
Lowry, MN 56349 - - -)

* * * * *

LETTERS

Dear Friends,

We are a group of 20 people from a Danish travelling Folk School. We have just been to Harrisburg, to find out about the T.M.I. accident, and to talk with people living there so we could go back to Denmark and tell people about it. We have made a film and a book - our goal is to get more people against nuclear power.

The power company here wants to start the construction of the first nuclear plant soon, but we won't let them. We heard about you from some friends in USA and we got very interested to know more about your actions against the powerlines. cont.

People here in Denmark were very glad to hear of your successful way of getting the powerlines down.

Especially when you put pigshit on yourselves, so the police wouldn't touch you.

We would be very glad to get more information about what you are doing, newsletter, how it all started and so forth

Greetings from
Denmark

Dear HTL,

I spent one glorious week in the BWCA and the single most conspicuous feature was the absence of Power Line. When I got back, I heard of the extremely strong wind that blew down 1 of those iron monstrosities. Only goes to prove, you can't fool Mother Nature! Keep up the good work.

Morton, MN

HTL,

Can't you do something about those towers falling down? Enclosed is a donation to aid you in your efforts. Keep up the excellent work you are doing. We appreciate it.

Crystal, MN

Dear HTL

Enclosed is some money for the newsletter. Please add these names to the list.

Villard, MN

Black Hills Alliance

July 6 6:00 p.m. "Save The Hills
Symposium"
Rapid City Civic Center

July 7 9:00 a.m. "Walk into a
National Sacrifice Area"
meet at the Rapid City Civic Ctr.

July 8 All Day Workshops in Nemo
Canyon

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

TRIAL

The jury took about five hours to convict Bill Hansen on June 11. The evidence which convicted him came from statements which were ~~suppressed~~ by Judge Claeson after the omnibus hearing several months ago. When it became clear that the prosecutor didn't have a case if existing rules about trial evidence were used, Lindstrom puffed himself up big and mighty, strode manfully back into chambers where he made up a new rule and spilled milk of magnesia all over his new black robe. (We all have digestive problems from time to time.) Then he called up a whole bunch of BCA boys for protection. So once again THE LAW is changed in the middle of the process to meet the demands of the utilities and the state.

It is important to note exactly what went on here. Lindstrom decided he had the power to arbitrarily overturn an existing court order in the middle of a trial without benefit of the written or oral argumentation which is built into the normal appeal process. The "normal process", which is THE LAW was violated. THE LAW was simply not used because once again protesters would have won against the state and the utilities if THE LAW had been followed. But in his foolish arrogance, Lindstrom decided he doesn't have to follow THE LAW because he is THE LAW. By doing so he chews away at the tenuous threads of an already torn and ragged social fabric. He chews away and then he swallows it down. No wonder that pompous black robed ninny is constipated!

Lindstrom's ruling violates the LAW in another way, as well. The "evidence" which went before the jury as a result of the ruling was obtained by the BCA boys by placing citizens under extreme duress until they said what these state thugs wanted to hear. That is fascism. That is supposed to be illegal here in the land of the free and the home of the brave. Judge Claeson ruled: was illegal to do that and the statements couldn't be used. But the state couldn't get the evidence it wanted, because in spite of all their scare and pressure tactics the cops, judge and prosecutor couldn't get anyone to talk. 5 people were placed in contempt of court and 3 went to jail, farms and families notwithstanding. So Lindstrom reminds the prosecutor about the statements and asks him if he might be interested in using them. The Minneapolis Tribune calls such behavior "breaking new ground", and the way it works is the cops take the stand and read unsigned statements to the jury. The cops read the part that they say the witness said while the prosecutor takes the parts of the cops. Sort of like one might expect the trial of a Russian dissident to like.

When state thugs can obtain statements by using such tactics, we as a society are dangerously close to fascism. When the state is interested in us such statements against its citizens in a court of law, we are dangerously close to fascism. But when a judge actually suggests and encourages such a course, in spite of all rules and precedent which prohibit such a course, it seems a fine line has been crossed in there somewhere, and it seems to be correct to call such a judge a fascist. Thank you Mr. Lindstrom. Good people everywhere are proud of you and Somalia.

From time to time we've stated that law and order and the CU project have very little in common. This is the latest example of that sad fact. The case will be appealed to the Supreme Court, but we've been there before too.

The courts aren't the only ones around here showing their true colors these days. Governor Quie has decided to get into the act in his own devious and uninspired way. Evidently Quie got told by the utilities that all this protest stuff has got to stop, and it is time to send the BCA out to the countryside in force. So Quie, full of resolve and mindful of his hard earned place in history, agreed. We now have an unmarked cop under every tree and rock. Albert, that is not the way to treat the people responsible in part for your overwhelming victory last fall and your continued popularity among the populace. Albert, that could even get you into trouble. After all, one of the thugs could get lost out here and not be found for days, especially when they don't know enough to stay out of people's yards. Albert, you should probably reconsider.

Some very interesting events transpired in the past couple days--the end result of which and timing which even surprised us.

Rick Nolan's office seems to think this health and safety stuff should really be checked out before this line is allowed to operate. So, Monday, June 25 starting at 8:30 pm and going as late as need be--there will be a meeting open to the public in which farmers will submit testimony on the ill health effects of the CU project. A representative from the Minnesota Dept. of Health will be present as will a court reporter. This meeting is giving the floor to the farmers--with no cross examination by utility representatives. Jim Graeve, a field rep from Nolan's office will chair the meeting.

If you've had headaches, rashes, nosebleeds or other affects while working near or under the line there are two things you should do:

1) Try to pinpoint the date and time of your problem as best you can and write it down. Just describe how it happened, what you were doing, what your symptoms were etc. Include in this a report from a doctor or nurse if you got checked.

2) Be there on Monday, June 25, at 8:30 pm (doors open at 8) at the Junior H.S. in Sauk Centre. (On 9th and State Road, north off freeway, 1st road to right-2 blocks long, take left and you'll run into it.)

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"The Washburn Leader" is a newspaper from McLean County in North Dakota where UPA/CPA's power plant is. On May 30, it had a headline which says "Coal Creek to Start 'Generating'". The article says July 1 is still their target date. "Testing of the power line," the article says, "is also continuing, despite intermittent delays caused by damages by Minnesota protestors. The two cooperatives still face opposition to the plant and powerline despite civil and judicial hearings which cleared the way for the project.

"Don Jacobson of UPA in Elk River says the cooperatives expect some problems. Protesters are hit and miss, generally the vandalism is aimed at insulators with some tower destruction. But there has been no concerted effort to destroy the DC transmission line," he said. My goodness! What a wonderful idea! Just imagine Mr. Don thinking of things like that for us! Although Don says he knows nothing about it, the article says, "Rumors of a shut-down at Coal Creek by protestors by June 30 is circulating among workers at the plant and mine." Don't worry though, because the article says "However it is only a rumor." Wait till control hears about that!

Meanwhile there have been a few other developments out by the plant. Falkirk Mining Co., the dummy coal mining outfit, was recently fined a whopping \$7500 for mixing soil on about 15 acres and so far Falkirk has been getting away with mixing water pumped from the mine into the natural water ways. Those fools sure know how to pick a fight. While farmers in the area are late with their crops because fuel is unavailable, UPA/CPA continue to fire the boilers out there with oil, and it is still unclear about just how much oil will be required to keep that lignite.

But July 1 is still their target date, and Phil Martin, manager at UPA, is very excited. He says in an article in the Kandiyohi REA newsletter that, "I am sure many of you have experienced similar great events in your own private lives or in your businesses." He brags about how well managed the whole affair has been, and expresses his concern about the tremendous cost that will result if the line is taken out of service--about \$25 additional dollars per coop member for July, he figures. It is so high because, Phil says, all the replacement electricity would have to be from oil fired peaking stations. He is a lying forked tongued son of a puppy doggie. Industry figures from MAPP and National Electric Reliability Council show an abundance of base load power available, much of it cheap hydro electricity. And then look at the Runeston REA newsletter where it states that the average cost of electricity will more than double in August (how much more is not clear) just to pay for the CU project.

But let's assume it will cost each UPA/CPA member an additional \$25 in July because the line is out of order. It is hard to understand why Phil is so excited at having to more than double members' bills to pay for the project when he could have gotten by with only a \$25 increase. Maybe we're confused and he is excited by something in his own personal life instead.

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THINGS THAT GO BUMP IN THE NIGHT

Albert the Governor is finally getting into the Great Powerline Dispute. Better late than never. His previous involvement was limited to taking 4 months to say "no" to a public forum on the CU project, and trying so hard to ride the fence without taking his thumb from his mouth. But things have gone too far. Albert became incensed and fell off the fence when he learned that another tower (#7) was no longer functional. So he got right to work and said how protesters are "morally wrong", in part because someone might get hurt taking towers down. Being as Albert got born again, he knows all about morality, but somehow he doesn't want to consider the fact that people are already being hurt by this areal sewer. Then he said the very things Phil Martin had in the REA newsletter about coop members having to pay an extra \$25 per month and all. Albert is a lackey, but he's not a very smart lackey. So Phil winds him up and tells him this and that and how Stearns and Pope Co. residents must "provide authorities with information that could be used to arrest vandals." Somebody should stick a new tape into Albert. We've heard that one before.

Perhaps the reason he is such an angry governor is that he sent 20 or more of his BCA boys out here a few weeks ago and tried to make it look like Sheriff Ira asked for them. But Good Old Ira denies knowing anything about it. That makes Albert and his young boy Robbie Stevenson liars. The whole lot of them look even sillier considering that the only thing all these cops have found is a few old saw blades and some mysterious smelly yellow tinted dirt.

So Quie is involved, and he says catching protesters is top priority for BCA boys. It is more important to bust farmers than to stop drug traffic in grade schools, expose communists and corruption in government, or break up organized crime. Now that Albert finally fell off the fence, called out the cops, revealed his moral convictions and established his priorities, now that UPA/CPA think they're ready to come on-line with this thing, and now that the courts are again rewriting laws to insure felony convictions, it seems safe to conclude that this movement is under a heavy attack. Albert's young boy Robbie even is quoted in the St. Cloud paper that he knows of reports to the governor saying some line opponents will loose a barn if another tower falls. That sounds almost like a threat. Protesters have been prosecuted for less than that.

What the governor, the courts and cops and utility yahoos will have to learn in the next few years, or maybe sooner, is that this movement will not be scared away. We will not be tricked or intimidated into submission while our concerns about cost, need, health and safety, etc, remain unanswered. We will not be guinea pigs to support an inhuman and cancerous addiction to corporate progress. In years past we attended and respected the hearing process. Because we respected and believed, we were screwed by state agencies and utilities alike. We participated and believed in our system of justice, and for our efforts we got to see the LAW repeatedly changed to accomidate the energy corporations. We petitioned and appealed to our elected officials, and they scoffed at us before kicking us in the teeth.

They aren't scoffing anymore. If they think that they are going to beat the life out of this movement, they better be ready for many surprises. A tower is down. There are many more from which to choose. Woof.

* * * * *

Dear Ira,
Would you believe your mother if she was yelling at you from the top of a mile high stack of Bibles? Unbelievable!

Dear Unbelievable!
I don't know...I'll go check ... um, how high is a mile high stack of Bibles, anyway?

The powerline conflict has arrived in Blue Earth Co. Condemnation proceedings June 12 in Blue Earth District Court will decide whether the cooperatives building a powerline from Delano to Mankato can legally take land from area landowners for construction of the line.

Judge Miles Zimmerman's decision, expected later in the week before press time, will probably determine the fates of similar proceedings in 4 other southern Minnesota counties affected by the powerline.

CPA and UPA propose to build a 75-mile 345kv powerline from Delano to Mankato. The line will cross Scott, Sibley, Carver, Le Sueur and Blue Earth Counties. The powerline is a southern extension of our 300kv line running from Underwood, N.D. to Delano, Mn.

Ken Tilsen, the attorney representing landowners opposed to the line, told the court he wanted to combine the cases of landowners opposed to the line from all 5 counties. Tilsen said he would like to question the whole legal process with which the cooperatives have proposed the line and to question whether the line will ever be needed in southern Minnesota. He said combining the cases would save the courts and the people a lot of time and money to try.

The condemnation hearing held Tuesday will decide the cooperatives' right to take the land upon which to build the line. Only 2 miles of the line extend into Blue Earth Co., but it is the first county in which organized legal representation has presented a case debating whether the line can legally be built. Tilsen prepared pretrial testimony stating that:

- *citizens were not properly notified about the hearings in which the need for the line was to be established;
- *the possible corridors for the proposed line was never assembled or published as mandated by law; that the need for the powerline was never determined by the Minnesota Energy Agency;
- *the certificate of need was granted by the MEA even though the proposed line would violate the Environmental Rights Act because the project is a wasteful, ecologically unsound proposal and promotes the unnecessary use of fuel; and
- *that the various agencies that have already approved the project ignored evidence and acted arbitrarily.

Drawz, the UPA/CPA counsel, said that the project had already been approved by the courts and various state agencies and that further discussions about whether the plant was needed were unnecessary.

Tilsen said, "that the need for the line has never been determined in court", and said after court that Drawz's statement was "absolutely untrue." Drawz refused to comment until "after the trial is over!"

Judge Zimmerman, who had not read the pretrial petitions and who admitted he knew very little about the case, said that he would decide later this week whether he will allow the condemnation proceedings to begin. If he rules in favor of the cooperatives, Zimmerman will then appoint disinterested land appraisers to determine the "damages" done to the land usurped by the line and establish a fair price with which to reimburse owners for the damages. But the landowners against the line hope that Zimmerman will rule to continue the hearing in the form of a trial in which they can present the "facts" that they say will convince the court that the line is unneeded and illegal.-----PARTIAL REPRINTED FROM THE MANKATO FREE PRESS, TUESDAY, JUNE 12, 1979.

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Seems John Williams, from Elbow Lake, arrested recently for a shooting incident in which he

* allegedly shot a man 3 times - is none other than the Grant County sheriff's brother. He was also a powerline guard.

* * * * *

POPE COUNTY BLUES

Larry Long is compiling poems and songs on rural america. If any readers of HTL have written or have knowledge of poetry and music about the powerline or farming, please forward the material to him. Include with it the author and

address. Send it to Larry Long, Box 6 Rt. 2, Clear Lake, Mn 55319. Tele: (612) 743-2496. Larry has met farmers from across the U.S. this last winter and most all of them are aware of the powerline struggle. Likewise, they are supportive of our continued fight. Larry also said that he saw Wendy Anderson in a bar in Washington D.C. Wendy was happy to hear that Larry was from Minnesota, until, Larry gave him his name. Larry guesses that Wendy too, is still suffering from those Pope County Blues.

WE CAN'T HEAR YOU....!

A couple of weeks ago the youngest Pederson, Danny, had a shocking experience while working on a tractor under the powerline. His face was flushed and hot for a couple days afterwards, he then broke into a rash, and now is still experiencing nose bleeds. Despite repeated calls to the utilities' hotline to have somebody come out - nobody showed up until the evening of June 6. Enter our old friend Denny "The Hustle" Russell and some young engineer...we think. Anyway, they were supposed to send someone out to "monitor the line". Come to find out, the way they plan to monitor the CU project is to send out a PR man to stand there with a hand cupped over his ear and listen under a tower. Brilliant.

Well, needless to say, this made the 10 or so people who assembled for this show of modern technology rather angry. So, naturally the conversation became very heated about the safety for the people living out here. But Denny assured us that he "wants to solve these problems" just like us. Of course we told Denny how he could solve our problem, and he said he would be sure to suggest it.

Meantime, the Annoying Agent Award winner from last week; CHB-192, showed up on the road. But don't worry. Denny assured us that the utilities have nothing to do with the BCA. Makes sense, seeing as some folks went to talk to CHB-192 and they said that they have nothing to do with the utilities. When the BCA was asked what it was doing there - they replied, "We're watching that tower." We assured them that we wouldn't let anyone take it, but they declined to answer. We then asked them why they had all that equipment and an uncased shotgun in the back seat of their car. They said, "Nice day, isn't it?"

Realizing that this was indeed a dead-end conversation, the small delegation returned to the tower the BCA was assigned to watch with their shotgun and Denny "I want to solve these problems just like you" Russell. But Denny was done "listening" to the line and left saying he'd stop by some time when it rains. Amazing what modern technology can do.

IN THE GOOD OLD SUMMERTIME

It was a rainy Saturday night and the utilities have yet to figure out the significance of the fact that about 100 protesters got together at the Tripp farm in western Stearns Co. The wind and rain and trials and tribulations did not dampen spirits as the fire burned hot close to the barn where secret plans were made. Some were even carried out. And that's not all. There was over \$60 collected for this here newsletter, which is a good thing because we had to dip into the reserves last time around. Please send your cards and letters and a bit of money!

Meanwhile, some of those new-fangled "bullet-proof" hard rubber insulators that got put up out in Traverse Co. came down again, and were replaced with the good old fashioned kind. Now what could that mean? Not only that, but there are still a whole lot of places where birds or lightning or something like that ran into that line and messed it all up. And it still hasn't been fixed.

* * * * *

Well, well, well. Remember a while back when
 all the trouble started with the phones and
 * the utilities said they'd have to wait till *
 after winter so they could move the phone cable?
 * Well, out here west of Lowry we got a whole new *
 cable being put in north of the line. The phone
 co. says the utilities will get the bill...
 * * * * *

Farm magazines have always tended to promote the "bigger is better" doctrine, but LANDOWNER, a new publication aimed at informing big farmers and land investors of the secrets to land accumulation has taken things a bit farther. It offers spiritual guidance to the land buyer. "A new piece of ground can literally offer you a new frontier to conquer and a rebirth of business and intellectual growth... Thus, it isn't sheer greed or power hunger that compels most of the people who're "buying up the whole country" around you. New land is their chosen route toward self renewal."

We suggest that people "buying up the whole country" find alternative paths to self renewal which do not threaten the livelihood of their communities.-----CENTER FOR RURAL AFFAIRS, MAY, 1979.

The Center's Electrical Utility Research Project is moving from research to action this month with the completion of a report on utility rates in rural areas of the Midwest. During the next six months, Utility Project staff will be working with rural community groups and the federal Community Services Administration to develop a strategy to involve rural people in rate reform activities. The project is not only concerned with rate structures, but with institutional issues as well, such as how regulatory commissions determine fair rates of return, how territorial disputes between utilities affect consumers, how future growth of a utility is figured into today's electricity bills, and how the right to pass along all fuel cost increases to consumers encourages utilities to waste fuel and ignore alternative energy sources. The project takes a special look at rural utilities, many of which in the Midwest are either cooperatives or municipalities and therefore have local governing boards, and may be more subject to consumer pressures for change than many of the major privately owned utilities. People interested in the Project's work should write: Electrical Utility Research Project, 740 1/2 Massachusetts Avenue, Lawrence, Kansas.-----CENTER FOR RURAL AFFAIRS, MAY, 1979.

The following is a list of publications available through the Citizen's Energy Project. If you are interested in ordering any, write to the Citizen's Energy Project, 1413 "K" Street, N.W., 8th floor, Washington D.C. 20005, U.S.A.)

COMMUNITY SELF-RELIANCE

Presents ideas on how local communities can become energy self-reliant through the development of indigenous renewable energy resources & through energy conservation. More than a dozen technologies are discussed; resource listings included with each. 150+ pp, \$7. \$5 for non-profit groups.

OPPOSING UTILITIES IN SOLAR

Argues against private utility involvement in solar commercialization; discusses problems of competition, consumer prices, regulations, technical innovation & public policy. Resources provided. 12 pp, \$1.

ENERGY & FOOD

Offers an examination of the sources & inputs of energy in the production, processing, & delivery of over 150 selected foods. Considers fuel use in agriculture, energy used in feed for livestock & packaging. 80 pp, \$6.

99 WAYS

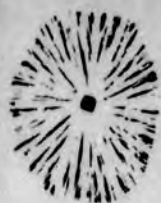
99 Ways to a Simple Lifestyle offers 99 essays explaining the problems created by today's over-consumptive lifestyles & provides proposals for "simple" alternatives. Entries suggest ways to conserve human & natural resources in a range of activities including energy, clothing, food, recreation & housing. 324 pp, \$3.50.

HOUSEHOLD POLLUTANTS GUIDE

Discusses over 100 harmful chemical substances commonly used in the home ranging from oven cleaners to rugs & curtains to aerosol to paints to detergents. Precautions for use are suggested as well as suggestions for safe alternatives. 309pp, \$3.50.

GASOHOL

Reviews the history of alcohol fuels in the U.S. & its potential for reemergence as a primary automotive fuel. 15 pp, \$1.20.



JUNE 30

1979

COME TO THE PARTY!

EVERYONE FROM COAST TO COAST IS CORDIALLY INVITED TO A SPECTACULAR EVENING OF MUSIC, FUN, DANCING and EXTRACURRICULAR ACTIVITIES.



THE UTILITIES HAVE ANNOUNCED ANOTHER COMPLETION/OPERATION DATE FOR THE MINN. 800KV. POWERLINE! THIS TIME "THEY SAY" JULY 1"

PROTESTERS, THEIR FRIENDS, FAMILIES, SUPPORTERS AND A FEW AGENTS WILL GATHER WEST OF LOWRY ON SAT, JUNE 30 TO CELEBRATE A BIRTHDAY OR TWO AND THE PASSING OF THE BLESSED DATE.

For more info, call:

GENERAL ASSEMBLY
TO STOP THE POWERLINE 1-283-5428

T.C. NORTHERN SUN ALLIANCE 874-1540



From the town of Lowry (6mi. N.W. of Glenwood, Minn. on rt 55) TAKE COUNTY rd. 28 west for 4 mi. till it turns NORTH. GO SOUTH (LEFT) ON GRAVEL rd. TO 1st FARM ON RIGHT.

(R)

AVAILABLE LIT & OTHER STUFF

LIT THE POWERLINE WILL AFFECT YOU-25¢
MAPP & THE CU PROJECT-25¢
POWERTGATE-25¢
ELECTROPOLLUTION-25¢
WHAT IS PURE COAL-25¢
PHYSICS RELATED PROBLEMS OF COAL
FIRED POWER PLANTS-\$1
NORTH AMERICAN COAL CAPERS-\$1.50
NOTES ON UPA/CPA FROM THE REA
FILES IN WASHINGTON-\$2.50

T-SHIRTS MINNESOTA STATE TREE-\$5
G.A.S.P. -\$5

BUTTONS IF YOU KILL OUR FARMS YOUR"
CITIES WILL DIE-\$1
USE ALTERNATIVE ENERGY-50¢

BUMPERSTICKERS NO POWERLINE-75¢
DECENTRALIZE ENERGY-75¢
UNSAFE/UGLY-75¢
FARMLAND FOR FOOD-75¢

COMING SOON IN LIT
VARIOUS ARTICLES ON
PHYSIOLOGICAL AND BIOLOGICAL
EFFECTS OF ELECTROMAGNETIC
FIELDS

(Send all orders to HTL, Box,5,
Lowry, Mn. 56349--including postage
is helpful, we'll provide the envelope.
By the way, when items you've seen
before are not listed, that means
we're out and making more. So be
patient and look in future newsletters
for their listing)

We are not responsible for the content
of the letters we receive. We only
print what's readable.

LETTERS

Dear HTL.

On a recent visit to my friend
from Kensington I enjoyed hearing
a briefing on the upcoming 4th of
July celebration you have planned
for the High Line.

I enjoy reading your news-
letter and keep it available for
personal at the plant kitchen area.

Here's \$25 for one of your
nite riders t-shirt and the fest is
for you to help keep the faith.

Rockford, Ill.

I would like to receive your news-
letter HOLD THAT LINE. I support
your efforts. enclosed is a check

Stillwater, Mn/

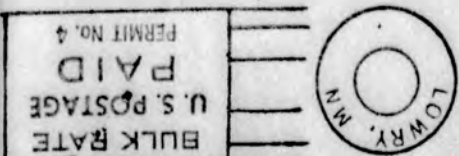
Dear Hold That Line,

Boy! you guys are sure crazy,
writin all that stuff about some
old dubmb powerline. You don't
know how to spell, niether. and
that crazy typist makes so many mi-
sstakes.--and somebody makes up sil-
ly words like Tucktoyyahktuck.
Wheres that? Someplace by the Nor-
Pcle? It's discusting! Then you
make fun of so many people. Shame
Shame! Shame!! You must be all foo-
nuts, dumbheads!!

Besides, I ain't got no news-
letter for a month now. Whatsa
matter? Every day I go to the mail
box as soon as the mailman goes an-
it ain't there. And then do I eve-
get mad!

Lake Woebegone, Mn

P.S. I sent a couple of bucks last
year and that _ _ _ a mint worth
it. See to the next one gets here



LOWRY, MN. 56349
LOWRY TOWN HALL
HOLD THAT LINE

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

TRIAL

The first powerline related felony got underway May 21, Judge John Lindstrom presiding. Veteran protesters will remember his honor the judge. He's a guy appointed by ex-politician Wendy Anderson and back in those days Lindstrom did what he could to keep his boss and benefactor from powerline embarrassment. In those days, many things were done to keep the powerline protest an aimless and stifled cry in the dark. Most of those things were done in the name of THE LAW, and many times THE LAW was our honorable friend judge Lindstrom. It is so nice to sit once again at the feet of His Honorable and listen to his inaudible muttering while gazing in awe at the top of the Head he has buried in his desk. These nasty habits of His Honorable would come to mind less readily if it could reasonably be thought that such forgetfulness would be beneficial to the defense. But instead of falling into such naive and wishful thinking, let us at least be strong enough to look at a few facts.

Look on page 1A of the Nov. 25, 1976 Pope County Tribune, for example. There we find a headline, "District Judge Tells Sheriff 'Clear Line For Power Surveyors'". The article describes the order given to Sheriff Emmons by "Judge Lindstrom and lists 6 specific duties which the sheriff must perform to insure unobstructed surveying. It also says what to do with anyone who gets in the way. The article says, "Emmons said that he was told verbally by Judge Lindstrom that, 'if it takes 100 extra people to execute this order, then hire 100 poor Ira recognized the foolishness of such an order (mainly that it would break the county) and tried to find another way. Apparently Ira is still trying.

On the other hand, while all that ruckus in the fields was getting started, there was a whole series of civil cases which powerline protesters brought to court in an effort to get a bit of justice. Eventually all these cases were consolidated and brought before a special 3 judge panel. One of the judges on that panel was a guy named Stahler, and Stahler was also responsible for the court order the troopers enjoyed reading in the winter of '78. At first Stahler was scheduled to be the judge in this case, but he was removed by motion of the defendant. Then we got Lindstrom. Lindstrom was also on that 3 judge panel, and the judges, as we shall see, behaved more like 3 blind mice than anything related to justice. For starters, the LAW says that UPA/CPA needed a Certificate of Need before they could apply for a Construction Permit and begin construction. In fact, construction had begun before the Construction Permit was issued, and it was sometime later before a rubber stamp version of a Certificate of Need came along. The LAW was being broken, and Mr. Lindstrom could find nothing wrong. Lindstrom ruled it was ok if State Agencies destroyed transcripts of some testimony at public hearings, and it was perfectly acceptable to Mr. Lindstrom if Environmental Impact Statements did not meet the required standards and were not available when the LAW required them. In short, we all know how the LAW was violated time and time again by the utilities and state agencies in this powerline business. This judge of ours knew about every one of those violations too, and in his wisdom he saw fit to issue whatever court orders and decrees necessary to make sure that the LAW, people, human and civil rights, and common sense and decency did not get in the way of the powerline.

Anyway, now that we understand our fair and impartial history lesson, let us look at the fair and unbiased court proceedings of the past 2 weeks. 12 jurors and 2 alternates were chosen by May 29, with such memorable questions by the prosecutor as, "Have you ever been involved in any vandalism along the powerline"? But here in Pope County, where civilization is running amok, the Prosecutor Fabel was able to use 2 of his 3 preemptory strikes on alternates. That's mostly cause Lindstrom did such a good job of removing potential prosecutor strikes for cause. They started taking evidence on the 29th, but most of the action has been going on in the back room where they try to figure out what to do next. The Fabeled Prosecutor is not pleased because the only thing he can prove is that something happened a year ago last March. Exactly what

happened is a little vague, but it seems to involve a damaged construction (2 crane that was either owned or rented, no one knows for sure, a damaged security vehicle, a light colored pick-up of some sort which left some tire tracks which cannot be positively connected to some tires which cannot be positively identified, some rifle shots including those made by the BCA while testing the hole size, a security guard who was injured during the incident, a very scared deputy sheriff. And at this point, that is the extent of the prosecution's case. The prosecutor came to trial, of course, assuming that a few of his gaping holes could be filled in by testimony from some powerline protesters, so he has subpoenaed 5 of them. So far, 3 have refused to testify and are in civil contempt of court (which means they are only in contempt through the trial), and one has been jailed as a result. It appears that the remaining 2 will get their chance this coming week. Except for these 2, the prosecutor has run out of witnesses.

While the prosecutor and the judge are getting along with each other marvelously, neither of them has had much experience with witnesses who refuse to testify which is why most of the action has been in the back room. The Fabeled Prosecutor has actually made some rather strong statements back there like "It's a disgrace to the State of Minnesota that there's been all this vandalism and there hasn't been one single felony conviction!" Fabel went on for 45 minutes like that once. At one point he went so far as to try to get one of our lawyers charged with contempt for counseling his client on questions asked in chambers. He also said that unless these 6 guys get put away for good there will be bloodshed out here. He probably got that part backwards, but he is definitely taking this thing very seriously and much too personally.

So the trial continues. Powerline protesters are on trial because of a very foolish and nearly tragic incident that happened over 14 months ago, yet there is not nearly enough evidence to convict anybody of anything. While the State spares no expense and dashes frantically back and forth attempting to wrench its evidence from the citizens of Pope County, the ongoing tragedy of the powerline continues. It is absolutely disgusting that those who stand against such gross injustice are the ones on trial, while the state gives it blessing to the culprits. In the Land of the Free and the Home of the Brave, Justice seems to leave a bit to be desired.

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LETTERS

Dear HTL,

Here is money for your newsletter. We are fighting a 500kV line from the Wyoming to Medford, Oregon. Pacific Power is beginning to fall trees for the line this week. Several people in the area got your newsletter, but there are ten people in our community so it will be well read. Any information you can send us we will appreciate and use. Yours in unity.

Ashland, Oregon

"DEAR IRA"

Dear Ira,

Is it really true, Ira, that just recently when you went to deliver a subpoena, your foot got in the way of a puppy's mouth? Not only that, but now you want to shoot the poor little thing just cause you were stupid enough to get out of your car??!

Animal Lover

Dear Animal Lover,

I don't know...I'll go check. ("Puppy, my foot, it was as big as a horse, why I could have been killed!")

Dear Ira,

I know you have done some regrettable things in your time, but I was quite taken aback last week when I saw you putting the handcuffs on the farmer in Glenwood court house. Did I hear you right when you snarled, "We will teach you how to talk!" and wrenched and tightened the cuffs??!

Outraged

Dear Outraged,

I don't know...I'll go check. ("I don't know why everybody got so upset about that, I mean they did re-elect me...I am the LAW!")

Might the proximity of one's home to high-current electric-power lines increase one's risk of cancer? A study by Nancy Wertheimer of the University of Colorado Medical Center and Ed Leeper in the March AMERICAN JOURNAL OF EPIDEMIOLOGY suggests that such a link might explain the distribution of leukemia and other cancers among children in the greater Denver area during the past 30 years. While the study falls short of proving a link between cancer and power lines, it did find that the homes of children who got cancer were situated "unduly often" near electric lines carrying high currents.

Wertheimer, who described the study at an environmental health conference earlier this month in Park City, Utah, said it was visiting the neighborhoods of childhood-cancer victims that led her to look at a possible link between cancer and high-current power lines. Searching for clues on environmental factors that might heighten cancer risks, she was struck by the frequency with which electrical transformers appeared close to the homes of the cancer victims. Although a link seemed far-fetched, she followed it up.

Persons younger than age 19 who died of cancer were identified from Colorado death records. Those with Colorado birth certificates who had lived in the Denver area were used; the group numbered 344. Individuals whose birth records immediately followed those of the case study group were chosen as a control group for comparison. Birth and death addresses, when known, were visited and a small map was drawn of local electrical wires and transformers. Homes were then classed with their apparent proximity to high-current (HCC) and low-current (LCC) configurations.

In the HCC category were: homes less than 40 meters from large-gauge primaries (primary lines carry power from an electrical substation to the local neighborhood transformer) or an array of 6 or more primary lines; homes less than 20 meters from an array of 3 to 5 thin primaries or from high-tension (50 to 240 volt) wires. Secondary wires run from the local transformer supplying power for individual homes and businesses. Depending on the local power load, secondaries serve anywhere from a few homes to a block or more. "First span" secondaries are those that issue directly from a transformer to the first service drop. Secondaries separated from a transformer by at least one service drop (ignoring drops attached directly to the transformer pole) are termed second span. The significance of first-span wires is that more current runs through them because they carry current for the first and all subsequent service drops.

First span wires serving no more than two single-family homes were considered LCC, as were all remaining configurations.

The death rate for leukemia, lymphomas and nervous system tumors in children was roughly twice the expected rate in HCC homes (normally 4 per 100,000 particularly for those near a substation. Since "a wide association with different types of cancer is not characteristic of known carcinogens...the broad association observed here suggests that the HCC-cancer relationship may not be a casual one," the authors say. It may be due to some artifact, or may reflect some effect on the body's ability to resist cancer.

How HCC's might be related to cancer risk is unknown, but Wertheimer and Leeper offer suggestions. Explaining that some of the current entering a home generally returns through the ground, usually through the plumbing, Wertheimer speculates whether magnetic fields induced by the currents might somehow directly cause cancer. Although the field strengths are small, they are orders of magnitude greater than that of the earth and even more potent than the fields associated with the wires, Wertheimer says. HCC's might alter the distribution of some ambient carcinogen or cause local changes in such things as drinking water that runs through pipes that serve as electrical grounds. Although some factor independent of the HCC's may account for the cancers, correlations with social class, neighborhood, street traffic and family make-up have already been checked and ruled out, the authors say. Whatever the cause, the increase in risk to any individual remains small, they add.

Preliminary findings of a follow-up study of cancer among the region's adults appear to show the same relationship, Wertheimer told SCIENCE NEWS, but only in persons under 60 years of age. — SCIENCE NEWS, APRIL 21, 1979.

ANNOUNCEMENTS

(4)

JUNE 6 & 7 Come one, come all to the CPA Annual Meeting in Owatanna, Minnesota at 9:30. It will be held at the Holiday Inn with the directors meeting on on the 6th and the regular meeting on the 7th. Now this meeting has hardly been publicized for obvious reasons, and the few who have found out and mailed in requests to speak are being denied. See, CPA says that even if you're a member of a member coop, you have no right to vote, but we think that's a debatable point seeing as we ar the member coops and they have the right to vote. So, see you in Owatanna!

JUNE 9 the weiner roast formally announced for the 8th will be held at John and Alice Tripp's farm east of hwy 71 and south of Elrosa. Starts around dusk, for more info call 987-3346.

JUNE 10 there will be a conference sponsored by Minnesotans for a Democratic Alternative in Minneapolis. It will be held at Willey Hall, University of Minnesota, Hwys 52 and 12 - west bank of the Mississippi. The conference starts at 10:30am with a brunch/fundraiser, \$5/person, \$12/family. The afternoon will present discussions on agriculture, health care and the economy. For more info call, 297-0250. The reason this could be an interesting gathering is cause people are looking for some alternatives to the guys running the country right now... sound familiar?

JUNE 30 Remember is the NO LINE ON LINE PARTY at Ronnie Stoen's farm. We'll be having a meeting to plan further for the event once court and field work settles down a bit, so keep in touch.

* * * * *

BCA STRIKES AGAIN!!!

Agents from the Bureau of Criminal Apprehension have been busy around here this past week. Not only are those mal-contented bone heads chasing back and forth between the court house in Glenwood (where they sit importantly upon their thumbs) and Wilmar (where they continue to harass a Pope County farmer who is locked up for refusing to testify), but a bunch of them have spent the last couple weeks on a "fishing trip". Only trouble is they sleep all day and come back real muddy in the morning. Ain't caught nothing either. Then this guy named Andy Smith (really, Pat, you fool, you can do better than that!) and a couple of buddies show up in the area to have a friendly chat with farmers about missing insulators. Even the nice puppy dogs started growling, and "Andy" and the boys had to make a few quick exits. Key-stone cops is one thin but this stuff is even worse than Dick Tracy and has no redeeming social value. Andy would be wise to keep both eyes watching his next step and one eye over his shoulder.

There are also a few of these characters running around the western part of the country side. A brown car was spotted the other night parked off of 55 with one guy standing on the road with binoculars and the other with a walkie talkie. Needless to say, they were quite taken by surprize when a fairly well known protester's car went past, and they just had to jump in their car and chase after them to see just how close you can touch a bumper before the car goes in the ditch. So even though the competition is close, this week's Annoying Agent Award goes to license number CHB 192. But don't give up "Andy", it was close!

* * * * *
SOC has agreed to spend \$300 to help us charter a coach to the Black Hills for July 7-8. It will probably leave the evening of the 6th, and return very late on the 8th. We need 40 people to confirm reservations by June 25, and it will cost \$30 per person. Contact 283-5771 or 283-5218.

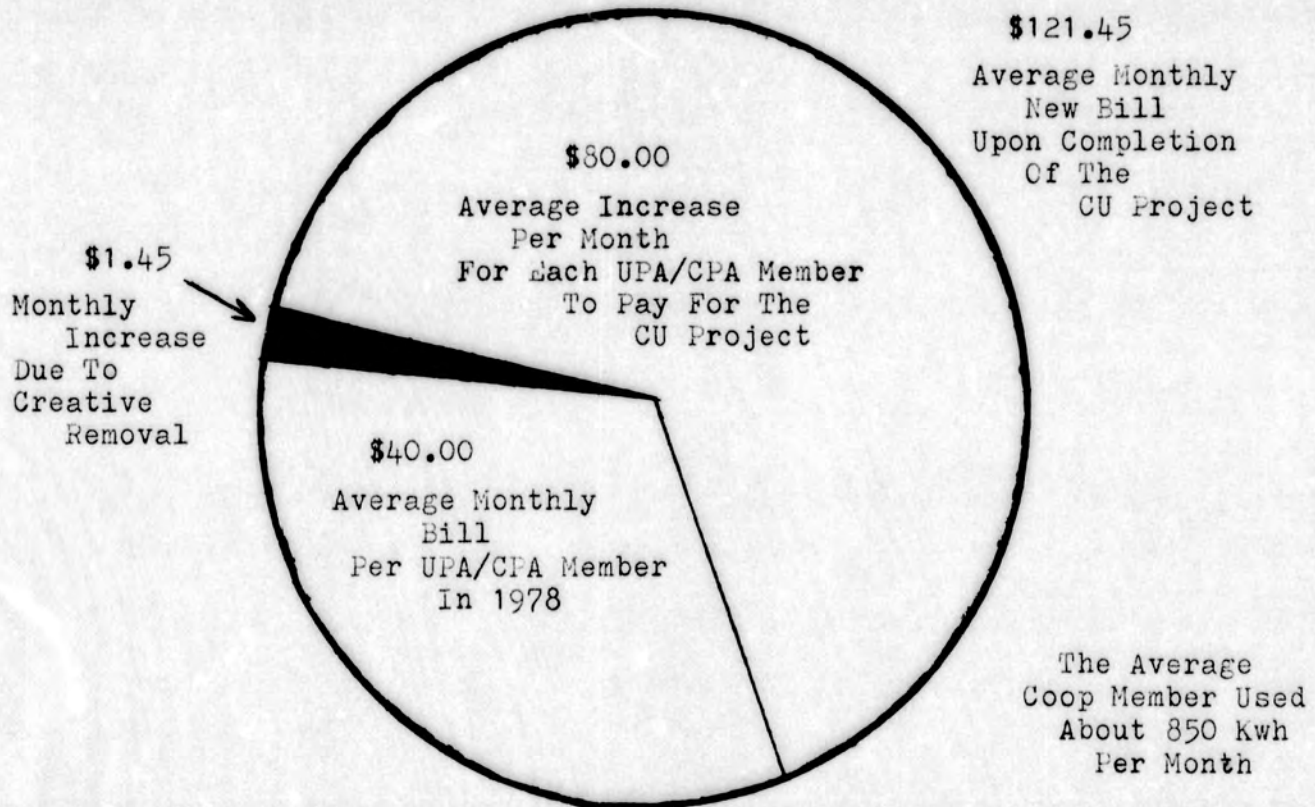
* * * * *

THE POWERLINE WILL AFFECT YOU

or

THE PROTESTOR REPORT

Looking at the costs of the CU project to cooperative members, we find:



Coop members can escape this tremendous cost increase only by keeping the CU project from working. There are also other good reasons to keep the CU project from working.

The CU Project Is Not Needed

The project is not needed by UPA/CPA members. It is needed only by the utilities industry and big business. The figures show that CPA had a peak demand in 1978 of 474 Megawatts (MW), which is up one (1) MW from 1976. Peak demand was also 474 MW in 1977. Many of the rural REA distributors are experiencing declining trends in the demand for electricity, and growth rate increases tend to be limited to suburban REA distributors.

CPA is capable of meeting its peak demand of 474 MW because three of CPA's firm and renewable contracts are for: 110 MW from Western Area Power Administration (WAPA); 170 MW from Dairyland Power Cooperative (DPC); and 180 MW from Northern States Power (NSP). CPA can generate 65 MW for a total available capacity of 525 MW right there. That is 51 MW more than CPA has ever used.

WAPA power is hydro power from government dams along the Missouri River, and that power is 10 times cheaper than electricity from the CU project would be. Dairyland is an REA Coop which must sell electricity to other coops at cost plus service costs. The 170 MW from DPC is further guaranteed to CPA because it represents the CPA share of a powerplant run by Dairyland. CPA has contracts for 180 MW from NSP through the Mid-Continent Area Power Pool (MAPP). (MAPP is an organization of electric utilities in the Upper Midwest which is responsible for coordinating the sales of bulk electricity.) NSP has such a large reserve generating capacity that state agencies have recently scrapped NSP proposals for an additional 2400 MW generating capacity because that capacity is not needed. The reserve capacity within MAPP currently amounts to about 4,000 MW, or 25% of its generating capacity during the summer peak, when UPA/CPA demand is low. The MAPP reserves rise an additional several thousand MW to over 40% in the winter, when UPA/CPA experience their peak demand. The law requires a 15% reserve generating capacity.

UPA's peak demand has risen only 25 MW since the 1976 peak of 378 MW. UPA has three similar firm and renewable contracts for public and private power amounting to 131 MW, and owns 325 MW of generating capacity. The figures show a 1978 peak demand of 403 MW, while 456 MW are already accounted for. There is simply no need for this project.

Cost Factors

As previously stated, the project also costs too much. It costs so much that alternative systems which will adequately meet residential and agricultural electric needs would be cheaper. Using wind power, the most expensive but by no means the only one of these alternative systems, electricity costs between \$1666 and \$2500 per generated kilowatt. Electricity from the CU project will cost between \$1812 and \$2717 per kilowatt if there are no further cost increases, which there will be. UPA/CPA's own "Booz, Allen, Hamilton Report" says so. And that is not even

counting interest rates or fuel costs. The fuel costs are already scandalously high and they will also be increasing. We all know about interest rates.

Meanwhile, the current projected cost of the CU project has risen to \$1.246 billion, up from an initial projected cost of \$538 million. For \$1.246 billion, about 4000 MW of electricity could be generated at existing small dam sites in the Upper Mississippi region. Comparatively, the peak capacity of the CU project is 1000 MW.

Health, Safety, & Environment

There are additional problems in the areas of health, safety, and environmental protection. The powerline is an experimental 800,000 volt direct current line. The closer one lives to this experimental powerline, the greater are the hazards from induced shocks, ion ingestion and non-ionizing radiation, and contamination from ozone and nitric-oxides. The shocks are potentially lethal, and are severely disruptive to livestock operations. Contamination from ozone and nitric-oxides is cumulative - exposure to only several parts per million over a period of time will kill human beings. Plants are even more sensitive. There is little public knowledge about long term biological affects of non-ionizing radiation beyond the fact that such effects do exist. Among the possibilities are sterilization, increased irritability and nervousness, cataracts and cancers, diminished appetite, and decreased physical size from one generation to the next. Over-ingestion of positively charged ions causes headaches and depression while over-doses of negatively charged particles brings on a state of drunken euphoria. The utilities will have much more information on all these problems after they've had a few years to examine living things along the line route.

Toxic emissions from the powerplant in North Dakota insure that the environment of people living far from the powerline will also be affected. The list of serious toxicants (including carcinogens) from coal-fired plants include: arsenic, beryllium, cadmium, cobalt, nickel, selenium, mercury, lead, sulfur oxides, nitrogen oxides, silicon oxide, hydrocarbons, hydrogen fluoride, uranium and thorium which are radio-active and decompose into other radio-active chemicals, and potassium. The plant will release many tons of each of these poisons each year, because pollution control devices to contain such emissions do not exist. The particles are too small. Minnesota weather comes from the west.

How Could Such A Thing Happen?

If the CU project is not needed, if it is too expensive, and if there are cleaner, safer, cheaper and renewable energy sources which are available, the obvious questions become: 1) how are UPA/CPA getting away with it, and 2) why are they doing it?

What's Been Going On Around Here?

UPA/CPA are still trying to get away with it because they have had enough support from the State to build the CU project with brute force. UPA/CPA have violated the "law" at will. When they are challenged in court, the courts make everything done by UPA/CPA "legal". When not actively supporting the utilities, the governor(s), the Attorney General, and the legislature(s), not knowing what to try next, continually do their best to ignore the entire situation. In the mad scramble to use this facility, the utilities use the latest version of "THE LAW", private armies of security forces, sophisticated electronic surveillance equipment, private, federal and state investigators, an occupation force of 200 - 300 State Troopers, a host of dirty tricks, and a flood of propaganda.

But in order to have gotten so far along, in order to secure the financing for the project in the first place, the utilities industry and other big business operations first had to take control of the local REA cooperatives. That process was begun many years ago, and resulted in the management, rather than the Boards of Directors being the decision-makers. The Directors became little more than rubber stamps, coop members were systematically excluded from the cooperative process, and the management started rubbing shoulders with the BIG BOYS.

There were no visible problems for many years. After all, REA and the Coops were electrifying the farms and the rates seemed fair. For years, coop members didn't need to care or notice that they were always re-electing directors which had been appointed by the management, or that they were re-electing them by using mail ballots - a practice which has been illegal in Minnesota for over 20 years. The Big Boys took all these things for a good sign, and REA seemed firmly under control. Some deals were made.

Rumor of these deals began to float around, and curiosity was further aroused by the sudden presence of steel and cable waiting in construction yards along highways in West Central Minnesota. When coop members went to some board meetings to find out what was up, it came to them as some surprise to learn that Board Meetings were closed and the Board Minutes were unavailable. Directors actually adjourned board meetings rather than conduct coop business in the presence of members. Adjourning was thought to be better than calling the cops to remove the members.

With board meetings closed, board minutes and all other vital information withheld, with the election process for director positions firmly in the control of management, and with young, gung-ho managers from young gung-ho UPA and CPA calling the shots, coop members have but one last refuge: the district and annual meetings.

Notices of District Meetings, however, were confusing and misleading, or else missing. Nobody went anyway. Annual Meetings, on the other hand, were turned into a circus long ago. There is entertainment by magicians, music and prize drawing (with big prizes!), free dinner, and there are even psychologists who come to amuse the people while telling them how to cope with stressful situations. When it finally becomes necessary to

bring up business at these meetings, most of the members who bothered to attend have already left. Then business items are ticked off like the tocking of a clock, and the meeting is adjourned. For members to do anything else, or to attempt to do anything else is ruled "out of order".

Many things have been "out of order" these last few years, however. The growing organizations of coop members which are taking back control of their cooperatives by organizing for the District and Annual Meetings have met with much resistance, as well as much success. There is much left to be done. The degree to which coop members are successful at controlling their coops will be the deciding factor in determining how long large private corporations of the energy sector will continue to be able to use REA Cooperatives as the perfect source of public (tax) money.

Virtues Of The CU Project

The CU project is being built with federal tax money. There is not one private investor risking as much as one cent on this project. Using this kind of "welfare money" for such projects is the easiest (maybe the only) way for large energy corporations to make enormous private profits while maintaining monopoly control of the energy industry. UPA and CPA are small fish in a big pond, but because they are REA Cooperatives they have access to massive federal funding. Such funding is not otherwise available to private energy corporations, and UPA and CPA are being used to get the big money. While members of UPA and CPA get swindled, and good tax-paying citizens finance the raping of the earth and the poisoning of the sky, North American Coal Corporation, the nations 2nd largest independant mining corporation, makes off like a thief in the night. Not only does North American get over \$200 million worth of equipment to strip mine low-grade lignite for free, but UPA and CPA will buy that low-grade lignite for 66% more per Btu. than other utilities are paying to have the same amount of Wyoming and Montana coal mined and shipped to Minnesota. North American also has clauses in the contract which will insure that the cost of mining lignite will be constantly rising. This fact is pointed out by "The Barry Report", a study commissioned by CPA. North American Coal Corporation gets more money that way.

The private utilities of the region, NSP in particular, will make out pretty well, too. When the cooperative rates skyrocket to pay for the CU project, the private sector will have an excellent opportunity to make a case for raising their rates as well. Also, NSP will have to sell less electricity to UPA/CPA, and will therefore be able to export more power to areas outside the MAPP region. NSP charges higher rates to distant utilities not covered by MAPP contracts. The powerlines of the CU project will make it easier for NSP to export power at no additional cost to NSP stockholders.

In Conclusion

The CU project is not being built because it is the most efficient, or the safest, or the most desirable way to meet our energy needs. It is not even being built to meet a need. It is being built to make a lot of money for the owners of the energy monopolies. The only need society has in this case is to stop the CU project.

But the problems we are facing will not come to an end just because the CU project is relegated to the scrap heap. The government and the corporations are planning for the development of 75 coal-fired powerplants in the Western Area Coal Fields before 1992, with a total generating capacity of over 31,000 MW. They also have awesome plans for nuclear development in that area. The resulting powerlines have to go somewhere, and according to a 1971 industry study called "North Central Power Study, Report of Phase I, Volume I" (p.60), "One concept would be to have major corridors 1 mile wide, spaced 100 miles or more apart, and used for highways, rail roads, overhead transmission lines, underground transmission lines, gas lines, oil lines, communications lines, water lines, parks, etc. Minor corridors at shorter intervals could be added as needed."

We need to help each other. For more information, contact:

Hold That Line
Box 5
Lowry, Minnesota 56349

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

EVENTS OF THE WEEK

The main event of the week was spring weather finally coming to West Central Minnesota, bringing farmers out to the fields busily trying to catch up on work.

However, Tuesday, May 15, a group of folks who could tear themselves out of the fields, met to make an outline of summer events. The calendar goes something like this:

- June 1-5 Are the "International Days of Protest". Throughout the world there will be actions planned to protest nuclear power. In our region, the big events will take place in Minneapolis and at the Prairie Island Nuke. At noon on Friday, June 1, there will be a march down Nicollet Mall in downtown Mnpls demanding Zero Nuclear Weapons. From 10am to 2pm on Saturday, June 2, there will be teach-ins and workshops at Regina High School, 43rd Str. and 3rd Ave., in Minneapolis. Workshops will range from Windpower to Uranium Mining, including one entitled Energy Consciousness in Agriculture with reps from GASP. That afternoon at 2pm, there will be a demonstration at Honeywell, 28th Str. and 4th Ave. S., against nuclear weapons. This is all building up to the 3rd, when there'll be a huge rally at the Prairie Island Nuke. Folks will assemble at the State Capitol at 11:30am to make a car caravan to the site. This will be a great opportunity for people internationally to show their opposition to present energy policy around the world. It will also be an opportunity to further educate people on the dangers of coal as well as nukes. GASP will also speak at the rally.
- June 2-5 The Great Plains Environmental Festival in Regina, Sask., Canada. This promises to be a very interesting 4 days to check out what is going on with our Canadian neighbors. Workshops will include Human Rights, Agriculture, Citizen Participation and Energy. There will be reps from GASP participating.
- June 8 Will be our first formal bon fire/weiner roast in Stearns County. The affair will take place at John and Alice Tripp's farm, east of hwy 71 and south of Elrosa. Should be lots of fun, starting around dusk, for more info call 987-3346.
- June 30 Is our big "No Line On Line Party". The festivities will take place at Ronnie Stoen's west of Lowry. There will be music, an auction, possibly a film, refreshments, food and by the way, it will be Ronnie's birthday party as well. At the May 15 meeting we outlined committees to plan for the event. There will be another meeting between now and then which we will announce in HTL to tighten up plans.
- July 4 Is the annual picnic at Tyrone, Wisconsin. Remember, even though Tyrone is on the shelf now, it may not be for long. Also, they still want to build a powerline from Prairie Island to Eau Claire with or without Tyrone, as well as a possible coal fired plant either in Mn or Wis. For those who can't make it to the picnic, there will undoubtedly be more informal fireworks on the powerline.
- July 7-8 Is the big march and rally in the Black Hills of South Dakota sponsored by the Black Hills Alliance. It will be a national affair, with GASP and SOC possibly taking a bus. The plans of

so many huge corporations to exploit and destroy the Black Hills for (2)
wasteful and dangerous energy is of interest to all of us. The plans to turn
the beautiful Black Hills into a giant energy park typifies the beginning
and the end of the fuel cycle we're all trying to stop.

So, that's what we've got coming up - so far on the summer agenda. We'll
keep you posted on more specifics as the events draw near.

BROWNOUTS AND BLACKOUTS AND READDY...OH MY!!!

Remember last summer when everyone was so hot and NSP was begging people
not to use their air conditioners so much because they were running out of
electricity and there wasn't enough to go around? Well, NSP probably should
have been telling people that it would be better to throw the fool things
away, seeing as most folks would be better off without them. But NSP was lying
through its Readdy Kilowatt when they said they were facing brownouts and
blackouts, and running out of electricity. Just ask Mike Belford of the Minn-
esota Energy Agency. During the summer peak in 1978 there was a 29% reserve
margin in the region. There was a 48% reserve margin during the winter peak
when UPA/CPA experience their biggest load. 29% amounts to about 6,000 mega-
watts. Comparatively, the CU project is supposed to be able to carry about
1,000 megawatts.

UPA/CPA seem to have changed their tune to a slight degree recently,
however. In a mailing sent to all UPA/CPA members in mid-May 1979, they aren't
talking about brownouts and blackouts. Instead, they say, how expensive that
"nasty, dirty nuclear power" they'll have to buy from NSP will be if the people
of West Central Minnesota don't let them have their CU project. Never mind
that CPA is a partner in the proposed nuke of Tyrone, Wis.. Never mind that
it is the CU project itself that will cause UPA/CPA consumers' rates to raise
by a factor of 3 to 4 or more.

They justify their project on the grounds that they save fuel costs of
the coal transportation by having the mine mouth and the powerline. Never
mind that they need massive amounts of fuel, or that higher grade coal will
probably have to be transported to the plant just to make the lignite out
there burn.

In the mailing, UPA/CPA apologize for the multitude of mistakes they've
made. It's about time. Perhaps all those terrible people from West Central
Minnesota should apologize to all the wise and benevolent ones at UPA/CPA
as well, and we'll all be one happy family. Perhaps fishes will grow legs
and worms will learn to fly. "Pardon us", says UPA/CPA, "while we slowly
crush your heads beneath our corporate foot." How wonderful. How American.
Things will soon be very curious.

* * * * *
Remember the Hansons from Wadena had their trial
* start this week, May 21, in Glenwood. Their *
charges stem from an alledged incident near Vil- *
lard over a year ago. Support in the courtroom *
will be helpful. *
* * * * *

KNOCK, KNOCK...

On May 14, State Senator Chmielewski introduced a resolution similar to
the one which was overwhelmingly adopted by the House and is critical of
West Central Minnesota residents and chastises their law enforcement person-
ell. Nicholas Coleman is the head cheese in the Senate and 30 seconds after
Chmielewski opened his mouth Nicholas moved to send the resolution to the
Rules Committee because to discuss it on the floor would be a controversial
waste of time. Or maybe they have to change the rules again. It's nice to
see our legislature running so smoothly and efficiently. It would be even
nicer if some of the stuffed-shirts would decide to try to get to the root
of some of these problems, rather than wallowing in their verbal garbage.

MARYKNOLL

Remember when Maryknoll Magazine did an article on the powerline struggle way back last June, 1978? Well, we finally had a reader send us a copy of Maryknoll from September, 1978 to let us know that folks are still discussing the subject quite strongly by mail. In one letter to the editor, a man from Minneapolis calls farmers in West Central Minnesota "closed minded, prejudiced vociferous and unwilling to cooperate in a 'science court' proposed by the governor of Minnesota". Another letter says "All of the nonsensical statements in the article about a high voltage power line threatening human rights ...". And on, and on and on. Needless to say, the thousands of people around the world who read Maryknoll are being bombarded with misinformation about what's happening in Minnesota, as well as elsewhere in the energy wars. A few letters from folks would be a good thing. So, take the time to drop a line, if you can to Members Memos, Rev. Robert J. Carleton, M.M., Maryknoll, New York, 10545.

* * * * *

For those of you who don't live on the line and have been writing about whether they're juicing it or not, the answer is sort of. They have been testing here and there, despite missing insulators, but when they do it seldom lasts for long. They recently made a trial run from North Dakota to Delano, which didn't last very long either, which isn't surprizing considering they have to use oil to get the coal burning, (shipping in Montana coal must have gotten too expensive). We also wonder with all it takes out of the plant to be kicking it in and shutting it down all the time just how long it'll take the wear before they need a trade-in?

* * * * *

DREAM

DREAM got into court, finally, on May 17. Judge Kennedy was presiding over district court in Wadena, seeing as how Douglas Co. was all booked up. For some reason, the apologists and supporters of the Runestone Manager and Directors think that this court business is being conducted by a bunch of "radical sore losers" in the powerline fight. "Sore winners", perhaps. But really...

Two decisions were made on the 17th. First the plaintiffs asked to ammend the initial complaint to declare the election of March 24, 1979 invalid because mail ballots were used. Judge Kennedy allowed the ammendment, and the validity of that election has yet to be decided. Second, the defendants (directors and manager of Runestone) moved to have Vernon Jutila, Runestone General Manager, taken off as a defendant. That was denied.

Among the interesting tidbits: 1) Kennedy is very interested in the fact that there is a definite lack of governmental relegation in these "coops". 2) The manager and directors were claiming that the plaintiffs made no effort to remedy the mail ballot issue before going to court. They changed their tune and admitted that many attempts have been made. 3) Runestone has 8,246 members but only 7,688 ballots were mailed. Jutila said that the others were dead. At issue is the number of signatures needed to get 10% for purposes of petitioning. One wonders how many other UPA/CPA members are dead. 4) The manager and directors presented a petition to Kennedy of 200 signatures saying they liked mail ballots, as if signatures determined the "LAW". When Jutila was asked how he got 200 signatures, he said "people" circulated the petition. He wouldn't say who "people" were, and got very angry when asked if "people" were paid to do it. 5) Lawyers from REAs all over the state are writing letters to Kennedy and are doing their best to help their enbattled comrades. We're all in this together you know. Kennedy took the case under advisement.

COAL

4

Coal has been a primary source of energy for hundreds of years. Shovel-
ing coal into the furnace is an early memory for many people, so it is easy
to understand why the dangers of massive, centralized coal-fired power plants
have been overlooked and underestimated. The danger, however, is real, and
it is immediate. Like so much else in the screwed-up world of today, unless
some drastic changes are made very quickly, large numbers of people will not
survive to enjoy the blessings of prosperity, and vast tracts of land will be
wasted - sacrificed to the power and the glory of a corporate elite. (The
Powerful and the Glorious are kinda hard to recognize around here, though,
because whenever we see them, they're ranting and raving, squirming uncomfort-
ably, getting ready to cry, or generally acting out of character!)

While the terror of Three Mile Island has altered the situation, there
is still a substantial amount of evidence supporting the claim that large
coal-fired plants are tens, or even hundreds of times more toxic than fission
reactors per kilowatt-hour of electricity produced. For example, there is
uranium and other radio-active impurities in the coal. These radio-active
impurities are released from the coal during combustion. Based on a conser-
vative 2 parts-per-million uranium by weight in the coal, over the course of
time the radio-active toxicity from coal ash is very comparable to the sum
of all the fission products of a reactor for the same amount of power produc-
ed. Yet little care is taken to adequately dispose of these radio-active
coal ash wastes. Rather, in most instances, there is not even an attempt
made to isolate the ash wastes from surrounding land and water.

Radio-active wastes are also released into the atmosphere, along with
chemical toxicants. During normal operation, air-borne emissions from a
coal-fired exceed those of a fission reactor by a factor of 18,000 to 1, or
more. None of these atmospheric emissions are carefully disposed of, and
for many of the toxicants there aren't even set standards for allowable em-
issions. Instead, the garbage is spewed forth in a form (very minute partic-
les) into the medium (the atmosphere) which guarantees maximum hazard to
living organisms.

While we are being quietly poisoned, the extent of the debate which is
raging between the utility industry and their regulators in the U.S. Environ-
mental Protection Agency is whether or not to make taller smokestacks. The
utilities want the taller stacks because that's cheaper than electrostatic
precipitators and gas scrubbers. Taller stacks simply spread the poison out
over a larger area so more folks can get a bit of the action. The PCA, on
the other hand, thinks that pollution control devices would be better. Un-
fortunately, mile high stacks with scrubbers and precipitators would leave
us with virtually the same problems as we had in the first place.

The best emission control devices claim to remove 99.8% of the particles
going up the stack of large coal-fired plants. Even if such a statement were
true, it would not avert the disaster that is being created. But it's not
even true. It's also not relevant or complete.

Pollution control devices are not 99.8% efficient because it doesn't
pay to keep them that well adjusted. Both precipitators and scrubbers are
fine-tune instruments subject to a large number of constantly changing vari-
ables including gas composition, temperature, flow rate, ash content, col-
lected deposits, sulfur content in the ash, moisture content, and so forth.
Throw in the "human element", and it's a lot easier and cheaper just to cheat.
We've had many lessons at how good these guys are at lying when they think
it's worth some money, but the lying is sort of like the warm-up exercises
so they're all set and ready to do a good job of cheating.

The 99.8% efficiency figure is not relevant because if, for example,
half of the particles coming out of the stack are 200 times bigger than the
other half (which is about the way it is), and all of the big particles and
none of the little particles are removed (which is close to the way it is),
than the device would be 99.999987% efficient. Half of the particles, how-

ever, would still be escaping - the dangerous half. The smaller the partic- al, the less likely it is to react to the charged plates of the precipitator, and the less capable precipitators are of removing them. Precipitators don't even touch the toxic gases such as sulfur and nitrogen oxides. That's what the scrubbers are for. But unless they are persistantly and very precisely maintained (and there is certainly no economic incentive to do so) scrubbers may actually increase the amount of pollution being released.

In sum, the gases and fine particles which escape pollution control de- vices will remain active in the ecosystem. Eventually, these poisons will be retained by plant or animal life and enter the food chain where they may remain indefinitely, causing damage the whole time. It is these fine partic- les against which living organisms are virtually defenseless. When larger particles are injested, there is a good chance they will be exhaled, coughed up or excreted. But when these fine particles are injested, they will stay with you. It is the fine ones which are poisonous and do the damage.

The degree of damage done to the systems in the environment is severe. It is unknown just how severe that damage is at the present time in part be- cause the combined effects of multiple pollutants is an area almost wholly unstudied, and in part because we are all guinea pigs in the corporate labor- atory. The effects of these pollutants will become increasingly evident with the passage of time. Yet the list of known serious toxicants, including carcinogens, from coal-fired plants include: arsenic, bertllium, cadmium, cobalt, nickel, selenium, mercury, lead, sulfur oxides, nitrogen oxides, silicon oxide, hydrocarbons, hydrogen fluoride, potassium, and uranium and thorium and the radio-active elements into which they decompose. If it is ever allowed to operate, the Coal Creek Plant would emit a minimum of several hundred tons of these pollutants into the environment each year.

The radio-active pollutants, of course, are well-known carcinogens. Cadmium and lead are linked to learning disabilities in children, anemia, constipation, colic, paralysis or muscular cramps. Mercury and beryllium affect virtually every organ in the body, beryllium is highly carcinogenic, and mercury destroys brain cells which control coordination, speech and vision. Selenium resembles arsenic in its toxic effects, and acts against kidneys, the liver and the heart. Fluoride poisoning causes bone and teeth deformation, emaciation, and a chronic wasting away. And so it goes. Anybody want a bigger air conditioner?

* * * * *

S.L.A.M.

The Southern Landowners Alliance of Minnesota has been meeting regular- ily for the past couple months. They have a newsletter "SLAM" (% Tim Hinike Rt 1 Box 241, Kasota, MN. 56050), and are getting ready to deal with the "quick take" condemnation proceedings in a unified manner. The Southern Alliance is organized as a non-profit organization and will engage the util- ities in court action around denial of due process during legal proceedings, lack of corridor inventory, and lack of an adequate need forecast. Several lawyers and para-legal people who have been working with the G.A.S.P. Legal Defense Committee are involved with these legal efforts, along with MPIRG.

Meanwhile, folks on the southern line are running into the same type of arrogance and disrespect that people along the DC Line route have had much experience with. An outfit called "Brown Engineering" was hired to do the test drilling. They've also been chasing local folks off the road, using unlicensed vehicles, running around with overweight rigs on soft roads, using equipment on public roads that have noticable mechanical deficiencies, and not only that, they also leave their test holes, which are up to 60' deep and 7" in diameter, wide open. Underground water is being contaminated Local authorities and state beaurocrats are busy pointing fingers at each other, and once again, it looks like it's up to the people. . . .

A U.S. district court judge in San Diego has struck down as unconstitutional one of California's nuclear safety laws. The statute, which was enacted in 1976, prohibited construction of nuclear plants in the state until adequate waste disposal technology has been demonstrated and certified by the Federal Government. Following a January 1978 determination that no acceptable waste disposal options were available, California became the first state to adopt a de facto moratorium on nuclear construction.

In a 22-page advisory opinion, Judge William Enright found that Federal law preempts conflicting state laws on nuclear waste disposal. Enright's decision reflects his conclusion that the national commitment to develop nuclear power, established in the Atomic Energy Act of 1954, would be thwarted if every state were to adopt a statute similar to California's.

The judgement comes on the heels of a December ruling by a New York federal court that voided a New York City ordinance forbidding reactor construction on similar grounds. While such constitutional interpretation may signal rough times for some state and local nuclear regulations, California's Energy Commission has vowed to appeal. According to Richard Maullin, energy commission chairman, "It is not uncommon for a lower level federal court to assert strong federal powers over a state. I am confident that California's nuclear safety laws are constitutional." Moreover, Maullin points out that the law remains in effect pending the outcome of the appeal.

Copies of the ruling, Pacific Legal Foundation et al. v. California Energy Resources Conservation and Development Commission, are available for \$1.50 from NIRS.-----GROUNDSWELL, MARCH 1979

General Electric, which manufactures nuclear generator equipment, has canceled sponsorship of an ABC-TV Barbara Walters special, apparently because the program contains material critical of nuclear power.

The Walters special will feature an interview with actress-activist Jane Fonda involving her forthcoming film, "China Syndrome" - a fictional account involving the cover-up of an accident at a nuclear generating plant.

GE says it will withdraw its sponsorship of the show, but the announcement did not mention Miss Fonda - an active campaigner against nuclear power plants.

The GE announcement said:

"General Electric has sponsored the Barbara Walters 'Interview Specials' since December 1976, a relationship that has served us well. However, we decided not to sponsor the program produced for telecast on March 13 because it contains material that could cause undue public concern about nuclear power. This is an issue of significant public controversy and, and as a supplier of nuclear power equipment, it would be inappropriate for General Electric to sponsor the program. Our decision on this particular program in no way alters our respect for Miss Walters and her staff who produce the series of interview specials."

It was not clear if the GE objection was to comments made by Fonda in the interview, or to film clips from the movie.-----SAN DIEGO TRIBUNE, FEB

1979

Three Mile Island is not the first major accident or near-miss at a nuclear plant:

*December 1952: Partial fuel meltdown and release of more than 1 million gallons of radioactive water inside the NRX experimental test reactor at Chalk River, Ontario.

*October 1957: Uranium fire in the British government's weapons production reactor at Windscale, England. Farmlands were contaminated over a 200-square mile area; more than a half-million gallons of milk poisoned with radioactive iodine had to be dumped.

*January 1961: U.S. government test reactor at Idaho Falls, Idaho, went out of control. Three workers were killed, one of whom was impaled on the reactor ceiling by a control rod.

*October 1966: Partial meltdown at the Fermi breeder reactor near Detroit. Nuclear explosion was narrowly averted.

*March 1975: Fire at Browns Ferry plant in Alabama destroyed control cables for many safety devices, including emergency core cooling system. By rigging up a makeshift cooling apparatus, operators managed to avert a meltdown.

These are some, but not all, of the most dramatic nuclear mishaps. In a recent two-year period, there were more than 2,000 "reportable" accidents at nuclear plants in the United States alone.-----NORTHERN SUN NEWS, MAY 1979

A wide variety of energy experts have calculated that with more efficient energy use, conservation measures, and an emphasis on solar, wind, and other alternative technologies, the U.S. could meet all its energy needs without a sacrifice in the quality of life. For workers, the advantage of this approach lies in its capacity to provide a huge number of safe, productive, permanent jobs. A number of recent studies have emphasized the connection between jobs and energy:

*A study completed by Fred Dubin for the Department of Environmental Control in Long Island found that a program of energy conservation and solar energy would produce four times as many jobs as would building two nuclear power plants.

*Calculations by the Council on Economic Priorities showed that installation of solar heating units alone would provide 500,000 construction jobs a year - three times as many jobs for each dollar spent as would be provided by further nuclear development. These jobs would be for plumbers, laborers, sheet metal workers, carpenters, and teamsters.

*A Massachusetts Energy Policy Office study found that by 1985 more jobs could be made available from solar power (directly and indirectly) than from producing equivalent amounts of energy from offshore oil recovery and new nuclear construction combined.

*A 1975 study for the Sheet Metal Workers International Association found that solar heating and cooling could create \$240-\$300 million in yearly salaries for sheet metal workers.

*An American Institute of Architects study calculated that a good conservation program for new and existing buildings would create half a million to more than a million direct jobs through 1990 and save the equivalent of 12.5 million barrels of petroleum per day.

*A 1978 study by the California Public Policy Center concluded that during the 1980's, California's solar industry could create 376,815 new jobs annually without displacing existing jobs, yielding \$41.2 billion in increased personal income, and \$19.8 billion in tax savings.-----GROUNDSWELL, MARCH '79

Tests show that highpowered electrical fields might cause biological changes in some animals. Effects were confirmed in three experiments out of dozens conducted during the past four years, says R.D. Phillips, manager of electromagnetic programs at Battelle Northwest Laboratories. But the tests did not give any solid evidence that energy radiating from high tension power transmission lines might be dangerous to animals or humans, Phillips said.

In one experiment, rats were exposed to high-power levels for one month. Their nerve ganglia then were removed and stimulated. The nerves showed a higher level of excitability than those in an unexposed control group, Phillips said, adding that reactions were subtle, but could be important in showing interaction between electrical fields and the nervous system.

In another experiment, rats exposed to high energy fields had a hard time fighting off foreign protein, suggesting effects on the animal's immunity systems, Phillips said.----- (unknown, sorry, it's a clipping from Canada)

President Carter, a life-long lover of the outdoors, has been given the "Conservationist of the Year" award by the National Wildlife Federation for his environmental achievements.-----ALBUQUERQUE TRIBUNE, FEB 1979

(Sorry about that last one, but we couldn't resist!!)

EQB'S MESS UP REPORT...NOW WHAT???

8

One of the plaintiffs in our complaint filed with the Environmental Quality Board against the utilities and more specifically the "mess up" crews finally got the results in the mail. The results we're speaking of here are the soil tests run by experts and the EQB investigator. In this particular instance, here's some of what they found:

- 1) Soluble salts. This test provides an indication of the presence of dissolved ions, such as calcium, ordinarily found in soils and is based on measurement of the electrical conductivity of a soil-water extract. The uncontaminated soil samples revealed conductivities of 1.4-1.5 mmhos/cm while the conductivity of the contaminated sample was 2.8 mmhos/cm. The elevated conductivity of the contaminated sample seems to suggest elevated concentrations of calcium ions. The effects of soluble salts on plants are usually negligible when a soil-water extract conductivity of 0-2 mmho/cm is maintained. Conductivities of 2-4 mmho/cm could result in yield reduction of very salt-sensitive crops.
- 2) Calcium carbonate equivalent (CCE). The CCE of a material provides an estimate of the acid-neutralizing capacity of the material and its expressed as a weight percentage of pure calcium carbonate. Pure calcium carbonate is the standard against which other liming materials are measured, and its neutralizing value is considered to be %100. For comparison, most agricultural limestones have a neutralizing value, or CCE, of %90-%98. The uncontaminated samples collected had a CCE of %1-%2 while the CCE of the contaminated sample was %25. The possible presence of calcium hydroxide in the sample may be responsible for this phenomenon.
- 3) Soil pH. Soil pH is a measure of the acidity or alkalinity of a soil solution. The solution may be a mixture of soil and distilled/deionized water or, soil mixed with a diluted calcium chloride solution. Use of the calcium chloride method is sometimes preferable to use of other methods since it will produce a pH measurement which is practically independent of the initial amount of salts present in the soil. In this particular case, both methods were used and are in close agreement with each other. The uncontaminated samples showed pH ranges of 7.6-7.8 and 7.4-7.6 for the distilled/dionized water and calcium chloride methods respectively. The contaminated sample had a distilled/dionized water pH of 9.2 and a calcium chloride pH of 9.1, again possibly suggesting a relatively high concentration of calcium hydroxide.

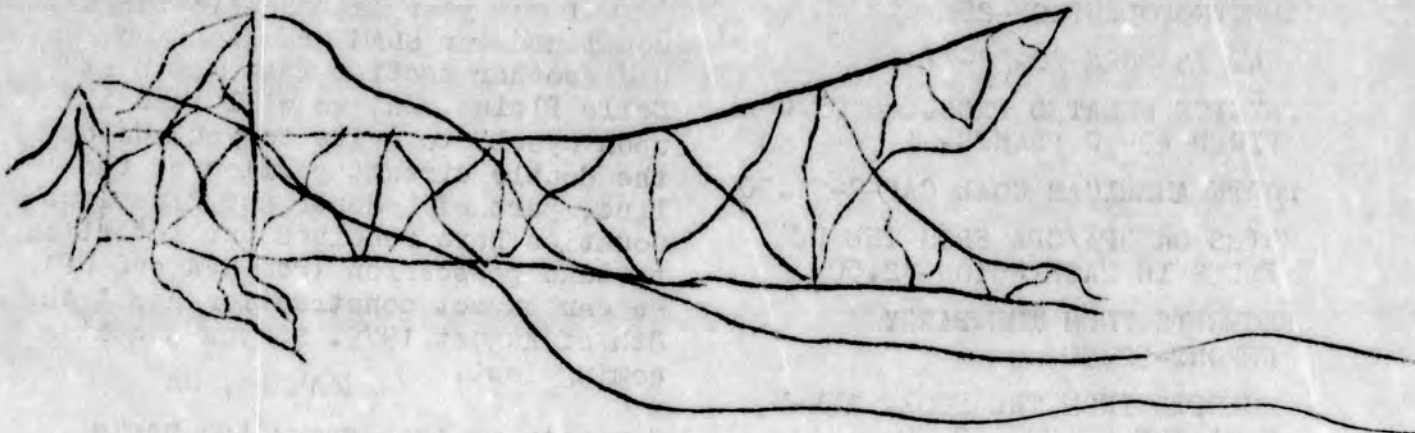
If you think that's something, here's the report's suggestions for "dealing with the problem".

- 1) Leaving the material in an undisturbed state. Although this method probably be the least expensive of those suggested, it is unlikely that the problem would correct itself in the near future.
- 2) Incorporating the material into surrounding soils as a means of diluting the effects of the material. Again, there may be a considerable time period involved before correction of the problem occurs.
- 3) Removing as much of the material as possible to an Agency permitted landfill and thoroughly incorporating the remainder into surrounding soils. Since the areal extent of the material is quite limited, it is thought that implementation of this alternative could be easily achieved by use of hand tools to remove the material for subsequent loading and transportation to an appropriate landfill. Any remaining material could then be incorporated into the surrounding soils by use of normal tillage equipment. Implementation of this alternative would lead to an expedient resolution of the problem.

Well, we had a reader who was kind enough to submit to us an explanation of what that last part is talking about. It goes like this:

Three alternative methods of dealing with the problems are offered as follows:

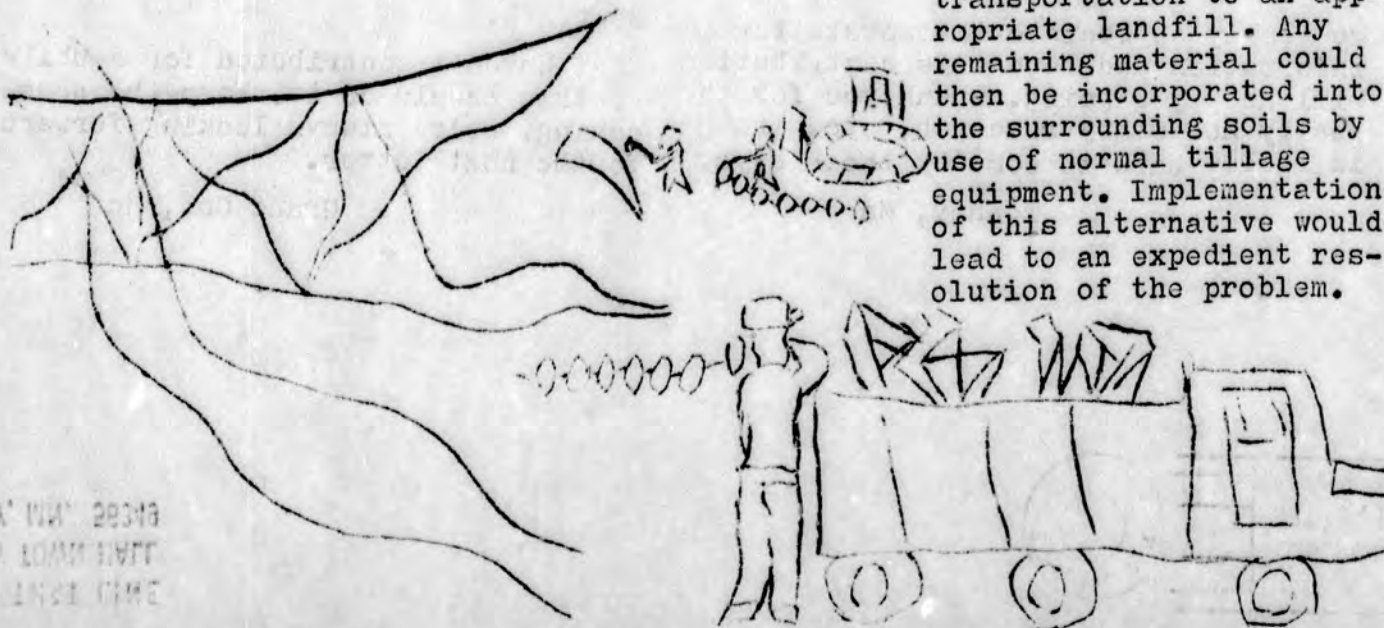
1) Leaving the material in an undisturbed state. Although this method would probably be the least expensive of those suggested, it is unlikely that the problem would correct itself in the immediate future.



2) Incorporating the material into surrounding soils as a means of diluting the effects of the material. Again, there would be a considerable time period involved before correction of the problem occurs.



3) Removing as much of the material as possible to an Agency permitted landfill and thoroughly incorporating the remainder into surrounding soils. Since the areal extent of the material is quite limited, it is thought that implementation of this alternative could be easily achieved by use of hand tools to remove the materials for subsequent loading and transportation to an appropriate landfill. Any remaining material could then be incorporated into the surrounding soils by use of normal tillage equipment. Implementation of this alternative would lead to an expedient resolution of the problem.



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(Send all orders to HTL, Box 5, Lowry, Mn 56349 - including postage is helpful, we'll provide the envelope. By the way, when items you've seen before are not listed, that means we're out and making more. So be patient and look in future newsletters for their listing.)

LETTERS

We really appreciate the newsletter information and hope this contribution will keep you going. Thank you for the really necessary research, etc. Truth is really hard to come by these days.

Tonney, Mn

Enclosed is \$25 donation. Keep up the good work. Hope we can do away with all this Nuke etc.

Sheridan, Illinois

Hold That Line,

I saw your last newsletter had mentioned our SLAM organization. We had another meeting last May 8 at Belle Plaine, Mn, so will take it upon myself to write to you. We on the double circuit portion of the line, part of LeSeuer and Blue Earth Counties have received our intention to take possession from CPA and UPA. We can expect construction about the 8th of August 1979. So you see it's coming fast.

Mankato, Mn

Seems to me once every two weeks should get the job done. Keep up the good work.

Hiram, Ohio

Enclosed is a check in the amount of \$25 to help keep your newsletter. We hope you can keep it coming. We go to a jury trial soon in our battle over the transmission lines. The eminent domain rule was enforced and we were condemned. One line has been constructed and the next one soon will be. How I wish Wyoming towers would fall as those in Minnesota do! Keep up the good work.

Yoder, Wyoming

Dear Hold That Line,

As soon as I saw the new issue of Science News I thought of you.

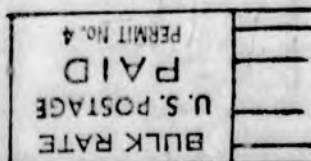
Thank you for sending Hold That Line. It keeps us up on news from the Front. We're in it for the duration.

Summertown, Tennessee

Dear HTL,

Haven't contributed for a while, so this should do it. Keep the news coming. We're always looking forward to the next letter.

Grant Co., Mn



LOWRY, MN. 56349
LOWRY TOWN HALL
HOLD THAT LINE

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

* * * * *

FRIENDS AND FAITHFUL READERS - WE AT HTL ARE GOING TO TRY SOMETHING NEW AND NEED YOUR FEEDBACK AS READERS AND CONTRIBUTORS AS TO WHAT YOU THINK ABOUT IT. RATHER THAN PUTTING OUT A WEEKLY NEWSLETTER, AS WE HAVE FOR THE NEAR YEAR WE'VE BEEN IN OPERATION, WE'RE SERIOUSLY CONSIDERING GOING TO ONCE EVERY TWO WEEKS. THE REASONING BEHIND THIS DECISION HAS MANY ANGLES, ONE OF THE BIGGEST BEING \$\$\$\$\$\$. WE WANT OUR NEWSLETTER TO BE SELF-SUFFICIENT ALL THE TIME, AND IF THAT MEANS GOING TO EVERY TWO WEEKS THEN THAT'S WHAT WE'LL DO. BUT AS STATED BEFORE, THIS IS YOUR NEWSLETTER AND IF YOU'RE NOT HAPPY WITH THIS NEW MOVE, LET US KNOW!!! SO, UNLESS WE'RE TOLD OTHERWISE THROUGH YOUR LETTERS AND DONATIONS, YOU CAN BE LOOKING FOR YOUR NEXT EDITION OF HTL THE WEEK OF APRIL 23. THANK YOU KINDLY!

* * * * *

COURT CAPERS

Jackie Thurk went before Judge Grey Wednesday afternoon for sentencing. The courtroom was full. Before imposing the sentence, the judge had some interesting things to say. He said there are three areas for a judge to consider when determining someone's sentence. The first was rehabilitation. The judge made it clear that he did not think Jackie needed rehabilitation, and commented that the sign she was carrying last February 10 expressed concern for the health and safety of future generations. The second area was punishment for wrong-doing, and the judge noted that he takes a dim view of anybody messing around with law-enforcement personel. But he also said that he was aware of the ordeal Jackie has already been through while waiting for trial and the trial itself. The third area was the deterant factor a sentence has on keeping similar situations from occuring. The judge said how he understood the unusual chain of events and circumstances which led to Jackie's arrest, and then he said, "I have exhausted my imagination in trying to figure out why society needs to protect itself from people like Jackie Thurk." With that, he sentenced her to 6 months unsupervised probation. There is no jail or fine, stayed or imposed.

We are thankful that this whole sorry situation has finally been concluded without more pain and anger. People like Jackie make us proud to be a part of this movement. We can only add to Judge Grey's closing comment by saying that there are many people like Jackie Thurk involved with this movement, and there will be many more. When the state decides its interests are best served by bringing criminal charges against people like her, then society is no longer being protected.

The day before the sentencing, the Pope County courtroom was full as Judge Claeson heard evidence on our Discriminatory Prosecution Motion in the case of the Villard 3. Eight specific events, out of many which have occured, were brought before the court to illustrate the biased law enforcement Pope Co. residents have had to put up with. In order for an event to be used, our lawyers had to show that 1) identifiable workers or security had violated the law, 2) law enforcement personel were either at the scene of the crime or notified of the incident, and 3) the cops did nothing to enforce the law.

The day started out with Ira on the stand and Ken Tilsen conducting the examination. Ira and the records of the Pope Co. Sheriff's Dept. were subpoenaed, but only Ira showed up. According to the sheriff, there is no written record of any powerline related incident. There is no record on file of any

of the arrests, any of the troopers' activities, or any of the hundreds of complaints registered by protesters or by the utilities. Ken Tilsen asked if any additional names or details of these incidents might make it easier to find some written record, and Ira responded that the filing system in use makes it difficult to locate any information which might be available, but maybe additional information would be helpful. "In other words," said Ken, "what you're saying is, 'I don't know...I'll go check.'" Without making a sound, protesters in the audience doubled up and almost started rolling on the floor. We are very well behaved in court. But Ira agreed, and he was instructed to go check during the next recess.

Needless to say, Ira's recollection of any of the incidents was either very vague or non-existent. That is not surprising, being as it is much easier to have no records or recollections of illegal behavior than it is to admit the records exist, the illegal behavior happened, and the law was not enforced. The prosecutor helped us out a bit with his cross examination when he got Ira to say that the number of complaints registered by protesters is about even to the number of complaints registered by the utilities - in spite of the fact that a lot of protesters are the only ones who have been arrested.

Tom Thumb (remember the former special powerline prosecutor?) was the next one called to the stand. The first thing that that little fellow did after taking the oath, was to ask to approach the bench. Seems that the only things he could testify about concerned the Grand Jury proceedings, which are supposed to be secret, and Tom Thumb was not at all anxious to expose himself before the public. So they all went into chambers to discuss the matter. We never saw the rascal again. So, if you're ever passing through Olivia, why not drop in for some coffee and donuts.

Protesters took the stand in the afternoon, this time with lawyer Mark Wernick taking the reins, to document the events which had been confusing to Tom and Ira earlier. As event followed event, one was amazed at what folks out here have been putting up with. Judge Claeson will have the briefs on the motion by April 16th, and will make a ruling sometime afterwards.

* * * * *

Landowners along the Delano-Mankato line met in Kasota April 2 to discuss their situation. The utilities seem to be ready to condemn the land and begin construction on at least the southern part of that line which is supposed to be a double circuit 345kv ac line. People from west central Minnesota were on hand to talk about how to deal with the condemnation proceedings and various other lessons we have learned in the past several years. Spirits are high and there will be resistance along that line should the utilities be foolish enough to pursue the path of their own destruction. We'll keep you posted.

* * * * *

HONORABLE MENTION AWARD

Hold That Line is committed to maintaining its reputation as a fair and unbiased reporter of the facts, and so, based upon an article in the March 26 edition of the West Central Daily Tribune, it is our privilege to present this Honorable Mention Award to our favorite Pope County Sheriff, Ira Dale Emmons. It seems that Phil was speaking to the Kandiohi said, among other things, ing I flew up and saw the tower night in Pope County. Now some of that, think it's a great them have said, but I'll tell saw it. It's very, very discour-



Martin, UPA General Manager, Coop Annual Meeting, and he "Before I came to this meet- that was downed on Thursday people may get a big kick out Christmas present, as some of you, I damned near cried when I aging."

"And I say," said Martin, "it (the creative removal) is not being done (3) by farmers. It's being done by a handful of 15 to 25 people who have the mentality of 7 year olds, who have no respect for law and order, and who are getting their kicks out of destroying insulators and cutting down towers.

"There are 427 miles of transmission lines from the middle of North Dakota to the Twin Cities," said Martin, "2 counties, 2 counties is where the destruction is. There is no destruction all the way across North Dakota, and they're farmers, too. There is no destruction in other counties, just in Pope and Stearns."

"I defy anybody to tell me that there is law and order in Pope County," said Martin, "when you can go out night after night and destroy insulators and towers which cost you and I millions of dollars. And they can't catch anybody? Poppycock. There's no law and they have no respect for it."

Here comes the award part. Ira said he had "No comment" when told of Martin's accusations. "I just consider the source. I'm not responding to Phil Martin or anyone else. I've heard it all before." Three cheers for Ira. Hang in there Phil old boy, when you get discouraged enough maybe we'll have an award for you too!

* * * * *
When the tower fell a couple of weeks ago, Don Jacobson said they'd have it up in 2 or 3 days. They have yet to touch it, and Rumor Control has learned that it is not likely to be touched until road restrictions are lifted May 15. Or maybe they just don't have enough steel. Even though winter is still hanging around, it seems that hungry wire worms came out of hibernation and chewed their way through the conductor that was on the ground. The utilities managed to put some of it back together a couple days later and they've had a security force out there ever since. Rumor Control has learned that the security force is armed with shotguns and small caliber weapons, and is extremely nervous. There are several shadows with holes in them.
* * * * *

BOOZ, ALLEN, HAMILTON REPORT

Sometime last summer, UPA and CPA retained an outfit called Booz, Allen and Hamilton to help them figure out their problems with the Coal Creek Power Plant. Evidently they are having trouble with some cost overruns and schedule delays. Unfortunately, the B, A and H report just skims the surface, "During the course of our evaluation," the report says, "we were unable to cross-check the validity of information provided us by the contractors." Later it says, "However it should be recognized that our impressions are not based upon a comprehensive evaluation of contractor work but rather on the limited amount of information supplied to us by Black and Veatch (the prime contractor) and our experience on similar assignments." Such a report.

The report isn't as juicy as the Barry Report. Instead it paints a generalized picture of mismanagement all over the place. "A combination of factors suggests that work on Unit 1 may not be completed per the acceleration schedule, and that further schedule slippage is highly likely." "Work on Unit 2 is lagging and will worsen unless specific problem areas are corrected in the near term." "Under the best circumstances, additional project cost increases will be incurred, although the total amount has not yet been determined."

Due to a wide variety of reasons, including a remarkable inability to get the right material and engineering documents to the right place on time, it was deemed necessary to do a lot of the work "out of sequence". It's a bet that most of that work had to be taken apart and done over again. The report lists four major systems in which the engineering had not been completed even at that late date, and goes on to state that "The contractors

have reported problems with the engineering and design work which, if not (4) corrected, could in their opinion begin to impact the project progress."

The report rattles on awhile about problems with maintaining a work force, and productive vs. non-productive manhours of the work force (which turns out to be an average of about 42.4% non-productive time industry wide). It also discusses the lack of organization between UPA/CPA, the prime contractor, and all the little contractors. As we said, a general picture of mismanagement. But there are a few specific highlights which deserve mentioning.

For example, "approximately one million feet of cable two conductor size 12 could not be located." My goodness! After the engineering is supposedly done and the contractors are called in to get to work, "some contractors believe that the engineering work is not yet complete...primarily in the electrical area. The report says that the prime contractor is having particular difficulties with the contractors providing the 1) Piping and Equipment Insulation, 2) Ash handling system, 3) Control and Instrumentation Construction, and 4) Electrical Testing Services. In addition they say "No minor problems" whatever that means, with the Lignite and Ash Storage Construction.

In conclusion, Booz, Allen and Hamilton state, "We believe that a concerted improvement effort on the part of all the contractors, with UPA/CPA spearheading the effort, will make a significant impact on improving productivity at the project site and preventing further degradation of the Coal Creek schedule and budget." Let's hear it for "improvement efforts" and "further degradation."

* * * * *

Exploratory drilling for uranium is being done in Benton County, and some unexplained drilling is going on near Greenwald, St. Martin and Belgrade in Stearns County. *
When asked, the drilling crews say they don't know what they're doing. Someone should probably tell them that they're in the wrong place...
* * * * *

IF THEY DON'T WAKE UP, THEY MIGHT START DREAMING!!

Another chapter in the continuing saga of "The Dream Machine vs. The Steamroller" was written April 2 at the state capitol in the Senate Judiciary Committee. The committee has been considering a bill (Senate File 251) which would legalize mail ballots and forgive those coops that used them illegally in the past. About 15 coop lobbyists, directors and managers were at the hearing to testify, along with a representative from DREAM.

While the director of the Minnesota Association of Coops and Coop lobbyist Ed Sletton was testifying with flowery words on the virtues of the proposed legislation, Senator Sckorski brought up a recent letter to the editor of the Minneapolis Tribune regarding closed meetings of the Board of Directors. The Senator asked Edward to defend that policy. Edward's tongue became thick, and his words dribbled down his chin and messed up his new suit. The Senators began looking at him through the corners of their eyes.

It was then brought to the Senators' attention, and documented through a recent article in the Alexandria newspaper, that the votes of the coop membership at the annual meeting doesn't really mean very much. The article states that the management and directors of Runestone look at such votes as "recommendations to the board", and the directors and management has the right to refuse to comply with such directives.

The Senators appeared to be quite disturbed by this whole state of affairs. Runestone General Manager Vernon Jutila happened to be present, so he was asked to testify and try to explain what is going on with illegal balloting, closed meetings, member "recommendations", and so forth. Now, we must all be patient and understanding with young Vernon. After all, he isn't old enough to fully appreciate the thrilling experience of explaining to Senators what a silly nuisance all these laws and things are. So it was perfectly natural that he was very confused and shook like a leaf in the wind.

Right there in the full committee hearing Senator McCutcheon amended the

bill to include open board meeting and the committee referred the entire (5) bill back to the Law Reform Judiciary Sub-committee. There seems to be a possibility that if the bill ever makes it out of sub-committee again, it will say that mail ballots will still be illegal, board meetings must be open to members, directors and managers must comply with membership votes, and maybe even that these coops will once again be subject to regulation by the Public Service Commission. That would be quite a switch! A letter or 2 to the appropriate politician in this regard might be in order. Meanwhile, Runestone asked for a change of venue on the court hearing which will determine whether or not the current law on mail ballots must be surfaced. If the judge decides we must stop all this running amok in civilization and follow the law instead, there will be a new election. No date is set for the hearing, but the coops are worried.

Of course, Runestone isn't taking all this sitting down. Considerable amounts of pressure are being brought to bear against the DREAM people who have sued Runestone over the mail ballot issue in an attempt to get the suit dropped. It is not likely that such tactics will improve the situation of the utilities. On the other hand, because of the management's retaliations against DREAM efforts to become involved in Runestone affairs, the Commissioner of the State Dept. of Agriculture has been asked to intervene in this whole state of affairs. That would make things very interesting.

* * *
* It seems the General Accounting Office *
* has set up a hot line for good citizens *
* to call in toll free to report cases of *
* governmental fraud and waste. Should *
* anyone know anything about such devel- *
* opements, they are urged to call 1-800- *
* 424-5454 weekdays between 8 and 5pm. *
* ROBBIE AND THE GOVERNOR *

Robbie Stevenson, the governor's "trouble shooter" who was up here the first part of March, finally sent us a letter addressed to G.A.S.P., just like he was supposed to. The letter was dated March 28, and says:

Dear Members of G.A.S.P.,

Thanks for the hospitality shown me during our recent visit to Lowry. In an effort to best respond to your request for some type of an open meeting, would you as a group answer the following questions for me:

- 1) Location - We would like your recommendations of where the meeting should take place. (St. Paul, Alexandria, Glenwood, etc.).
- 2) Who - From your collective thoughts, who should attend from the state and the powerline companies.
- 3) Format - Do you want a panel discussion, comments by the representatives of the state or listening to your comments only.
- 4) Outcome - What do the members of G.A.S.P. hope to have as the outcome of the meeting?

Please send back your comments so the meeting can accomplish what you want.

Evidently, Robbie forgot much of what he learned in Lowry on his way back to St. Paul. Anyway, G.A.S.P. met April 5 to discuss the matter and get a response together. Our letter was addressed to the Governor and Mr. Stevenson, and reads as follows:

The General Assembly to Stop the Powerline met April 5 to discuss the questions presented in your letter of March 28, 1979.

We would like to meet with Governoe Quie and the President of UPA and CPA in the Lowry area at your earliest convenience.

The purpose of the meeting, as stated in the mail-grams sent to (6) Governor Quie in January and as stated to Robert Stevenson during his recent visit to Lowry, will be to initiate negotiations between G.A.S.P. and UPA and CPA which will set the terms for a public forum to investigate all aspects of the EU Project.

So, now we get to wait around to see what happens next. There will be another meeting called as soon as we get a response from the governor.

SAVE THE HILLS * * * * NO MORE HARRISBURGS

March 30, 31 and April 1 an incredible thing happened in Rapid City, South Dakota. A few hundred people from Wisconsin, Minnesota, Iowa, California, New York, Wyoming, Montana, North Dakota, Illinois and South Dakota gathered together to figure out how to save the Black Hills.

The Black Hills have been deemed a National Sacrifice Area for utility exploitation. If corporations like Union Carbide, Exxon, Tennessee Valley Authority, Shell and Gulf Oil get their way, in the very near future the Black Hills will be a giant energy park, complete with uranium and solution mining, nukes and coal plants and of course, many, many, powerlines.

The people responding to the call for help at the conference a week ago represented many organizations doing various work in and out of the Energy War, who saw the need for the Hills to be a national focus in the coming year.

Friday, March 30 was mainly conference registration - with a program of speakers at a local junior high school. Those speaking included reps from Union of Concerned Scientists, Black Hills Alliance, Friends of the Earth and G.A.S.P..

The bulk of Saturday was spent in workshops after an opening session with speakers from the American Indian Movement, the Alliance and local ranchers. People had to choose 1 out of 4 workshops to spend their day in. They consisted of Mobilization, Litigation and Documentation, Education and Communication and Fundraising. Good work was done in each area, with the outcome being fairly concrete tasks for people to do all over the country and specific national actions planned for in the Hills over the next year. The first of such actions will be a March from Craven Canyon to Edgemont, South Dakota on July 7 and 8. G.A.S.P. will be having a rep working on that one and it looks like SOC is trying to get a bus.

After the workshops on Saturday, each state met to compare notes on what each of us have to do to spread the word and build support back home. Sunday was wrap-up, goodbyes and for part of the Minnesota delegation a chance to drive through this breathtaking target of the utilities.

A truly impressive part of this conference - was the learning experience that took place between people. People from all walks of life; Indians, Ranchers, Farmers and Urban people. Learning about the incredible oppression of the Indian people, who have lost hundreds of lives in the fight to stop the utilities. To stop the desecration of the land such as what they now want to do in the Hills or with shale mining in the Rockies. Feeling the power of what's happening all over the country today, not just at home.

Another incredible thing happened during the conference in the Black Hills. They've come to call it Harrisburg. Through our contacts at the conference - we had a pipeline straight into Harrisburg, and folks you ain't heard the 1/2 of it or the last of it. We are not going to talk here in technical terms, about the bubble, the valve that doesn't exist and the back-up systems that didn't back-up. But rather, about the cover-up. About the fact that everyone within a 30 mile radius of that plant should have been evacuated and not returned even now. The fact that people should have been instructed to bottle their water because of contaminated reservoirs and to eat only packaged, frozen or canned food. The fact that everyone should have been taking potassium iodine tablets to deter radiation from going to their thyroids. The fact that we have the type of government which would suppress life-saving information from the people because we have a nuclear engineer

for a president who puts on yellow booties, hikes around a bit, says (?)
everything's ok and has Rosalyn go weld her name into the Trident nuclear
submarine.

The only way we can stop another Harrisburg from happening is to stop
nuclear power and coal power and begin to use the renewable resources avail-
able before man walked the earth.

How can we sit by while a government supposedly of the people - destroys
the people? The Black Hills is the beginning of that destructive fuel cycle -
Harrisburg is the end. Save the Hills - no more Harrisburgs - no more power-
line.

NORTH DAKOTA UPDATE

Contrary to what Phil Martin would like you to believe, North Dakota's
popping! The utilities are still trying to blow all the miscellaneous garbage
out of the pipes in the boiler so it doesn't end up in the turbines. They've
collected wrenches, welding rods, dinner pails, hard hats and who knows what
else. The noise of that operation reached a level of 130 decibels about a
mile from the plant. It could be heard 24 miles away. Naturally, there are
no North Dakota laws on noise pollution.

Perhaps one of the reasons we haven't seen so much of the airplane cruis-
ing on the Minnesota side lately is that they crashed on the North Dakota
side. One man escaped with a broken ankle, but the other was badly hurt.

* * * * *

April 21 from 9:30am to 3:30pm there will be a
* conference entitled Energy and the Farm, Decrease *
Energy Cost and Increase Farm Profits. It's going *
* to be held at Willmar Community College and will *
cover such topics as wind, solar, biofuels, wood, *
* crop-drying and irrigation. The cost is \$4 per *
person and \$6.50 per family and includes lunch.

* * * * *

BEWARE OF THE THUGS

Folks should be taking care to look out for each other, 'cause the
utilities are showing signs of desperation. It's hard to say what they'll be
trying next.

In the early hours of April 7 a local man was walking home when a pick-
up truck approached him from behind. 2 guys were in the truck, and one asked
him, "Are you for this powerline?" The man said, "No.", and they beat him up.

The 2 guys were taller than 5'9", clean shaved, husky and wear glasses.
The man has lived in the Lowry area his entire life and has never seen the
2 before. The interior of the pick up was white, and it's a '72 or '73 Chevy
without running lights.

The sheriff was notified about 2:05am and the deputy got to the scene
some 40 minutes later. He took a statement and was instructed that it would
be wise if the department would start keeping records of such activities.
Be careful!

* * * * *

Now that spring is finally springing, all sorts of
* interesting creatures are running amok in civilization. *
* Migrating feathered friends of assorted species have *
* been pecking away at insulators up and down the line, *
* and have attacked one 3 mile section with a vengeance. *
* 3/4s of those insulators are missing. Then wire worms *
* wormed their way passed the security by the downed *
* tower and chewed through the tow conductors again. It *
* just doesn't seem that this powerline will ever be too *
* reliable. It should probably be removed. *
* * * * *

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BUMPERSTICKERS "NO POWERLINE"-75¢
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"UNSAFE/UGLY"-75¢
"FARMLAND FOR FOOD"-75¢

(send all orders to HTL, Lowry, Mn
56349 - including postage is very
helpful, we'll provide the envelope)

* * * * *

LETTERS

Am sending you a 25.00 check.
Keep on plugging away, you have done
more good for the future of this
country than most people realize. God
Bless you all.

St. Joe, Mn

Sorry 'bout missing last month's
donation. Here's a "double".

Mpls, Mn

Dear G.A.S.P.,

Can't you investigate why these
towers keep falling down? Something
needs to be done. Every day I check if
you are making any progress. You can

count on hearing from me again as
you get further into your investiga-
tion.

Crystal, Mn

If you get a chance to send them
with someone, or happen to be coming
down before I get up your way. I
would be needing 4 copies of the
Barry Report.

Sauk Centre, Mn

Hold That Line:

Not only are we fighting high
voltage lines and Tyrone in western
Wisconsin, but we are trying to re-
direct the electrical coops from the
bottom up. They will have to eventu-
ally help with conservation and re-
newables. When...depends on the mem-
bers.

I especially enjoy reading about
DREAM. Are there any other coops
besides Runestone which are under
seige? Thank you for your newsletter.

Hager City, Wisconsin

Hold That Line,

I enclose \$20, which I hope will
keep your newsletter coming. I became
acquainted with Minnesota's situation
when I attended the National Energy
Facility Siting Conference at Glenwood
last fall, and I support the efforts
of Minnesotans to reverse the trend
towards centralized energy and the
rapidly growing web of HV lines in
which we are becoming entwined. I
appreciate staying informed on the
situation there, and I find your
excerpts from news around the country
quite helpful.

Terre Haute, Indiana

Gentlemen:

Enclosed find our check in the amount
of \$25 along with a copy of a letter
from this office to Dr. Bradley. As
you see, Dr. Bradley has requested
that we make a contribution on his
behalf to HTL. This contribution is in
consideration of his testimony in
Stearns Co. Willmar, Mn

POWERLINE PROTEST NEWSLETTER***PRESS RELEASE

EVENTS OF THE WEEK

Anger has replaced the shock felt by people of this movement when a jury in Alexandria convicted Jackie Thurk on March 21. Shocks are nothing new to us. And we have been living with our anger now for many years. Many times before the hammer of injustice has beaten on the red-hot steel in our souls, time enough to forge a strong and tempered movement. Perhaps this latest beating serves to help us better understand how close to each other we have become through the commitments we share, through the bonds which unite us. Jackie and Kenny and the kids want to thank all their friends who have shown their love and support through this difficult time. It is deeply appreciated.

No doubt there will be other beatings as the utilities and the state begin to understand what they're up against. That will also make us stronger. Let would be tyrants beware!

Before the trial began on the 19th, the prosecutor reduced the charge to simple assault, a misdemeanor. He made his case by parading 4 troopers before the jury, each of them expanding on a cock-and-bull story made up the night before the trial began. They gave proof to the old saying that if you tell a lie big enough and say it often enough, people will believe you. Especially if you're a cop in a fancy uniform who claims to suffer spasms after being clobbered by a Sunday School teacher. After 7 hours of deliberation, the jury needed to ask what "to-wit" means.

Not all the news is so hard to take. "Laumeyer's Lament" was more than leaning as the clouded sun rose Friday morning. The 6th tower to fall was definitely down on the ground northwest of Villard. The cops were there by 2pm to confirm the report. The only trouble was that it was reported on the news at 8am, and by 11am UPA had 4 or 5 guys tromping around out there to see what happened. Then KCMT tv showed up to examine the situation, and protesters began to arrive. Before long there was a well-worn path through a quarter mile of deep snow as small groups of protesters walked out to get a closer look, take some pictures and so forth. It seems that some of them also relieved themselves, that being a perfectly natural thing to do.

By 2 pm, when Ira, a deputy, and the BCA boys arrived, there was a group of protesters sunning themselves up on the corner, protected by the trees from the north March wind, and three more protesters out looking at the remains of a tower. So Ira and his buddies climbed into the helicopter and went to investigate. They found a toppled tower and many trampled paths. They took some filings from the sawed-off leg for evidence, and noticed that additional "evidence" was still being walked on by good, upstanding citizens of Pope County. That made Ira very angry, and the BCA called those citizens "dim wits" who could be arrested for doing things like that. The protesters thought that was very funny and watched as the cops looked around for more evidence. The only other thing they could find was a patch of yellow snow. The cops collected as much of it as they could find and stuffed it into little plastic bags. Dear Ira, don't eat the yellow snow!!!

Soon the cops left, their investigation complete, and protesters came and looked and departed. The utilities made no attempt to put it back together and they may run into some difficulties when they do.

Meanwhile, UPA/CPA are experiencing some difficulties in North Dakota. It seems that insulators and conductors between Hawkenson and the Minnesota state line keep getting into trouble. Not only that, but they had a big fire by the coal mine near Underwood a couple of weeks ago. It caused an estimated \$500,000 worth of damage to construction headquarters for the great big Falkirk dragline. Tools, blueprints, and equipment were lost, work is shut down, and the cause of the blaze has been chalked up to mismanagement.

They had another fire in the converter station a week later when some line shorted out, and while blowing out the boiler, they also blew out a chunk of the pump house wall, causing it to get flooded. The plant superin-

tendant got so angry that he said the plant should have been built in Minnesota, and his buddy said Florida would have been better. (2)

The people around Underwood have an awful lot to put up with. On top of everything else, when they blow out the boilers there is such a racket, that 3 miles away it sounds like there's a jet plane in the yard. So when they do it, they offer to move everyone in the area into the motel and feed them at the cafe. That's so nice of them.

* * * * *
Remember the discriminatory prosecution
* hearing for the Villard 3 is coming up *
starting on April 3 in Glenwood Quite
* a few protesters will be testifying on *
the "pick-and-choose" prosecution policy
in Pope County. Everyone is welcome.
* * * * *

NO WORD YET, EXCEPT...

On March 15, Robbie Stevensen, the governor's aid and "trouble-shooter" promised that the governor's office would respond in writing to G.A.S.P. on our request that the governor use his office to initiate negotiations between G.A.S.P. and the utilities to set the terms of a public forum. We are still waiting. At that same meeting, Kris Sanda of the Office of Consumer Services said she would do what she could to help. On March 22, Hold That Line received a packet from Kris and the Consumer Services people. The packet included a cover letter, 2 leaflets describing the Office of Consumer Services, 2 survey questionnaires which ask, among other things, "how many of the items in a super-markets newspaper ads do you believe are reduced in price" and "what in your opinion, is the most serious problem facing consumers today?", pamphlets on buying a new car, buying an old car, how to shop, conciliation court, medicare supplemental insurance, and Minnesota's 3 day cooling off period. We don't get it...Anyway, if anyone has any problems involving the things listed above, feel free to contact Kris Sanda or Richard L. Auld, Office of Consumer Services, Metro Square Bldg, 7th and Robert, St. Paul, Mn 55101, (612) 296-2331.

* * * * *
* Jackie Thurk's sentencing comes up *
on April 4th in Alexandria at 1:30 *
* pm. A good show of support would *
be nice. *
* * * * *

THE DREAM and REA

The excitement for Runestone Electric Ass'n. Board members didn't start Saturday, the day of the annual meeting but rather on Thursday afternoon when the sheriff showed up at the board meeting to serve them papers asking them to appear at a hearing in Glenwood Friday. A group of REA members had filed a suit against them for sending out "mail in" ballots, and were asking for a restraining order holding the ballots of the annual election till the court could decide whether they're legal.

According to several sources it has been illegal for cooperatives to have mail in ballots since 1956. This was brought up several times to the board but they denied that it was illegal and proceeded to send out the ballots. In the meantime rumor has it that someone (manager?) was down at the capital working to get a bill passed to make mail in ballots legal and to forgive past trespasses.

The board members didn't look too happy in the courtroom, but (3) their lawyer quickly made a motion to replace Judge Claeson with some other judge (they really like Judge Roberts). Then they all packed up and left because it took too long to locate another judge. The Clerk of Court finally got Judge Willette from Willmar instead, and he denied the restraining order against the mail ballots because the Plaintiff DREAMERS didn't show that they would suffer irreparable harm if the election took place. So the mail ballots got counted and the election is being officially contested. Judge Willette set the hearing for the injunction against mail ballots for April 20 at the Courthouse in Glenwood.

When Saturday rolled around the manager and Board members had the annual meeting all prepared so things wouldn't happen like they did last year. And sure enough, things didn't, because some very fine things got done instead. But it all started with the chair asking for a motion from the many "friends" he brought along with him to limit the time for each person speaking. He tried so hard to get the old steamroller moving. The directors all got red and blew smoke out their ears, the parliamentarian whistled "out of order" at regular intervals, lots of Board members from neighboring Rural Electrics heckled the DREAMers, and even the new manager's wife was sitting in the audience adding her little derogatory comments.

But the old steamroller just ain't greased up like it used to be, and despite all the noise and hullabaloo the people came through with another victory. All the by-law amendments supported by DREAM were passed. So it is now possible for REA members to have an alternative source of power without being cut off from REA and also get paid for any electricity put back into the system. The voting system will change from voting for directors at large to voting by district for directors, and it was voted to re-apportion the districts. It was also voted in that an appointed board member must run for office at the next annual election instead of completing the term, which is how it was done before. The only by-law amendment which did not pass would have changed the age limit for a board member from 65 to 70. Not a good day for the steamroller - but the best was yet to come.

After everyone had their free lunch and the crowd dwindled, the manager gave his speech. When everyone was awake again, a resolution was made that the board meetings be opened for members to come in and sit and listen. Cussin' and discussion followed. The voice vote sounded like it passed, and there was a call for a show of hands that looked like it passed. The manager wasn't satisfied with that either, but after a vote by ballot carried the resolution he had to accept it. Runestone Members: Welcome to Your Cooperative!! Treat It Gently But Firmly.

At this point it seems appropriate to note that the Board members have seen fit to make a resolution that shows disapproval of CPA management, and calls for the resignation of CPA management. In this resolution, the directors brought up both the Barry Study and the Boose, Allen, Hamilton Study, a study that talks about problems with the Coal Creek Generating Plant. The members were told they could come in and take a look at this Boose Allen study, so we hope to have more information on it soon.

Being as mail ballots were counted, there wasn't so much success this time around with the election of board members. The two incumbant directors were re-elected. But there is a very good chance that on the 20th, the court will tell them that they have to follow the law, and there will have to be another election. Some directors will be voted out. We'll have to get the rest of them to mend their ways. They can start by making sure they learned the lesson of March 24: The membership is the boss. Then they can make sure they learned the other lesson of March 24: The directors tell the manager what to do, not the other way around. Joe the Shmo is gone and the likes of him will not be tolerated!

All things considered, it was a fine day! The people out-organized the steamroller, and congratulations to all those who made it possible!!!

URANIUM MINING

It may seem one of the best kept secrets in the state, but it's true -- the "Minnesota Uranium Rush" is on. Over 100,000 acres in two northern counties have been leased or bought by three Colorado mining firms seeking "yellow-cake" -- processed uranium ore. They say the odds are against it, but Rocky Mountain Energy (a subsidiary of Union-Pacific Railway), Energy Resources and Martin-Trost Associates are betting that substantial pockets of the precious ore lie deep under the glacial drift of Carlton and Pine Counties.

Their keen interest stems from a 1976 survey which indicates that the geology of these areas is similar to the parts of Australia and Saskatchewan where the world's richest uranium fields are located.

The uranium is being sought to fuel the 70 nuclear power plants now operating in the United States. Soaring uranium prices in the past few years have sent prospectors scrambling all over the country with geiger counters in hand. 16 states, including 8 western states that have been long time suppliers of uranium, are being vigorously explored.

The most intense exploration in Minnesota is along a broad belt about 20 miles wide from Duluth to Denham in northwestern Pine County. But counties in southwestern, northwestern and central areas of the state are also being eyed hungrily by such energy giants as Exxon and Kerr-McGee. (Surveys show that another potential uranium hot spot is the BWCA.)

Unbeknownst to nearly everyone but the leasor, mining companies have been combing these areas for over 2 years. Last year at least one of them, Rocky Mountain, began punching test holes into the earth. The competition is intense. The companies aren't disclosing their findings. Hearsay has it that only "diffuse" occurrences have been found so far -- too little to mine but enough to prompt Rocky Mountain to budget \$5 million for at least 3 more years of drilling.

Over a third of Carlton County has now been leased for uranium prospecting. The figure is expected to grow since latecomers, like Martin-Trost, are offering twice the going price for leases. In some cases they are buying the farms outright for double their market value.

Not everyone, however, has caught "uranium fever" and signed away their land. Some are holding out for higher prices. Others have been put off by the confusion surrounding the leases. (Depending on the company and the property, leases may vary in price from \$2 to \$5 per acre per year and may either be open-ended or set for a specific number of years.)

A few persons are holding out with environmental concerns about this potentially hazardous activity. Far too few, says Bob Eikum, a Carlton County resident. Eikum heads a local Sierra Club group that is questioning the unrestrained exploration. "We're not pointing fingers at anybody," said Eikum. "We just want to stir up some questions in minds clouded by dollar signs." Questions like how thoroughly the test drilling is being monitored? What happens if a drill hole accidentally connects the water table with a pocket of radioactive ore? If uranium is found and mined, to what extent can the land be reclaimed? How will radioactive dust from the milling be sequestered? And perhaps, most importantly, how will the radioactive discards of the milling process be kept from the environment?

These concerns are commanding increasing attention, including that of staff members at the Minnesota Department of Natural Resources (DNR) and the Pollution Control Agency (PCA). Elwood Rafn, chief of the DNR's Mineral Division, and Dale McMichael, PCA Director of Environmental Analysis, participated in a seminar organized by Eikum in December. Over 600 people packed in the Moose Lake auditorium to hear geologists, mining company officials, attorneys and state officials discuss the vices and virtues of uranium mining. Judging from the Moose Lake newspaper coverage, the major message delivered at the meeting was Rafn's. The state, he said, is unprepared to handle uranium mining. There simply are no state regulations governing this potentially hazardous activity. The issue has never been faced in Minnesota before.

Because the exploration has been limited so far to private lands, (5) the companies are not required to report their activity to the state. "The only way we can get a handle on this is if they ask to lease public lands," he said. Since the state owns a quarter of both Carlton and Pine Counties, that may happen soon.

One of Rafn and McMichael's immediate concerns is the protection of aquifers, the underground pools of water that feed wells. The northern branch of the Jordan Aquifer, a huge water table that feeds the deep wells in the Twin Cities, stretches under Carlton County. The test holes may be punching through it. If a radioactive ore body is reached, the aquifer could become contaminated with radiation. To prevent this, the holes must be plugged with cement from the bottom up. Rafn has received assurances from Rocky Mountain that this is being done, but state officials have yet to check the test sites.

When in the earth, the radioactivity of uranium is locked safely in solid rock. But when the ore is mined and milled, large amounts of it are released into the atmosphere. Uranium ore is usually less than one tenth of one percent uranium-235, the material used to power reactors. To extract it, the ore must be crushed to a fine powder, mixed in a slurry and chemically separated.

The process is not entirely efficient. A good share of the radioactivity remains in the discards -- known as tailings. Common practice has been to dump these along side the mill. The fine, sandy tailings then begin to discharge radioactive dust, radon gas and gamma radiation into the atmosphere. Decay products of radon can cause lung cancer. They are responsible for the notoriously high incidence of this disease found among uranium miners.

Adequate containment techniques for tailings have not yet been developed. An earthen cover helps, but in time the earth yields to erosion. In western states, some 100 million tons of tailings have been abandoned to the winds and rain. Radioactivity from these have been detected in lakes in Colorado and Wyoming and in wells in New Mexico. "We know about these problems," said Rafn. "We've talked to people out there about our situation and they say 'hey watch it!'" Rafn said the state legislature is being asked to appropriate \$25,000 for a one-year study outlining the technology and the problems of uranium prospecting and mining -- "something documenting the state of the art in the layman's language," he said.

The Moose Lake meeting was essentially the first public disclosure of the explorations. And it marked the state's first efforts towards intervention. At present, no state agencies are monitoring the prospecting. Part of the difficulty with monitoring lies in keeping track of the rapid developments, said McMichael. "Sometimes it's like a wild goose chase. You've got to keep calling counties all over the state to find out what's going on."

An Environmental Impact Statement (EIS) on the activity may also be in the offing. The PCA would require one prior to mining. But McMichael suggests that it might be appropriate for the PCA to prepare one now. The PCA is assigning a subcommittee to the issue and may hold public hearings soon, he said. McMichael added that the PCA's involvement should probably go beyond health and safety concerns. "The PCA board has a policy that nuclear power should be used as a last resort only. Wholesale permitting of uranium mining would be inconsistent with this." He continued, "An ultimate policy decision could be that Minnesota not allow any uranium mining until a means for disposing nuclear wastes is developed and implemented." Some people contend that under no circumstances should Minnesota, a state that has eyed nuclear power skeptically all along, become an exporter of the nuclear industry's fuel. Don Olson is one of them. A member of the Twin Cities Northern Sun Alliance, he has travelled to Moose Lake many times in the last year to rally opposition to the explorations. "I'm opposed to anything involving the nuclear industry. The activity in Northern Minnesota just gives them another boost," he said. Another environmentalist tracking the issue is Steve Chapman. Chapman, a former MPIRG research director, is said by many to be the top source for information on this issue. He is now a member of Clear Air - Clear Water, a group that has requested the PCA to hold public hearings on uranium prospecting and to prohibit the exploration of public land until

regulations are established.

(6)

MPIRG is also taking an active interest in the issue. MPIRG lawyer Jim Miller and environmental researcher Bob Harding are considering petitioning the state Environmental Quality Board to prepare an Environmental Impact Statement on uranium prospecting. "It's important that the state decide now whether it will accept the risks of uranium mining," said Harding. "If the mining companies get their hands on any ore, they won't let go."

-----State Watch, January 29, 1979

BLACK HILLS ALLIANCE

Uranium mining is about to begin in the Black Hills of Western South Dakota. The Black Hills - the sacred ancestral lands of the Lakota People - are a place where over the centuries the Lakotas have gathered in prayer and ceremony - a place of power.

The Black Hills now - a place where local residents - both Indian and non-Indian - have hopes of raising children and guaranteeing a safe and healthy future for them.

Uranium mining - the beginning of the nuclear fuel cycle - a highly toxic undertaking, proposed by large, energy developing companies with apparent disregard for the wishes and needs of the local residents.

We are the Black Hills Alliance - an organization of united Indians and non-Indians who have banded together in the effort to save the Black Hills from their imminent destruction.

Several companies, including Union Carbide Corporation, Gulf Oil, along with the Tennessee Valley Authority have over a million acres already staked out. Open pit mines, strip mines, solution mines, new railroad systems and the influx of hundreds of thousands of boom town workers - these are some of the visible effects that we can expect if they are allowed to mine. There are other, less visible effects: The town of Edgemont, South Dakota, in Fall River County, for instance, had a uranium mine in the late 50's. To this day there are large hills of radioactive tailings emitting radioactive dust and leaking into the water system. Fall River County has twice the cancer rate of any county in South Dakota according to Dr. Judith Jhonsriud, a noted scientist in the nuclear waste storage field. Dr. Jhonsriud visited Edgemont in late 1978. She said, "It takes 20 to 30 years for the signs of cancer to become truly evident. No. I wouldn't live in that place (Edgemont)."

The uranium deposits already staked out lie in a crescent shaped formation which circles around the eastern edge of the hills from Edgemont in the south and as far as the northwestern corner of South Dakota. The massive mining about to begin here will be the source of nuclear fuel for many reactors and inevitably will provide material for more nuclear weapons.

We would like to ask you to consider this carefully: There are many local citizens now actively in opposition to the construction of nuclear power plants; there are also many groups against the proliferation of nuclear armaments. Nuclear power and armaments are founded on the mining of uranium and resistance to uranium development is resistance to each. We believe the Black Hills are significant, not only because of what they represent historically, but also because they are within the lands guaranteed to the Lakota People by the 1868 Fort Laramie Treaty with the United States.

G.A.S.P., along with many other organizations, is a part of the Black Hills Alliance, for we too see the need for such a show of solidarity in the issue of mining exploitation. March 30, 31 and April 1st there will be a conference in Rapid City, South Dakota of this newly formed alliance. A delegation from G.A.S.P. has already made plans to attend, and we urge anyone interested in going, to do so. . The weekend promises to be a true learning experience for many people of all backgrounds, ages, colors and beliefs, coming together with a common goal in mind. For more info call 283-5428.

AVAILABLE LIT & OTHER STUFF

- LIT THE POWERLINE WILL AFFECT YOU-25¢
- MAPP & THE CU PROJECT-25¢
- POWERGATE-25¢
- NORTH AMERICAN COAL SPEECH-\$1.50
- NOTES ON UPA/CPA FROM THE REA FILES IN WASHINGTON-\$2.50
- ELECTROPOLLUTION-25¢
- EXCERPTS FROM THE BARRY REPORT-\$2.50

- T-SHIRTS "MINNESOTA STATE TREE"-\$5
- "G.A.S.P."-\$5

- BUTTONS "IF YOU KILL OUR FARMS YOUR CITIES WILL DIE"-\$1
- "USE ALTERNATIVE ENERGY"-50¢
- "QUESTION AUTHORITY"-50¢

- BUMPERSTICKERS "NO POWERLINE"-75¢
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- "FARMLAND FOR FOOD"-75¢

(send all orders to HTL, Lowry, Mn 56349 - including postage is very helpful, we'll provide the envelope)

* * * * *

LETTERS

Keep up the good work, reading "Hold That Line" is the only way that most of us can find out what's going on.

Wheaton, Mn

Hold That Line -

Enclosed is \$10. Would you please send your "Hold That Line" newsletter to the following address in Texas.

These people are also fighting a powerline on their land and they already got 2 - and are interested what the people in Minn. are doing about ours and what they can do to fight theirs.

Hoffman, Mn

Thank you for sending me Hold That Line. I wish I were there to help you. Keep up the good work.

Denver, Colorado

Dear Friends,

A little something to help keep

"Hold That Line" going. We enjoy receiving your news. It's so much more informative. Keep up the good work. Your friends to the north. (7)

Sebeka, Mn

Dear Hold That Line,

As you say and I believe that you are running low on funds, so I am sending you \$25.

We live a few miles away from the line same as hundreds of others but we have helped fight all the way. I would like to see those farmers who got good pay for the line to show an appreciation and donate a couple thousand to you. Also the new officials who voted in through the powerline could show an appreciation. Keep up the good work. Thanks for the paper, I enjoy it.

Elrosa, Mn

Dear Gaspers -

Herewith \$2. I very rarely get U.S. currency here, but had the luck just as I had sent to me from a fellow ex - Farwell relative your "The Powerline Will Affect You".

During our election campaign I gave to a local candidate a News Week article detailing bad effects of power pylons and high voltage transmission lines. I asked him to pass it on to some candidate in So. Auckland which is plagued with pylons etc. However, I do not know whether he did so. There are no pylons in the affluent suburbs of Auckland. Please post to me by surface mail any bulletins which could aid protests here. Good luck and thank you.

Auckland, New Zealand

* * * * *

"DEAR IRA"

Dear Ira,

Is it true that Friday morning you got a call that said "A tower went down" and you thought they said "Stop running around" so you stayed in your office all morning in total confusion?

A Secret Admirer

Dear S.A.,

I don't know...I'll go check.

("Oh, come on now you guys, I got it straight when the BCA showed up!")

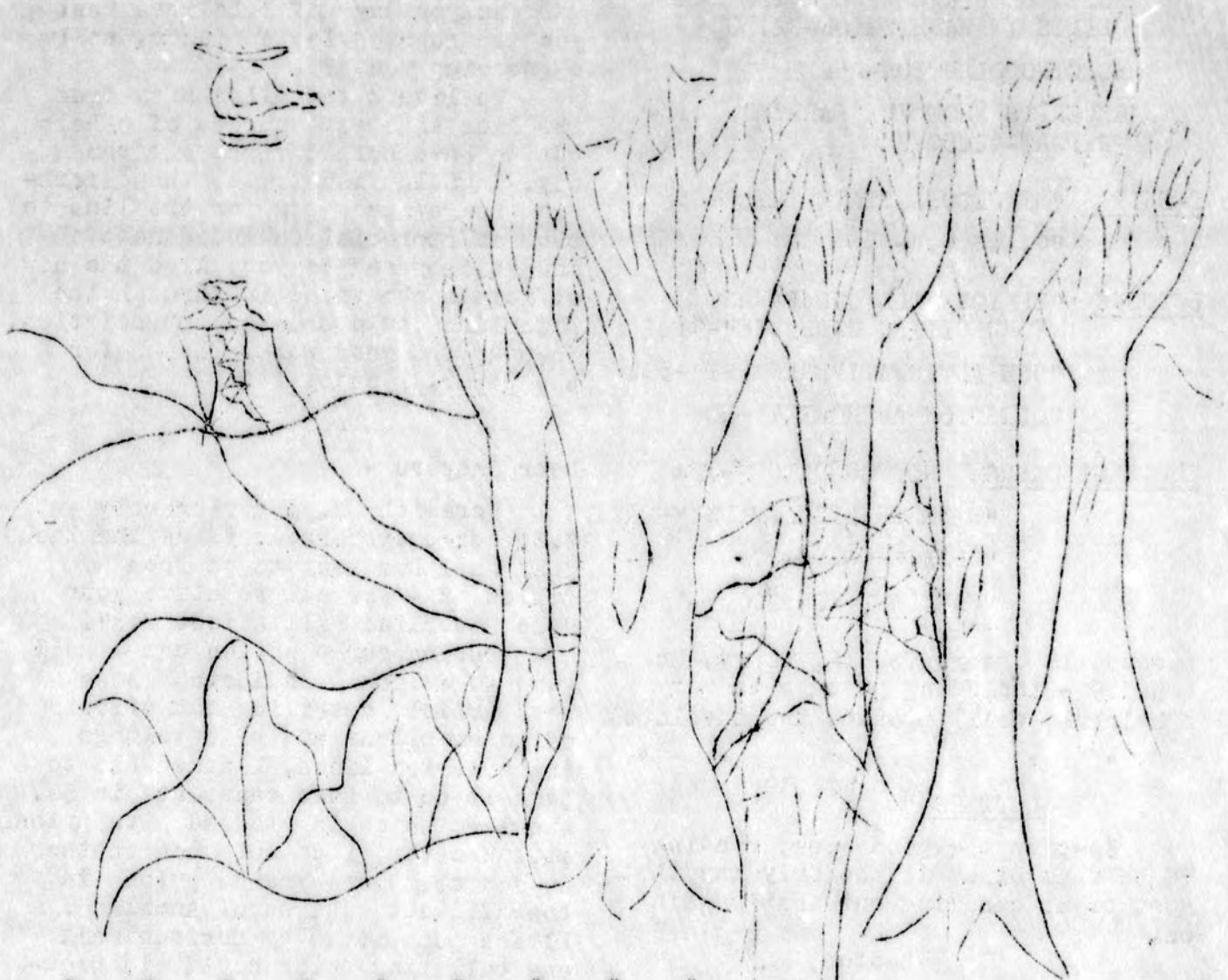
Dear Ira,

Is civilization really running amuck?

Spring Fever

Dear Spring Fever,

I don't know...I'll go check.



* * * * *
* Because of the Black Hills Alliance *
* Conference in South Dakota. Hold *
* That Line will be skipping a week *
* the week of the 26th-1st. This way *
* we can free more people up to go *
* to the conference. Look for your *
* next Hold That Line April 2-8!!!!!!! *
* * * * *

Beware The Ides of March!

An interesting thing happened on the way to the public forum. On the evening of the Ides of March over 150 protesters from up and down the line got to watch great gobs of good faith oozing from the pockets of Albert's errant boy, a Mr. Robbie Stevenson. Also present was Representative Fjoslien, who is in a difficult position and being very helpful in maintaining useful communications. Three people from the Office of Consumer Services were there too. The people from Consumer Services said they'd send some information on just what services they have to offer, and we'll pass it along when we get it.

Robbie was very sweet. If Ronnie Brooks would have been like that, Rudy would have taken her along with him to Yugoslavia. Robbie even said he wanted to start a "relationship", and he wasn't there to bargain, either. "Nobody's at fault," he said. "Lots of people are at fault in small ways," he said. "Just like in Pogo down in the swamp, "the enemy is us!" he said. Folks could not quite figure out if he was just speaking for himself or for Albert too.

After Robbie made his pitch, and after Consumer Services said they really wanted to be helpful but didn't know if there was anything they could do or how to do it, a very good thing happened. Two area farmers talked with us about these secret meetings we've been hearing about for the past couple months. They had attended several CPA board meetings previously, and when they suggested meetings in West Central Minnesota, good old Charlie (CPA prez.) thought it was a trap. The big wigs must be paranoid. Anyway, at the board meetings and the secret meetings both, it seems that a good share of the time was spent reading the directors the riot act. The directors heard for the 490th time (7 X 70 that the first thing they have to do to reestablish a bit of credibility is get rid of most of the present management. That might be very helpful in so far as it could be a prelude to getting rid of the powerline. It is really good that this report came back to G.A.S.P. Solidarity makes us strong.

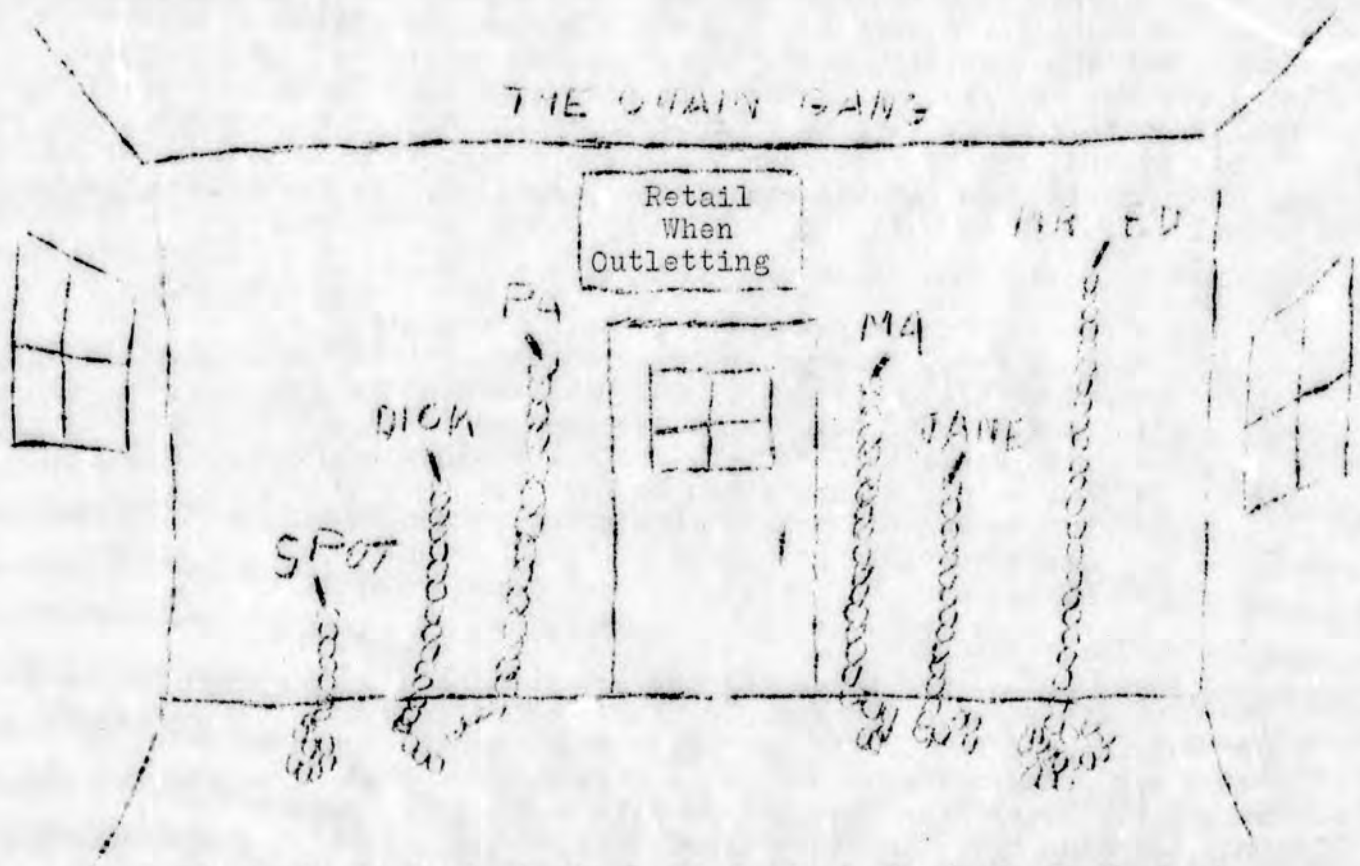
* * * * *
*
* Including the newsletter, and not counting lawyers fees, this powerline protest movement costs almost \$1500 a month. Our bank account is getting low, we have legal expenses coming up, and it's kinda hard to tell what else might happen out here. We are going to beat this powerline, but we do need money. Please help us out. Make checks payable either to G.A.S.P. or Hold That Line, Lowry MN 56349. Thank you.
* * * * *

After that, Robbie was asked why the governor hasn't responded to our proposal for a public forum. There was a "hem" and a "haw" and then the flood gates opened. Many times in the past five years protesters have eloquently presented their case to anyone who would listen. But that night has got to take the prize. Everything that people said was said so good that night! Robbie got his mind blown on every issue from health and safety, cost and need to civil rights and centralized energy systems. There was more information in that room about what is going on, Robbie concluded, than there was anyplace else in the country. Protesters politely agreed, told him the line has to come down, and asked him why the governor hadn't responded to our January proposal for a public forum. Robbie said that he had to take more heat when he met with the utilities than he was taking from protesters, and besides, the only reason Albert left a secure seat in Washington was that he was very disturbed about the fact that all the power seems to be getting out of local control and into the hands of a few big shots. Protesters thought that was nice, told him the line will come down, asked him why Albert hadn't responded to the proposal for

a public forum, and what's going on between Albert and Bob Bergland, anyway?

Robbie said he didn't know about the Bergland part, and that sometimes the protest newsletter hurts his feelings, but protesters really shouldn't want to have a public forum anyway. It's much more important to get to the few people who make the decisions, he said. Protesters politely but firmly disagreed, stating that it's not a matter of enlightening big wigs about anything. They know exactly what they're trying to do. It's a matter of stopping them from doing it. Robbie's head started to spin. He was told a few more times that the line is coming down, and when his head stopped spinning he said very quietly that the governors office would contact a spokesperson to get some sort of meeting together. Protesters said no. Instead, you will contact G.A.S.P. in writing about what the Governor will do to initiate negotiations between G.A.S.P. and the utilities to set the terms of a public forum to investigate the CU Project. Poor Robbie, his head starting to spin again, finally saw the logic behind it and agreed that that might be the best thing to do. He promised that G.A.S.P. would be receiving such a message shortly. After several very moving statements and rousing comments, the meeting was adjourned. And we are on the move . . . we hope.

We also hope that Robbie doesn't lose his job for the promise that he made. In Underwood N.D. on Friday morning you could almost hear his boss exclaiming, "You did what!?!?", and "Oh my goodness gracious me!!!" Nobody's heard from UPA/CPA about it yet. Either they got in a huff again and aren't talking, or else they're in a state of shock. We will keep you posted!



* * * * *

Rumor control has learned that once CPA started thinking of itself as a seller of bulk power, the management and directors began to think of themselves as little tin gods who needed a castle in the clouds in which to live. So they spent \$17,000 per acre for 30 acres of land in south Edina. Then they made plans to spend \$5.00 per month for every CPA member for the next 30 years to get the thing off the ground. That amounts to a whopping \$230,400,000.00 over the 30 year period. It is unclear if CPA was also able to get the plumbing included for that price. What next?

What follows is a little more thorough discussion of the infamous "Barry Report", commissioned by CPA. In a couple of weeks we will have copies of selected pages for those who request them.

The report says that CPA had nothing to do with the site selection. That was done by some outfit called "Burns & McDonnell" with a bit of assistance from UPA. Interesting - seeing as how CPA has a 56% share of the ownership of the facilities. Burns and McDonnell, the report says, failed to define site selection criteria, and failed to use explicit weighting of site selection criteria. That leaves the final site selection open to an arbitrary decision. The choices were between the Coal Creek site and a plant near Big Lake, Minnesota. That is a bit outrageous in itself considering that studies show that they could have generated 4 to 5 times as much hydro-electricity for the same amount of money.

Looking at the plant costs, the report says that the North Dakota plant is projected to cost \$222.3 million more than a comparable plant in Minnesota. They expected to make up the difference on fuel savings by having a mine-mouth plant. They used a base price of \$0.233 per million Btu in their computations. But even at that price there would only be a savings of \$40 million over the life of the North Dakota plant as compared with the Minnesota site.

The Minnesota site would have used Wyoming or Montana coal which has about 9,000 Btu/lb as opposed to about 6,500 Btu/lb for the North Dakota lignite. The cost of that coal shipped to the Minnesota site was calculated to be \$0.431/Million Btu. On spot market checks for that high quality coal, the current price would be about \$1.00/MBtu for coal delivered to the Minnesota site. Yet UPA/CPA expect to pay between \$1.16 and \$1.33/MBtu for this North Dakota lignite. That is an industry high, and that price goes up a whole lot more if one considers the cost of this powerline. One should consider the powerline cost because it must be compared to the cost of delivering coal to the Minnesota site.

Beyond that, the report says that the cost of production for coal from the Falkirk mine is not worked out. So UPA/CPA don't know what the coal will cost them. While the initial negotiated standard selling price of the coal was \$3.42/ton (including \$.55/ton Falkirk profit), the current estimates range from \$14 to \$16 per ton. Falkirk is also scheduled for a fee of 3.5% of the cost of production for managing the mine. So if Falkirk produces 5 million tons of coal in a year at \$15 a ton, they get \$2,625,000 in management fees. But if they say it costs them \$20 a ton to produce 5 million tons, they get \$3.5 million. Maybe that's why we have inflation. To add insult to injury, there are no premium/penalty adjustments in the coal sales agreement. Falkirk gets its bucks no matter what kind of garbage they throw out of the ground, and whether or not they get enough garbage where it's supposed to be at the right time. Instead of protecting themselves with a rational coal sales agreement, UPA/CPA have relied heavily upon Falkirk's management expertise and integrity of operation. No kidding.

Damaging as the report is to the utilities, non-the-less it appears to be a bit skewed in their favor. The report computes the cost per kilowatt to be about \$650.00 for the project, compared with an industry average of around \$450.00/Kw for fossil fuel generation of electricity in the year 1980. Yet if one divides the cost of the project (\$1.246 billion) by the number of kilowatts (900,000), one gets \$1,348 per kilowatt. This figure, of course, is ignoring line losses, interest payments, and it assumes the thing will be run at close to full capacity all the time. Oh my goodness!

The report goes on to talk about public relations:

The public relations strategy has been changed for the Delano-Mankato transmission line. Information sessions are being held locally to discuss the impact of the line with those landowners who may be affected. The response from these landowners, as well as the absence

of a strong protest movement against the line indicates that this strategy is worth while.

That's what the report says. The question that pops imediatly to mind of course, is what makes them think there won't be a very strong protest movement along the Mankato line if the utilities ever manage to get their act together enough to start building the darned thing? Anyway, the report also says that CPA needs to do a substantial PR campaign to get everyone to fall for the rate increases which are coming. The report applaudes the UPA/CPA trip to California a year ago because that trip quelled everybodies health and safety fears and showed the people that UPA/CPA are responsive to their concerns...so responsive that they're getting ready for a 3rd unit at the Coal Creek site.

The report leaves a bit to be desired. But it ain't bad considering that it comes from the utilities. The report recommends that CPA re-negotiate a couple contracts, re-estimate a few costs, develop some contingency plans for fuel supply in case Falkirk decides to take the money and run, and hire a few specialists. We have an additional recommendation or two. After examining all the evidence, and looking at all the sordid facts and most of the other ones, we have finally and painfully come to the conclusion that the only thing to do is wrap the blasted thing up and send it to Tuktoyaktuk.

* * * * *

It seems that all the reward money the utilities have been offering hasn't gotten them very far, so now they're trying something new. In fine print at the bottom of some of the easement papers which just came out is a little section which offers landowners money for any information which may be used against their neighbors. Too bad for them that Judas died a few years ago.

While we're at it, someone ought to put a tail on the big new Winnebego that has tax-exempt plates and three antennas sticking out.

* * * * *

Dear Ira,

What do you think is the best way to take care of these new fangled insulators that they are starting to put up? Foggy Nite

Dear Foggy,

I don't know, I'll go check . . . (maybe you should try putting them to bed and giving them lots of liquids.)

Dear Ira,

Are those new insulators they got out there what you call a technological breakthrough? The March Hare

Dear March,

I don't know, I'll go check (hey Mr. Walter, sir, . . . a breakthrough, now, um that's illegal, isn't it?)

Dear Ira,

When we get the public forum going, can we call on you to testify about civil rights, common decency, and so forth? Remembering

Dear Remembering,

I don't know, I'll go check . . . (don't you think Judge Roberts would be a little better for that?)

Dear Ira,

Robbie Stevenson from the governor's office said that the utilities gave him more heat than protesters did. Do the utilities give you more heat than protesters do, too? Protester

Dear Protester,

I don't know, I'll go check . . . (gee, you mean they're giving it away now? I always had to pay the bill for it before!)

NEWS FROM ALL OVER THE PLACE

The American Nuclear Corporation said it had had preliminary talks with the Standard Oil Company of California concerning the possible acquisition by Standard Oil of American Nuclear, which is engaged in uranium exploration and production.

American Nuclear said it could not expect an offer to be made for several months until Standard Oil had evaluated the properties in which American Nuclear has an interest. American Nuclear stressed there was not any assurance that Standard Oil would make an offer or that such an offer would be accepted by American Nuclear's board.

If the possible offer were made based on American Nuclear's closing price of 13 $\frac{1}{4}$ in the over-the-counter market yesterday and its 3 million outstanding shares, the offer would involve more than \$39 million.

-----New York Times, Dec. 6, 1978

The US Supreme Court refused yesterday to review a lower court ruling that the Nuclear Regulatory Commission has the right to reroute transmission lines already approved by state regulatory agencies. The decision supports the NRC's rerouting of transmission lines proposed for the Seabrook, N.H., nuclear power plant, a change the NRC proposed to protect the environment.

The Public Service Co. of New Hampshire, which owns 50% of the plant now under construction, had appealed the appellate court ruling, maintaining it would bring about a "sweeping change" in federal-state relations. The proposed route change for 2 of the 86 miles of Seabrook transmission lines would only cost \$500,000. However, company officials said they challenged the ruling as a matter of principle.

Decisions that can have disastrous effects on local landowners are now to be made by a federal agency in Washington, D.C., rather than by - and indeed contrary to those of - locally elected or appointed officials, Public Service attorneys argued in a brief to the US Court of Appeals earlier this year. While Public Service acknowledges that the \$500,000 cost of rerouting is miniscule compared with the \$2.3 billion cost of the plant, it has maintained that the case has significant national implications.-----Boston Globe, Dec. 12, 1978

41 Catholic Bishops from the Midwest are considering adopting a policy statement on the ownership and use of land in the American "Heartland" and will be hosting a number of public hearings over the next few months to receive public testimony on a draft statement. Titled Strangers and Guests: Toward Community in the Heartland, the draft document is a strongly worded critique of present values and trends in the land issue. It reaffirms longstanding Church doctrine favoring private ownership of land and the right to enterprise, but reminds that Church doctrine as sharply supports the public interest in the widespread ownership of property and the proper use of land resources. The rights to property and enterprise "must not be used as shields to protect the sins of avarice and greed," the draft statement says. Copies of the statement and information about the hearings to be held in your area can be obtained from the Catholic Church Diocesan Office.-----Center for Rural Affairs, March 1979

Upcoming Bills

- HF 565 _____ Voss (DFL) Relating to public utilities; placing certain cooperative electric associations under the jurisdiction of the public service commission for rate making purposes.
- HF 649 _____ Kahn (DFL) Relating to nuclear energy; providing for the storage and disposal of certain radioactive wastes; requiring licensure of radioactive waste management facilities in Minnesota.
- HF 650 _____ Kahn (DFL) Relating to large energy facilities; establishing certain conditions for the issuance of certificates of need.

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- POWERGATE-25¢
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- "FARMLAND FOR FOOD"-75¢

(send all orders to HTL, Lowry, Mn 56349 - including postage is helpful, we'll provide the envelope.)

* * * * *

LETTERS

Hold That Line,
 Keep up the good work in your area! We like to receive your paper. The line is sure disgusting - a disgrace for farmers. Also the line going from Delano to Mankato comes only 100 feet away from our house! Were to the capitol to see the governor but seems it all don't help.
 Like to get your magazine Hold That Line. Enjoy reading it. Sending a check along.
 Cologne, Mn

Enclosed is 10 dollars to use to keep up the good work.
Parkers Prairie, Mn

Dear Sirs,
 Just a small contribution to help with expenses. Have enjoyed your letter and keeping us informed keep up the good work.
 Glenwood, Mn

Dear Hold That Line,
 I'm sending you my Easter outfit money as I don't need it because I am now wearing a grin so big that no one would notice me if I just had on my Jay Bird outfit. I loved that statement from the power co. saying "we won't grant any more interviews". Anyway, next sitting Bob Sheldon comes on t.v. and says "we did the right thing by putting up the powerline". It took them a while to come up with that cute statement. If you have a meeting with Bergland, please call me collect. I love to watch him scream at farmers. Oh! Don't forget to invite the Farmer Protesters that were in Washington, as long as they couldn't see him there because he hid for 3 weeks. Good luck in everything and God Bless.
 Elbow Lake, Mn

* * * * *

DON'T FORGET THE RUNESTONE ANNUAL MEETING IS COMING UP ON SATURDAY, MARCH 24th AT THE CENTRAL JR. HIGH SCHOOL IN ALEX. THE EXCITEMENT WILL COMMENCE AT 10:00am SHARP. TO FIND OUT WHAT THAT MEANS...BE THERE! SPECTATORS ARE ALSO WELCOME!!!!!!

* * * * *

ON EFFECTS OF EXTREMELY HIGH VOLTAGE TRANSMISSION

by Louise B. Young

RECEIVED

JAN 24 1977

Executive Officer
Minn. Dept. of Health

In response to the request of the Environmental Protection Agency for information on environmental effects of extremely high voltage transmission lines (as published in the Federal Register, March 18, 1975), I am forwarding a copy of my book Power Over People which deals with the subject and a copy of an article from the Bulletin of the Atomic Scientists of which I was co-author. Since the publication of this book and article I have been engaged in further research into the electrochemical and electric field effects produced by 765 kv lines. This research is not complete but some of the results obtained to date appear to be significant and I summarize them below.

Electric Field Gradient Measurements

It is only very recently with the advent of extremely high voltage transmission lines that the measurement of electrostatic fields has become an important issue and some confusion still exists because of the different measuring techniques that have been employed by scientists here and abroad. It is important to recognize that the measurement of a truly unperturbed field is impossible because the presence of any measuring device and the observer perturb the field. The size and position of the meter and the observer are very important factors in determining the degree to which the field is perturbed. When the measurement is made at a height above ground the degree of perturbation caused by the meter and the observer is greater than it is at ground level.

Up until just a year or so ago the electrical engineers in the United States reported the electric field gradients under transmission lines at ground level. In this case the instrument in contact with the ground does not appreciably distort the field. However it was found that the results did not always correspond with theoretical ground level gradients because the presence of vegetation and irregularities in the ground surface caused significant variations in the electric field intensity.

More recently measurements in the United States have been made at about one meter above ground with an instrument held on a hot-stick or similar

long insulating handle. Measurements made in this way agree very well with theoretical calculations of the unperturbed field. It must be remembered, however, that these unperturbed values are useful only for evaluating one transmission line with another. From a biological standpoint, it is important to consider the fields that actually impinge on the body of a person exposed to the electric field. For example, the intensity of the the field impinging on the top of a man's head may be as much as fifteen times as strong as the unperturbed field at that position.¹ The taller the person (or other perturbing object) the greater the field intensity at head height. In order to evaluate the biological significance of electrostatic fields we must consider the effect on people exposed to these fields.

The most extensive studies of health effects from exposure to alternating electrostatic fields of powerline frequency have been conducted in Russia. The results of these studies were first reported at an international symposium in Paris in 1972.² Four other reports on this work have subsequently become available in translation.^{3,4,5,6} The Russian scientists concluded that long-term exposure to fields that exist under their 500 kv and 750 kv lines do cause significant and important biological effects. As a result of these studies they set up safety regulations designed to protect their workers from the influence of these fields.

Safety Regulations - U.S.S.R.

| Nos. | Electric field Intensity kV/m | Permissible duration of personnel stay in electric field during 24 hours min | Notes |
|------|-------------------------------|--|--|
| 1. | 5 | unlimited | Points 2, 3, 4 and 5 of the regulations are valid if 1) all the remaining time a man is in areas where electric field intensity is less than or equal to 5 kV/m 2) a possibility of electrical discharge influence is eliminated |
| 2. | 10 | 180 | |
| 3. | 15 | 90 | |
| 4. | 20 | 45 | |
| 5. | 25 | 30 | |

In trying to interpret the significance of the Russian results in relation to our own lines, a number of difficulties have been encountered. The principal one is that there appears to be an important difference between the electric field gradient levels measured under their lines and those reported by our

electrical engineers for lines carrying similar voltages.

I pointed out this discrepancy to Richard Tell (Electromagnetic Radiation Analysis Branch of the Environmental Protection Agency) in a letter dated January 13th of this year and drew these facts to his attention: In the CIGRE paper by Korobkova et al² maximum field intensity figures on roads under 750 kv lines of 22 kv/m are reported (see page 4). On page 5 the statement is made that "at 750 kv switchyards there is practically no area with the intensity lower than 10 kv/m." On page 6, Figure 4 (curve 3) shows a graph of field intensity versus distance to the conductor of a 500 kv line. This graph is reproduced below (Figure 1). It shows a maximum intensity reading beneath the outer conductor of 22 or 23 kv/m and this occurs when the conductor is about 10 meters away. I understand this to mean that the line in this case is approximately 33 feet minimum height above ground. Citing from "Rules and Regulations on Labor Protection,"³ page 9, work carried out on the ground in the zone of influence of a 750 kv transmission line without the use of protective measures is permitted in the span of the transmission line and close to anchor and corner towers for no more than ten minutes. If work is off the ground at height, it must be carried out using protective measures. Since the field that they allow their workers to be exposed to for a maximum of 10 minutes is 20 kv/m, we can reasonably assume that they believe fields of this intensity occur within the span as designated. They include a diagram of the areas which I have reproduced below (Figure 2).

These statements show quite clearly that the Russians were measuring field gradient intensities as high as 22 kv/m under both 750 kv and 500 kv lines. Maximum levels actually measured by electrical engineers in the United States are 10 kv/m under 765 kv lines and 8 kv/m under 500 kv lines. There appears to be a difference of a factor of more than two between the U.S.S.R. and the U.S. readings.

Some of this discrepancy may be accounted for by differences in line design. For example, the Russian lines are somewhat lower than our lines. It is difficult to quantify this factor precisely because there is not enough firm information available on the height of the Russian lines that were in service at the time these studies were being conducted. The only indication that we have of height is the one previously mentioned - a 500 kv line which appears to have a minimum height of about 33 feet. Our 500 kv lines have theoretical minimum heights of 35 - 37 feet under maximum load and temperature conditions. However even when lower clearances of this order of magnitude are taken into consideration there still remains a significant discrepancy, a factor of somewhere between 1.5 and 2.

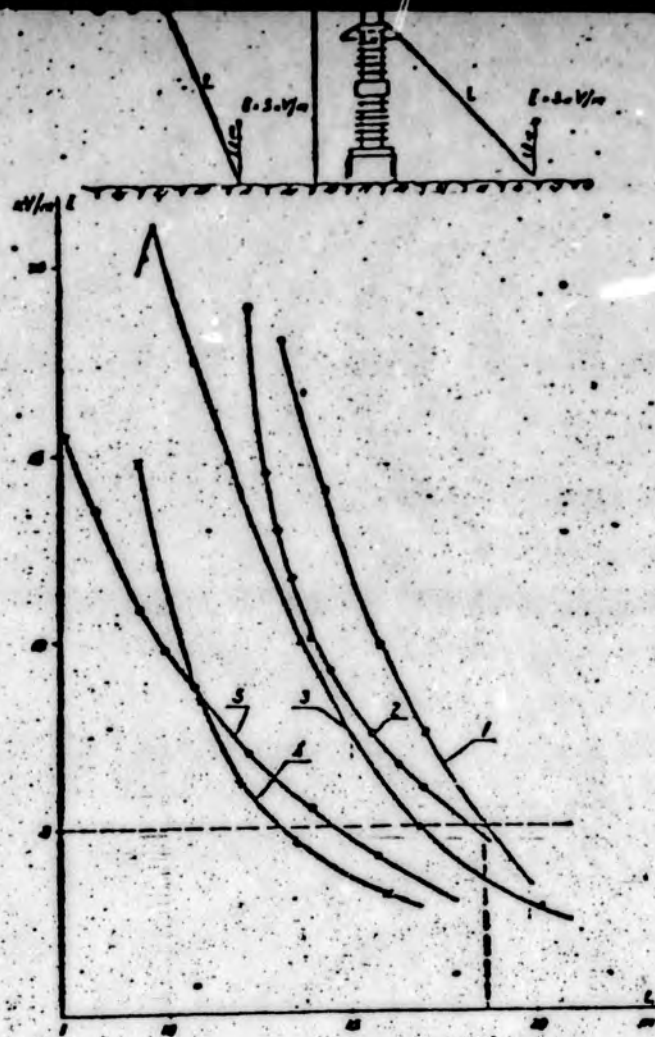


Figure 1. Dependence of Intensity on distance to live parts of equipment and buses: 1 - at a 500 kV air c-b, BB-500; 2 - at a 500 kV c-b, BB-500; 3 - on the roads; 4 - at a current transformer; 5 - at a disconnector. From Korobhova et al, p.6.

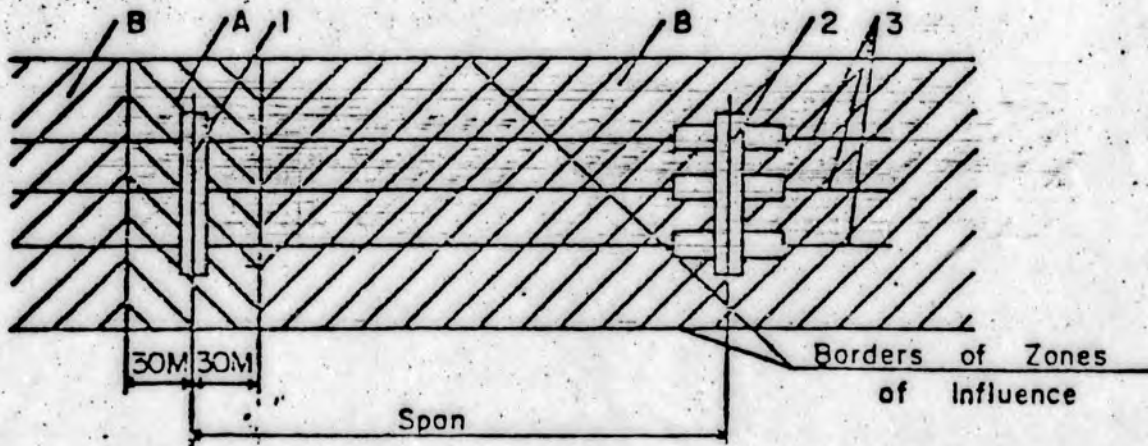


Figure 2
DIAGRAM OF 750 kV TRANSMISSION LINES WITH ZONES OF INFLUENCE

- 1--intermediary tower
- 2--anchor or corner tower
- 3--conductors

A--zones in which work is permissible without protective measures for durations of no more than 180 minutes (distances given in the diagram)

B--zones in which work is permissible without protective measures for durations of no more than 10 minutes

From "Rules and Regulations on Labor Protection," P. 9.

As I commented in my letter to Mr. Tell, it is important that this difference be resolved if we are going to consider the significance of the Russian studies as they apply to our own lines. And in his response of February 3rd, he agreed that an important discrepancy does appear to exist.

Since that time I have made a number of field gradient measurements under 765 kv lines, duplicating as closely as possible with the instruments available to me, the Russian measuring techniques as well as those of our engineers. I now believe that the discrepancy between the two sets of figures can be very simply explained on the basis of the different methods used in measuring the fields in the U.S. and the U.S.S.R.

It is stated in the Russian reports that the strength of the fields in their substations and under their lines was determined by measurements with an especially designed field gradient meter. The meter itself and the manner in which the readings were taken is described in detail. Theoretical calculations do not appear to have played any part in the determination of the field gradient by the Russian scientists. There is only one reference in the five reports to theoretical field strengths and this one reference indicates that their theoretical understanding of the spacial distribution of the electric field differs significantly from ours. On page 5 of the Morozov and Gromov paper the following statement is made: "...data from calculations and measurements of the distribution of the electric field on high voltage lines shows that field intensity is proportional to the square of the distance from the source of the field (conductor, connecting bus, etc.)" Even assuming that the authors mean "inversely proportional" this statement does not correspond with our theoretical formula for field gradient. It also indicates that their field gradient measurements increased in intensity fairly rapidly as height above ^{ground} increased - much more rapidly than occurs in our field gradient readings which do not alter much until more than half of the distance between the ground and the conductor has been traversed.

To measure their fields the Russians used a small ungrounded meter held by an observer on a short handle at 1.8 meters above ground. This meter is described in the report by Morozov and Gromov.⁴ In Figure 3 below I reproduce their sketch of the meter. On page 2 of their report they specify that the handle of insulating material is 250mm long and they say that "the operator holds the instrument by the handle and inserts it into the measured area." The height at which the instrument is held is described as 1.8 meters above ground (see "Rules and Regulations on Labor Protection," p.4).

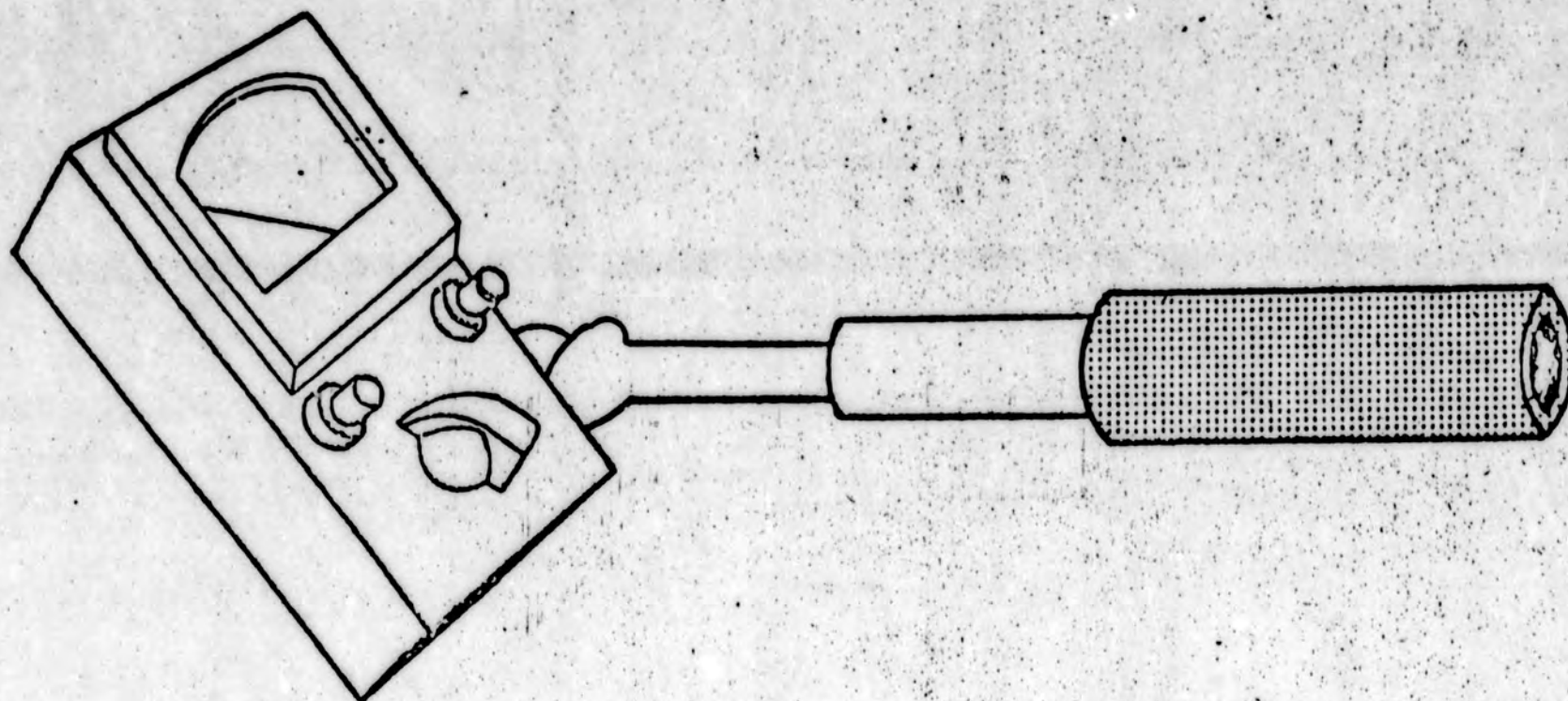
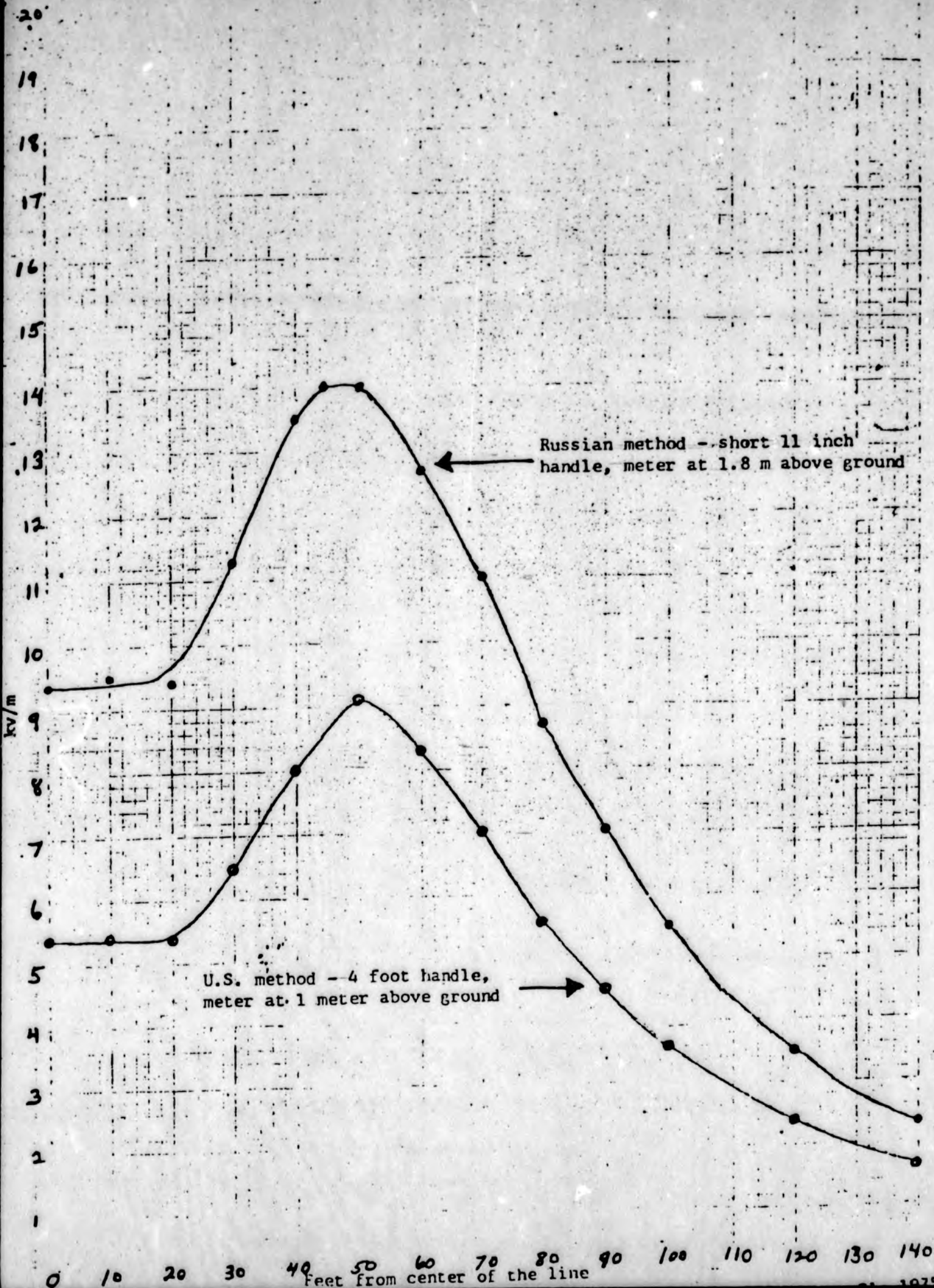


Figure 3. AN INSTRUMENT FOR THE MEASUREMENT OF THE INTENSITY OF ELECTRIC FIELDS OF 50 HZ
From Morozov and Gromov, p. 7.

A handle of 250mm (about 11 inches) is so short that the observer holding the instrument cannot avoid causing considerable concentration of the field by the presence of his body. I found that a Monroe meter (Model 238A-1 Portable Differential AC Electric Fieldmeter) held in close to the meter (thus simulating an 11 inch handle) and raised to a height of 1.8 meters above ground gave readings anywhere from 1.5 to 2 times higher than the same meter held out on its full 4 foot long handle at approximately one meter above ground. Figure 4 shows a field profile under a 765kv line with readings taken according to the standard U.S. method (on a 4-foot long handle at one meter above ground) and according to the Russian method (using an 11 inch handle with the instrument held at 1.8 meters above ground). In the short handle configuration the position of the hand is extremely important. The hand itself, of course, must occupy part of the 11 inch handle. If the hand is moved several inches nearer the body of the instrument the readings increase by as much as 50%. For the measurements in Figure 4 the hand was placed as far away from the meter as possible on the 11 inch handle. The readings taken by the Russian method average 1.6 times the readings taken by the U.S. method.

It is also interesting that the height at which the Russian measurements are made tends to magnify the discrepancy between the two ways of measuring electric field gradient. If the observer crouches down and holds the instrument in the short handle position at one meter above ground, the readings for field gradient are 1.26 times higher than those taken when the full handle is used. In other words the presence of the observer has a more perturbing effect on the field at 1.8 meters than it does at one meter (an observation that would also be predicted by theory).

It seems apparent to me that the Russians were measuring a more perturbed field than the U.S. engineers measure and this accounts for a large part of the discrepancy in the two sets of readings. The Russian method of measuring electric fields was valid within their own frame of reference as long as all their results were based on this same technique. A reprint just released of a paper given in February 1975 at a US/USSR exchange meeting in Washington indicates that Soviet scientists are revising both their measuring techniques and their theoretical calculations to bring them more in line with accepted international procedure.¹¹ However these recent changes do not alter the fact that the field measurements which were used as the basis of their health studies from 1962 to 1972 were made in the manner I have described above. Therefore, in order to relate the conditions of these studies to fields



created by our lines, a correcting factor of approximately 1.6 must be applied. For example the Russian safety regulations state that 25 kv/m is the maximum field to which people should be exposed at all. If we multiply this maximum figure by 1/1.6 or .6, we would obtain a limiting field gradient of 15 kv/m.

There is also another factor which must be taken into account. The frequency of the AC current in Russia is 50Hz while ours is 60Hz. For a given field intensity, the higher frequency causes a 20% larger charging current to run in the bodies of people exposed to these fields and since current is thought to be the principal cause of biological influence, we must apply a factor of .8 to arrive at the biologically equivalent field. Here are the Russian standards with these two correcting factors applied:

| Russian field intensity in kv/m | same fields measured by U.S. method | biologically equivalent fields kv/m | maximum permissible time in field in 24 hours |
|---------------------------------|-------------------------------------|-------------------------------------|---|
| 5 | 3 | 2.4 | unlimited |
| 10 | 6 | 4.8 | 180 minutes |
| 15 | 9 | 7.2 | 90 " |
| 20 | 12 | 9.6 | 10 " |
| 25 | 15 | 12 | 5 " |

It should be remembered, of course, that the actual size and characteristics of the Russian meter are slightly different from the Monroe meter which we used and this may affect the degree to which the field is perturbed. In order to determine the exact factor between the fields measured by the U.S. and the U.S.S.R. techniques, the Russian instrument should be used according to their method and compared directly with ours over a range of field strengths. However the charts and graphs above do give at least a rough estimate of the way our field gradients would compare with the fields to which the Russian workers were exposed and which were used as the basis of their Rules and Regulations on Labor Protection. It is apparent from the figures that the fields experienced under our 765kv lines fall well within the range of intensities which were found to cause biological effects. A graph of theoretical ground level gradients (Figure 5 below) shows maximum intensities of 13 kv/m and gradients at 100 feet from the center line (the edge of a typical right-of-way) of approximately 5 kv/m. It is significant, too, that the Russians emphasize that people exposed to these fields for the maximum times must not also be subjected to transient shock currents. People walking and working under our

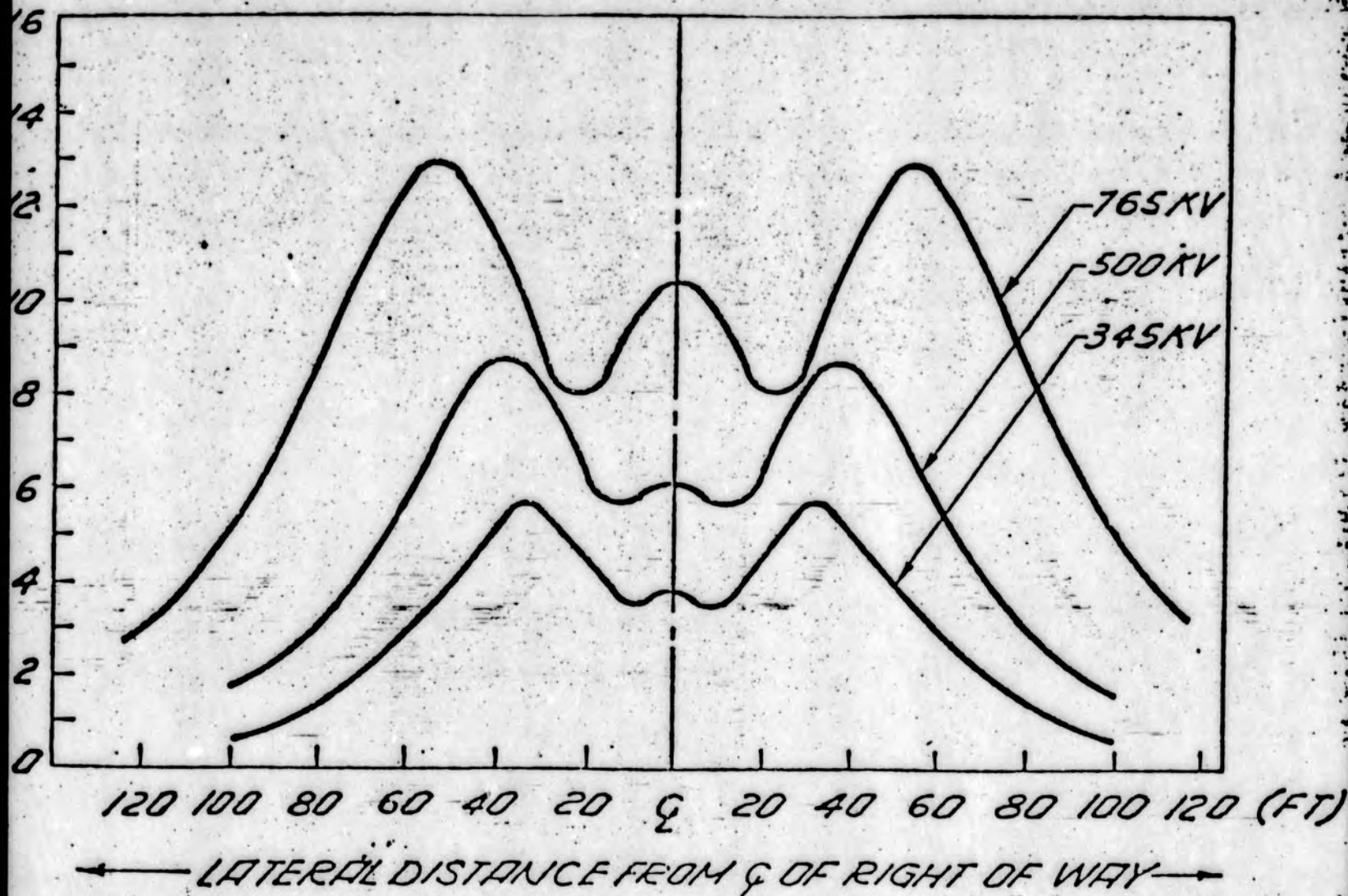


Figure 5. Typical Electrostatic Ground Gradient Profiles of Various EHV Lines
From E.S. Zobel and F.J. Dormady, Charles T. Main, Inc. Report of Tests with
Fluorescent Tubes to indicate Electric Field Strength Under 500 kv Transmission
Lines, Colstrip Project - 500 kv Transmission Lines, "March 1975, p. 11.

lines complain frequently of transient shocks from farm machinery - even leaves of corn and blades of grass.

Charging Currents

A more direct and more fool-proof way of estimating the biological significance of alternating electrostatic fields is by determining the amount of charging current that runs in the bodies of people exposed to EHV fields. I have measured currents as high as 200 microamps in the body of a 6-foot man standing with both arms raised at the strongest point of the field under a 765 kv line. With one arm raised the maximum current was 160 microamps. These measurements were made with the man standing on an insulating pad and holding one electrode of an ammeter between the thumb and forefinger. The other electrode was grounded. At the edge of the right-of-way (100 feet from the center line) body currents of 100 microamps were measured.

The CIGRE report by Korobhova et al states that studies of the biological influence of charging currents were being carried out in the U.S.S.R. (see footnote, p.2). "Preliminary data show that a 80-120 microampere current flowing through a man for a long time unfavorably affects him." The current levels measured under a 765kv line were within or considerably above this U.S.S.R. danger level. Again these current measurements indicate that the fields under our lines would be considered by the Russian scientists to be biologically significant.

The CIGRE paper by Schneider et al¹, reported current levels that are similar to the ones I have cited above. This group of German scientists found that a man standing on the ground with one hand raised would have a charging current of 18 microamps for each kv/m of unperturbed field gradient, so at the maximum point under the 765kv line where we measured 9.1 kv/m the total charging current flowing in his body would be 162 microamps. At the theoretical maximum of 13 kv/m the current level of 230 microamps would be anticipated.

Measurements made by Bonneville Power Administration and reported by T.D. Bracken⁷ yielded an average value of 16 microamps per kv/m for a 1.75m man with arms held at his side. Bracken also noted that the charging current is directly proportional to the square of the height of the person exposed to the field. Although the experiments on which this relationship was based did not consider heights above 2 meters or differently shaped objects, the implication is strong that a taller object in the field - e.g. a man on a horse

or a piece of farm machinery would sustain a higher body current (see Figure 6).

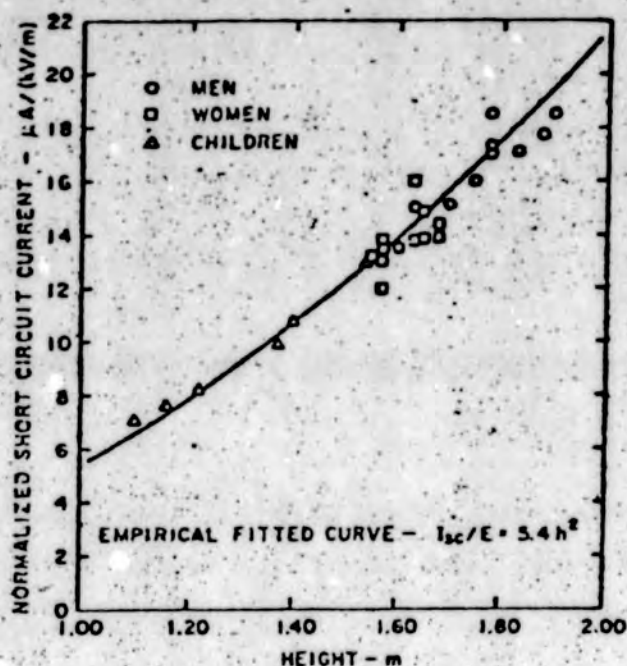


Fig. 6. Normalized short circuit current versus height for persons.

From T.D. Bracken, p. 7.

Putting all these facts together, it seems clear that a person walking or working under the main span of the 765 kv lines now in operation in the United States would have continuous displacement currents of 100 to 200 microamps in his body, and under special circumstances the amounts could be greater. These levels are significantly higher than the amounts considered safe by the Russians. Definitive research on this subject has not (to my knowledge) been conducted in this country. I believe that this health question should be answered before more of these lines are built.

Ozone Generation by Lower Lines

Over the past few years a number of field investigations of ozone levels under 765 kv lines have been made and have shown no appreciable increase over ambient ozone levels. However, at the time these tests were conducted the 765 kv lines were being operated at levels 8 to 10% below the rated voltage and, since corona discharge and the associated formation of ozone are threshold phenomena, this relatively small difference in operating voltage makes an enormous difference in the amount of ozone production that would be expected. When these lines are run at 690 kv or 720 kv corona loss would be negligible except under certain conditions such as rain or snow, and when there is considerable water vapor

present in the air less ozone is formed per kilowatt hour of corona loss. Under these circumstances it would be very surprising if monitoring for ozone near a "765 kv" line energized at about 700 kv would show significant increases in levels above ambient.

It is interesting, however, that at Oak Ridge National Laboratory ozone measurements at the edge of a right-of-way for two 500 kv transmission lines recorded ozone concentrations of 210 and 230 parts per billion on April 6, 1972, at 9:30 and 9:40 A.M.⁸ These figures were ten times the ambient levels. The Oak Ridge report suggested that these levels were caused by temperature inversion. Obviously, if a temperature inversion can cause a ten-fold increase in concentrations at ground level then a very considerable amount of ozone must be generated by the line and normally carried off by the surface winds. Such amounts generated by thousands of miles of lines would add significantly to the ozone concentrations in our atmosphere, concentrations which are already dangerously high during a large number of days.

It is apparent from purely theoretical considerations that the maximum levels are not likely to occur directly under the line but quite a little distance down wind.¹⁰ The ozone, being hot when formed, rises and then is blown by the wind, reaching ground level at some distance from the line. Even in the lightest of winds (about 2 miles per hour) the maximum concentration would occur about 300 feet from the line. Only when the wind blows parallel to the line would it be reasonable to expect higher levels under the line itself. When the wind is transverse to the line the maximum concentration is inversely proportional to wind speed. Temperature inversions and very light winds provide the most favorable conditions for elevated ozone levels.

The fact that ozone is formed in high electric fields can be very simply demonstrated in the following manner. Take a grounded needle point or a fine wire mounted in a teflon cylinder (to protect it from the wind) and attach this cylinder to the intake tube of a Mast ozone meter. Now mount this probe in the electric field created by a power line. (We used a wooden tripod.) At a certain field intensity the ozone meter readings suddenly begin to rise. In fact one has to watch very carefully because the level recorded by the meter rises so quickly that it can go off scale and saturate the meter. The field intensity at which this occurs has quite a definite threshold which is different for each different type of needle or wire. By standardizing on one type of probe this method provides a check on the field gradient readings,

a check which has the advantage of being independent of any calibrating procedure. This experiment also demonstrates the threshold characteristics of ozone formation in high electric fields and raises the possibility that ozone is not only created on the surface of the conductors themselves but may also be formed on any sharp edges on the towers, on barb wire fences under the lines, perhaps even on the tips of branches and leaves that project sharp conducting surfaces into the electric field.

Need for a Definite Study

It was reported to me by Richard Tell that on May 12th of this year Indiana and Michigan Electric Company and Ohio Power Company raised the voltages on some of their 765 kv lines; so now there is an opportunity to make more meaningful studies of lines carrying this voltage. The question of ozone production by EHV lines could be answered if an impartial study were conducted by a government agency such as the EPA. A line that is known to be operating at 765 kv to 800 kv should be continuously monitored for at least six months using six ozone meters deployed in the following manner:

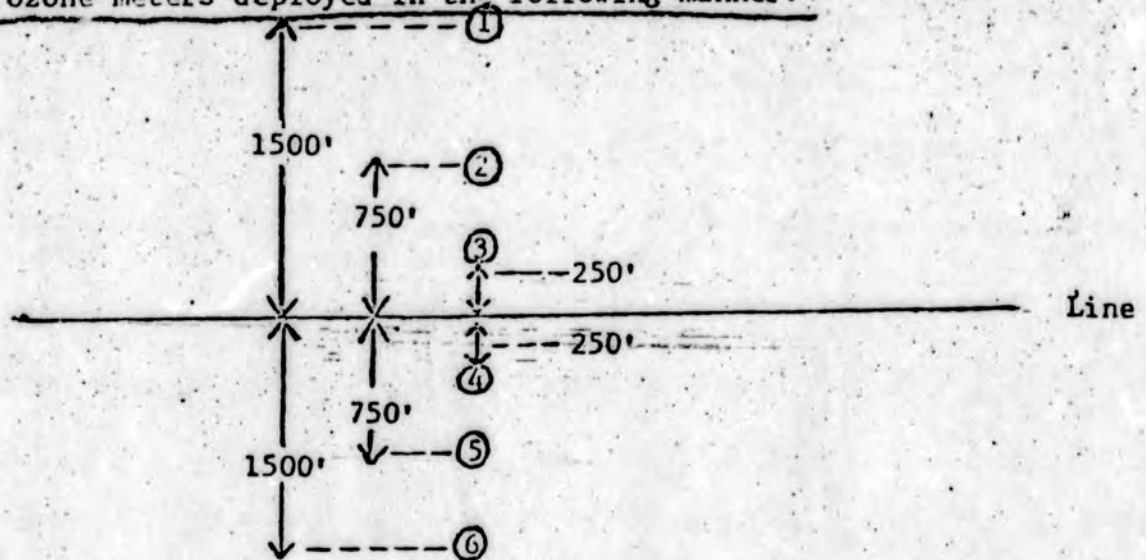


Figure 7

and speed, Wind direction, temperature, and humidity should also be recorded and the data analysed for upwind, downwind, and parallel to line conditions. Sulfur dioxide filters should be used and at least one instrument to monitor nitrogen oxide levels downwind of the line.

Although ozone is one of the most important products of corona discharge, it certainly is not the only one and it would be unfortunate if the

interest in ozone formation obscured the need to consider the other products of electric discharge. Monitoring for NC and NO₂ near power lines has been given only token consideration. To my knowledge only a few spot checks have been made. Furthermore, the question of what happens in rain or humid air is still unanswered. In these conditions ozone production per kilowatt hour of corona discharge drops very sharply. It is extremely likely that another chemical reaction is absorbing this energy. The most obvious candidate is the formation of hydroxyl radicals and atomic hydrogen from water molecules. Hydroxyl radicals are known to be very active biologically and may serve a function similar to that of hydrocarbons in the formation of toxic smog.

Since all of these questions have important implications for the health of people living near the big transmission lines, a really serious attempt should be made to answer them before allowing construction of the thousands of miles of extremely high voltage lines that are planned for the next few years.

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Source References

1. K. H. Schneider et al, "Displacement Currents to the Human Body Caused by the Dielectric Field Under Overhead Lines," International Conference on Large High Voltage Electric Systems (CIGRE), Paris, August 1974, p. 1.
2. V. P. Korobkova et al, "Influence of the Electric Field in 500 and 750 kv Switchyards on Maintenance Staff and Means for its Protection," International Conference on Large High Tension Electric Systems (CIGRE), Paris, August-Sept. 1972.
3. "Rules and Regulations on Labor Protection at 400, 500, and 750 kv AC Substations and Overhead Lines of Industrial Frequency (In the USSR)," translated by G.G. Knickerbocker.
4. Yu. A. Morozov & O. M. Gromov, "Device for the Measurement of Industrial Frequency Electric Field Intensity," translated by G.G. Knickerbocker.
5. T. P. Asanova and A. I. Rakov, "The State of Health of Persons Working in the Electric Field of Outdoor 400 and 500 kv Switchyards," translated by G. G. Knickerbocker.
6. T. E. Sazonova, "A Physiological Assessment of the Work Conditions in 400 - 500 kv Open Switching Yards," translated by G. G. Knickerbocker.
7. T. D. Bracken, "Field Measurements and Calculations of Electrostatic Effects of Overhead Transmission Lines," IEEE Paper No. F 75-573-6, p. 7.
8. "Environmental Sciences Division Annual Progress Report for Period Ending Sept. 30, 1972," Oak Ridge, 1973, as quoted in "Draft Environmental Impact Statement on Colstrip Electric Generating Units 3 & 4, 500 kv Transmission Lines and Associated Facilities," Montana State Department of Natural Resources and Conservation, Nov. 1974, p. 205.
9. As reported to me by Richard A. Tell, United States Environmental Protection Agency, June 10, 1975.
10. Harold N. Scherer, Jr., Brendan J. Ware, and C. H. Shih, "Gaseous Effluents Due to EHV Transmission Line Corona," IEEE Transactions on Power Apparatus and Systems, PAS-92, No.3 (May-June, 1973): p. 1046.
11. Yu.L. Lyskov, Yu. S. Emma, & M.D. Stolyarov, "Electrical Field as a Parameter Considered in Designing Electric Power Transmission of 750 - 1150kv; the Measuring Methods, the Design Practices and Direction of Further Research."

Original Contributions

ELECTRICAL WIRING CONFIGURATIONS AND CHILDHOOD CANCER

NANCY WERTHEIMER¹ AND ED LEEPER

Wertheimer, N. (Dept. of Preventive Medicine, U. of Colorado Medical Center, Box C-245, Denver, CO 80262), and E. Leeper. Electrical wiring configurations and childhood cancer, *Am J Epidemiol* 109:273-284, 1979.

An excess of electrical wiring configurations suggestive of high current-flow was noted in Colorado in 1976-1977 near the homes of children who developed cancer, as compared to the homes of control children. The finding was strongest for children who had spent their entire lives at the same address, and it appeared to be dose-related. It did not seem to be an artifact of neighborhood, street congestion, social class, or family structure. The reason for the correlation is uncertain; possible effects of current in the water pipes or of AC magnetic fields are suggested.

electricity; electromagnetic fields; leukemia; neoplasms

Electrical power came into use many years before environmental impact studies were common, and today our domestic power lines are taken for granted and generally assumed to be harmless. However, this assumption has never been adequately tested. Low level harmful effects could be missed, yet they might be important for the population as a whole, since electric lines are so ubiquitous. In 1976-1977 we did a field study in the greater Denver area which suggested that, in fact, the homes of children who developed cancer were found unduly often near electric lines carrying high currents.

In our modern power delivery systems, high-tension wires carrying current at

voltages up to several hundred kilovolts (kv) deliver power to distribution substations where the voltage is stepped down, resulting in proportionately higher current in the medium-voltage (usually 13 kv, wire-to-wire) primary lines. These latter radiate out from the substation to distribute power through a neighborhood. Then, at the local transformer, the voltage of the primaries is stepped down once more to produce the 240 volt current which is carried along the secondary wires to service drops which bring the power to the customer's house. The current flow will always be greatest in the wires directly issuing from the substation or the transformer. At these points the voltage has been stepped down and "transformed" into current. And it was particularly homes close to these transforming points that were over-represented among our cancer cases.

Because our findings appeared to relate to high current rather than voltage, we looked into the magnetic fields induced by current flow. Magnetic fields penetrate the human body (and buildings, etc.) readily. They are not easily shielded, but

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Abbreviations: AC, alternating current; HCC, high-current configuration; Hz, hertz; LCC, low-current configuration.

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The authors thank the Colorado Department of Vital Statistics and Dr. John Cobb of the University of Colorado Preventive Medicine Department for their facilitation of this research.

TABLE 1
Daytime measurements of 60 Hz magnetic fields (in RMS gauss) in Colorado in 1976-1977

| | 75 cm above ground, under wires | | | | 75 cm above ground over buried plumbing which serves: | | |
|----------------------|---------------------------------|---------------------------|-----------------------------|--------------------------------------|---|---------------------------------|----------------------------------|
| | Large primaries (N = 64)* | High tension (N = 22)* | Thin primaries (N = 51)* | First span† secondaries (N = 84)* | Second span† secondaries (N = 73)* | First span† homes (N = 160)† | Second span† homes (N = 104)* |
| Maximum measurements | .035 | .020 | .008 | .005 | .004 | .013 | .008 |
| Median measurements | .007 | .0033 | .0022 | .0017 | .0009 | .0015 | .0010 |
| % > .0030 gauss | 73.4% | 54.5% | 35.3% | 20.2% | 6.8% | 22.5% | 10.4% |

* N = no. of sites studied.

† First span secondaries are those nearest the transformer; second span wires are further "down-stream" from the transformer (see text). First- and second-span homes are homes near the respective types of secondaries.

they can be cancelled by balancing the currents that produce them. Such cancellation occurs in electric wires, where the return current tends to balance the supply current. However, the cancellation is imperfect because the wires are often separated in space and, more importantly, because some of the return current does not flow through the wires at all, but returns instead through the ground, and particularly through the plumbing system to which most urban electrical systems are grounded at each house.

This results in a locally imbalanced current, both in the distribution wires and in the plumbing. That imbalanced current produces a 60 hertz (Hz) magnetic field which, though small (table 1), is nonetheless orders of magnitude larger than the 60 Hz field found in nature (about 10^{-8} gauss (1)). The ground-current flows not only in the street plumbing, but also through the pipes in the house. Current which enters the plumbing at one house can flow through several homes before it returns to the distribution wires, because the plumbing provides a continuous, low-resistance path between houses.

The ground-current produces a magnetic field within the house (localized near the plumbing) which appears to be related roughly to the types of wiring configurations nearby (see table 1). This relationship between wires and plumbing is to be expected because, other things being equal, the greatest unbalanced current tends to occur where the total current in the wires is greatest, and the unbalanced portion of the current must detour through ground paths such as the nearby earth and plumbing.

A number of household appliances and power tools also produce magnetic fields, but in comparing the fields from appliances with those from power lines, it is important to note that most appliances present approximately a magnetic dipole source, with fields falling off roughly as the inverse cube of the distance, while a

wire with unbalanced current will have a field falling off only as the inverse of the distance. For instance:

ent wiring configurations (nearness and size of wires, closeness to origin of current, etc.).

| | 1 cm | 15 cm | 1 m | 3 m | 30 m |
|--------------------------------------|----------|-------|-------|---------|---------|
| Electrical drill | 13 gauss | .12 | .001 | < .0001 | < .0001 |
| Electrical range (4 burners on high) | 1 gauss | .04 | .0015 | < .0001 | < .0001 |
| Wire carrying 15 amperes | 3 gauss | .2 | .03 | .01 | .001 |

In the literature there are listings of 60 Hz magnetic fields produced by appliances which appear quite high. These should not be misinterpreted: They are apparently due to the use of measurements taken "as close as possible" to the appliance. Our measurements indicate that magnetic-field exposure to the whole body from normal use of household appliances rarely exceeds .001 to .002 gauss for any extended period, while the ambient fields in a house due to nearby distribution wires or plumbing may sometimes reach those levels, or more, for hours or days at a time. If magnetic-field exposure is responsible for our finding, it may be that, above some minimum threshold, duration of continuous exposure is more important than strength of exposure *per se*. There is some precedent for such a threshold effect in the literature on direct current (DC) magnetic fields (2).

Our field measurements showed that, on the average, those types of wires associated with cancer in our study exhibited high magnetic fields (compare tables 1 and 3). However, the readings varied considerably over time; and because our observations were all made in good weather and during work-day hours when domestic current is minimal, because current-flow had most probably altered since the time of our subjects' residency, and because it was rarely feasible to go close to the house to take a measurement, no attempt was made to take systematic measurements at our study homes. Rather this study is based on the potential current flow suggested by differ-

Experimental work on physiologic effects of low-level, extremely low frequency magnetic fields is limited. It has been recently reviewed (3). Among the positive reports are decreased mitosis in slime molds (4), decreased growth of seedlings (5) and chicks (6), decreased *in vitro* growth of embryonic tissue cells (7), and a number of behavioral and physiologic changes in rats (8). All these results are for fields considerably higher (.5-30 gauss) than the 60 Hz fields generally found near power lines; however, the findings reported often appear to be unrelated to dose over the range studied. Prolonged exposure to the .001-.1 gauss range most pertinent to wiring effects has not been explored experimentally.

Two studies suggest that a relatively strong AC (alternating current) field may interfere with growth of implanted tumors in animals (9, 10) except where the tumor tissue is exposed to the field *before* implantation. In this latter condition, tumor "takes" were increased (9).

To explore occupational exposure to AC magnetic fields, we analyzed data from a USPH publication on occupation by cause of death (11). All those occupational categories which seemed likely to include men frequently exposed to AC magnetic fields were grouped together and found to have, as a group, a cancer rate significantly higher than the total population. The "exposed" categories included: power station operators; stationary engineers; linemen and servicemen, telephone, telegraph and power; motor-men, street, subway and elevated railway; electricians; and welders and flame cutters. The

standard mortality ratio for cancer for these categories combined was 115, a significant increase over the ratio of 100 for all occupations ($\chi^2 = 24.5, p < .0001$). For other "natural causes" of death this same group showed a standard mortality ratio of 102 ($\chi^2 = 1.8$, not significant). While this crude analysis in itself proves nothing, it underlines the fact that the harmlessness of AC magnetic fields is still unproven.

METHODS

Our cases consisted of persons dying of cancer in Colorado before age 19 in the years 1950-1973, who also had a Colorado birth certificate. Only subjects with addresses occupied from 1946-1973 in the greater Denver area were used. Controls for these cases consisted of next Denver-area birth certificates, chosen both from the files organized by birth-month and county (*file 1 controls*), and from the alphabetical search-listings, which list all Colorado births alphabetically within several wide spans of years: 1939-1958, 1959-1969, and 1970-1974. These latter were called *file 2 controls*. If the next birth certificate was that of a sibling it was skipped.

Birth addresses were those listed on the birth certificates. "Death" addresses were obtained for both cases and controls by searching for parents in city directories

for the two years just prior to diagnosis of the case. For cases who could not be traced, the address on the death certificate was used. For controls, if the *file 1 control* could not be traced, the *file 2 control* with most similar birth date who could be traced was used. There were no significant differences in the proportion of "high-current configurations" (HCC's as defined below) shown by the *file 1 controls* used (21 per cent HCC), the *file 2 controls* used (23 per cent HCC) and the unused extra controls (25 per cent HCC), so it seems unlikely that our method of selecting controls biased our findings.

In all, 344 cases met our criteria. Thirty-nine of these were born before 1946, and 33 had a birth address which was lost because it had been demolished or was not adequately specified. Only death addresses were analyzed for these 72 cases and their respective controls. Similarly, 16 cases had no usable death address, so only birth addresses were used for these cases and their controls. Table 2 gives a summary of how many persons and how many addresses were available for cases and controls.

The procedure was simply to visit the birth and "death" addresses of each case and each control, and to draw a small map of the electrical wires and transformers in the vicinity. Primary (13 kv) wires were categorized as either "large-gauge" (built

TABLE 2
Distribution of persons and addresses available for analysis, for cases and controls, in a study of electrical wiring configurations and childhood cancer in Colorado in 1976-1977

| Residential status | Cases | | Controls | |
|---|----------|------------|----------|-----------|
| | Persons* | Addresses* | Persons | Addresses |
| Stable | 109 | 109 | 128 | 128 |
| Moved, birth and death addresses available | 147 | 294 | 128 | 256 |
| Only birth address | 16 | 16 | 16 | 16 |
| Only death address | 72 | 72 | 72 | 72 |
| Totals | 344 | 491 | 344 | 472 |

* Tables 3, 4, and 9 present data on total addresses, tables 5, 6, 7, 8, and 10 present data on total persons. Tables presenting data on persons are generally broken into total persons with an available birth address ($N = 272$) and totals with an available death address ($N = 328$).

to carry high currents) or "thin" depending on whether they were clearly larger than the secondary wires. Distances were measured from the part of the house nearest the wires to the wires, with a rollatape.

Three types of homes, because of their proximity to high-current wires, were considered to have "high-current configurations" (HCC's): 1) homes less than 40 meters from large-gauge primaries or an array of six or more thin primaries; 2) homes less than 20 meters from an array of 3-5 thin primaries or from high-tension (50-230 kv) wires; and 3) homes less than 15 meters from "first span" secondary (240 volt) wires. *First span secondaries* were defined as those secondaries which issued directly from the transformer and had not yet lost any current through a service drop occurring beyond the transformer pole. The span of secondary wires separated from any transformer by at least one intervening service drop (ignoring those drops directly attached to the transformer pole) were called *second span secondaries*. First span wires will have more current running through them than second span wires because the first span must carry current for all the drops that mark its distal end plus whatever current the second span requires.

All other configurations were considered "low-current configurations" (LCC's). In addition, where first span wires could be seen to be carrying current to no more than two single family homes, on the average (on both sides of the block), those wires were called *short first span wires* and, because they carried current for so few homes, they were always considered LCC's, regardless of distance. Houses situated beyond the pole at the end of a secondary line ("end poles" in tables 3 and 4) were considered the extreme example of LCC homes, because they had no distribution wires at all running past them.

Since the Denver area has been growing fast, many new primary wires have been installed to accommodate increased power demands. Many of these new installations are of a style easily distinguished from older wires. For addresses occupied before 1956 (20 years prior to our field work) we noted that only 59 per cent of the primary wires found near our study homes were of the "old fashioned" types which had been in use at the time of our subjects' occupancy. (Actually 71 per cent of the primary wires observed near pre-1956 case addresses were "old fashioned," but only 49 per cent of the wires near pre-1956 control addresses were of the older types that could have been in use in those early years.) Where the more modern wiring was observed, we could not tell whether it represented new installations or replacement wiring, but we did know that it could not have been there in its present form in the pre-1956 years. Therefore, we decided to treat all primary wires seen near homes occupied before 1956 as unreliable, and to code such homes strictly according to their more stable secondary-wire configurations.

This adjustment did not critically affect our findings. Proximity to primary wires was most strongly associated with cancer for recent addresses, and the association (as expected) was weaker in the older data. But the association was still significant when all years were considered and no adjustments made: For birth addresses, 31 per cent of the 272 cases and 22 per cent of the 272 controls had homes near (unadjusted) primaries, a difference significant beyond the .025 level by Chi-square. For death addresses the figures were 29 per cent of 328 cases and 19 per cent of 328 controls, significant beyond the .01 level.

RESULTS

General configurations. Table 3 shows how many cancer and control homes exhibited the various wiring configura-

tions. It can be seen that the most striking difference between cases and controls was found for subjects who had only one address from birth to death. This might be because, for subjects who moved, the effects of configurations at one address were diluted by effects of configurations at other addresses.

Table 4 indicates that the greater the exposure to current expected from a given wiring configuration, the greater the excess of cancer found in homes where that configuration was observed.

Type of cancer. The breakdown according to type of cancer (table 5) shows a fairly similar excess of HCC's in cancer cases for all categories but one, the death addresses of cases with "other tumors."

Such a wide association with different types of cancer is not characteristic of known carcinogens such as ionizing radiation; thus the broad association observed here suggests that the HCC-cancer relationship may not be a causal one. The most likely alternatives are that it is due to some artifact, or that it reflects some effect of HCC's on the body's general ability to resist cancer.

Onset age. As table 6 shows, the HCC-cancer relationship was observed in both young and older subjects. The fact that the relationship held for the birth as well as the death addresses of older subjects would seem to suggest that the effects of HCC exposure can be long delayed. However, a closer look at the data showed that

TABLE 3
Wiring configurations at the homes of cancer cases and controls, Colorado, 1976-1977

| Type of configuration* | Stable residence: | | Moved residence: | | | |
|----------------------------|-------------------|---------|------------------|---------|----------------|---------|
| | Case | Control | Birth address | | Death address | |
| | | | Case | Control | Case | Control |
| Substation <150 m† | 2 | 0 | 2 | 0 | 2 | 0 |
| Large primaries <40 m | 14 | 6 | 14 | 13 | 38 | 17 |
| High tension <20 m | 0 | 0 | 0 | 1 | 1 | 0 |
| Thin primaries <20 m | 13 | 10 | 11 | 4 | 17 | 11 |
| 1st span secondaries <15 m | 19 | 10 | 26 | 11 | 23 | 20 |
| Total HCC's | 48 | 26 | 53 | 29 | 81 | 48 |
| 1st span secondaries >15 m | 33 | 43 | 53 | 57 | 66 | 51 |
| "Short" first span wires | 6 | 11 | 9 | 4 | 11 | 19 |
| Second span secondaries | 20 | 33 | 40 | 40 | 51 | 66 |
| End poles | 2 | 15 | 8 | 14 | 10 | 16 |
| Total LCC's | 61 | 102 | 110 | 115 | 138 | 152 |
| (% HCC) | (44.0) | (20.3) | (32.5) | (20.1) | (37.0) | (24.0) |
| | $\chi^2 = 14.4$ | | $\chi^2 = 5.4$ | | $\chi^2 = 7.6$ | |
| | $p < .001$ | | $p = .02$ | | $p < .01$ | |

† All six cases within 150 m of a substation were also less than 40 m from large primaries.

* HCC = high-current configuration; LCC = low-current configuration.

TABLE 4
Cancer related to the amount of current expected from different wiring configurations, Colorado, 1976-1977

| Wiring configuration | Expected current | Total addresses: | | |
|----------------------|------------------|------------------|---------|---------|
| | | Case | Control | % cases |
| Substation | Very high | 6 | 0 | 100.0 |
| Other HCC | High | 176 | 103 | 63.1 |
| LCC except end poles | Low | 289 | 324 | 47.1 |
| End poles | Very low | 20 | 45 | 30.8 |

TABLE 5
Wiring configurations and type of cancer, Colorado, 1975-1977

| Residence | Type of wiring configuration* | Leukemia | | Lymphoma | | Nervous system tumors | | Other | |
|---------------|-------------------------------|--------------|---------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
| | | Case | Control | Case | Control | Case | Control | Case | Control |
| Birth address | HCC | 52 | 29 | 10 | 5 | 22 | 12 | 17 | 9 |
| | LCC (% HCC) | 84 (38.2) | 107 (21.3) | 21 (32.3) | 26 (16.1) | 35 (38.6) | 45 (21.1) | 31 (35.4) | 39 (18.7) |
| Death address | HCC | 63 | 29 | 18 | 11 | 30 | 17 | 18 | 17 |
| | LCC (% HCC) | 92 (40.6) | 126 (18.7) | 26 (40.9) | 33 (25.0) | 36 (45.5) | 49 (25.8) | 45 (28.5) | 46 (27.0) |

* HCC = high-current configuration; LCC = low-current configuration.

23 (66 per cent) of the 35 older cases born at HCC's were also living at a HCC (usually the same address) within two years of their cancer onset. Only three (20 per cent) of the 15 older controls born at HCC's were living at a HCC within two years of the "death" date. Thus the HCC-cancer relationship observed in the birth addresses of older subjects can be largely attributed to a HCC residence near the time of cancer onset, and there is no need to posit a long-delayed effect of HCC's.

Urban-suburban differences. Since cancer may show a different incidence in urban and non-urban areas, it seemed important to rule out the possibility that a difference in urbanization between cases and controls was the significant variable in this study, and simply carried the HCC differences with it, spuriously. This seemed unlikely, intuitively, because the field work was done one neighborhood at a time, and on none of the 22 days of field work did the individual day's results fail to show a preponderance of HCC's in the case addresses.

A more formal survey shows that, although there was a slight excess of suburban addresses in the controls, it was not statistically significant. Furthermore, the cases showed more HCC's than the controls independently in three areas: in old Denver, in the more recently developed Denver areas (as estimated from a planning department publication (12)), and in the Denver suburbs (see table 7).

Socioeconomic class. The literature reports an excess of leukemia in families of higher socioeconomic class (13). Our data, dealing with all types of childhood cancer, show only an insignificant trend in this direction. It seemed possible that our method of choosing controls might have biased our control group against lower-class controls, since only controls who could be traced in directories were used. However, a check on the discarded controls showed that upper and lower

class controls were discarded equally often, while Class III controls were somewhat disproportionately retained. There was no significant difference in the per cent of discarded and retained controls showing a HCC and, as table 8 shows, the association between HCC's and cancer was observed within each social-class group. It therefore seems unlikely that some spurious relationship to social class explains our findings.

Family pattern. The literature reports an excess of first siblings and older mothers among children with leukemia (14). In our total sample of childhood cancer cases, a trend towards both more first siblings and older mothers was noted, but neither was statistically significant. Furthermore, the HCC-cancer relationship holds to approximately the same degree within each maternal-age

and sibling-order category tested, so we see no clue in these variables as to why the relationship between HCC's and cancer should exist.

Traffic congestion. A recent report (15) suggests that cancer may occur unduly often near heavy-traffic routes. Our data did show a mild excess of case-addresses near such routes; case-addresses were more likely than control-addresses to be found within 40 meters of streets having a daily traffic count of 5000 vehicles or more on the 1960 Department of Highways traffic map. However, once again, a significant excess of HCC's in cancer cases was found independently for addresses on heavy-traffic routes and for other addresses. (For heavy-traffic routes, 53 per cent of 74 case-addresses showed HCC's against 30 per cent of 48 control-addresses; for other locations, 35 per cent

TABLE 6
Wiring configurations and cancer onset age, Colorado, 1976-1977*

| Residence | Type of wiring configuration† | Cancer onset 0-5 years | | Onset 6-18 years | |
|---------------|-------------------------------|------------------------|---------|------------------|---------|
| | | Case | Control | Case | Control |
| Birth address | HCC | 66 | 40 | 35 | 15 |
| | LCC | 103 | 129 | 68 | 88 |
| | (% HCC) | (39.1) | (23.7) | (34.0) | (14.6) |
| Death address | HCC | 68 | 37 | 61 | 37 |
| | LCC | 105 | 136 | 94 | 118 |
| | (% HCC) | (39.3) | (21.4) | (39.4) | (23.9) |

* Case-control differences are significant by Chi-square ($p < .01$) for each category in the table.

† HCC = high-current configuration; LCC = low-current configuration.

TABLE 7
Wiring configurations in different neighborhoods of cancer cases and controls in Colorado in 1976-1977*

| Residence | Type of wiring configuration† | Old Denver | | Newer Denver | | Suburban | |
|---------------|-------------------------------|------------|---------|--------------|---------|----------|---------|
| | | Case | Control | Case | Control | Case | Control |
| Birth address | HCC | 42 | 26 | 27 | 9 | 32 | 20 |
| | LCC | 77 | 91 | 40 | 44 | 54 | 82 |
| | (% HCC) | (35.2) | (22.2) | (40.3) | (17.0) | (37.2) | (19.6) |
| Death address | HCC | 49 | 24 | 35 | 19 | 45 | 31 |
| | LCC | 62 | 77 | 49 | 55 | 88 | 122 |
| | (% HCC) | (44.1) | (23.8) | (41.7) | (25.7) | (33.8) | (20.3) |

* Case-control differences are significant by χ^2 ($p < .05$ or better) for each category in the table.

† HCC = high-current configuration; LCC = low-current configuration.

TABLE 8

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Father's occupational class* at subject's birth, related to wiring configurations at birth residences of cancer cases and controls, Colorado, 1976-1977

| Type of wiring configuration† | Classes I and II | | Class III | | Classes IV and V | |
|-------------------------------|-----------------------------|---------|-----------------------------|---------|-------------------------------|---------|
| | Case | Control | Case | Control | Case | Control |
| HCC | 19 | 9 | 49 | 30 | 33 | 16 |
| LCC | 34 | 41 | 98 | 111 | 39 | 65 |
| (% HCC) | (35.8) | (18.0) | (33.3) | (21.3) | (45.8) | (19.8) |
| | $\chi^2 = 3.2$ $p < .10$ | | $\chi^2 = 4.7$ $p < .05$ | | $\chi^2 = 10.8$ $p = .001$ | |

* Class categories follow the schema provided in "Mortality by Occupation Level and Cause of Death," Vital Statistics Special Reports 53: #5, 1963, and are as follows: Class I: Professional. Class II: Technical, Administrative and Managerial. Class III: Clerical, Sales, and Skilled Workers. Class IV: Semi-skilled Workers. Class V: Laborers.

† HCC = high-current-configuration; LCC = low-current configuration.

TABLE 9

Increase of cancer cases within 40 meters of heavy-traffic routes, as related to the presence or absence of nearby* primaries, Colorado, 1976-1977

| Type of subject | Near primary wires | | Not near primaries | |
|-----------------|-----------------------------------|-----------------|-----------------------------------|-----------------|
| | Traffic routes | Other locations | Traffic routes | Other locations |
| Cases | 32 | 84 | 42 | 333 |
| Controls | 9 | 53 | 39 | 371 |
| (% cases) | (78.0) | (61.3) | (51.9) | (47.3) |
| | $\chi^2 = 3.3$.05 < p < .10 | | $\chi^2 = 0.4$ Not significant | |

* "Nearby" primaries here means that the primaries were near enough to the house to qualify it as a high-current configuration (HCC).

of 417 case-addresses showed HCC's against 21 per cent of 424 control-addresses).

In fact, the excess cancer we found on heavy-traffic routes seems to be related to the frequent presence on such routes of primary wires carrying especially high currents. Table 9 shows that the excess of cancer cases on high-traffic routes occurred to a significant extent *only* where primary wires were nearby.

Sex distribution. Many cancers, including leukemia, occur more frequently in males than females. This is reflected in our data where 57 per cent of our cases were males, as compared to 49 per cent of the controls. The excess of HCC's among cases was significant for both males and females when the sexes were analyzed separately, but the trend was stronger in

the males; 51 per cent of the 197 male cases had a HCC at their birth- or death-address, or both, while 45 per cent of the 147 female cases had such an address. This compares with only 28 per cent of the 168 control males and also 28 per cent of the 176 control females.

It is interesting that significant male excess among our cancer cases appeared to be confined to two categories: 1) cases whose birth address had a lower current configuration than the death address, and 2) cases with stable address who developed cancer after at least one year of postnatal life at a residence situated near primary wires (table 10).

Because these two categories were chosen from a number of ways we might have categorized the data, they must remain suspect until a replication confirms or

TABLE 10
Sex distribution of cancer cases in a study of electrical wiring configurations and childhood cancer in Colorado in 1976-1977

| Type of address | Males | Females | % male | Significance* |
|--|-------|---------|--------|--|
| Birth address had lower current configuration than death address | 28 | 14 | 66.7 | $\chi^2 = 4.0, p < .05$ |
| Stable residence at HCC† involving primary wires | 22 | 4 | 84.6 | $\chi^2 = 11.1, p < .001$ |
| Other cases with any HCC address | 56 | 48 | 53.8 | $\chi^2 = 0.5, \text{not significant}$ |
| Other cases with no HCC address | 91 | 81 | 52.9 | $\chi^2 = 0.5, \text{not significant}$ |

* An expected value of 50 per cent male was used to calculate the chi-squares.

† HCC = high-current configuration.

disputes them. However, we chose these categories for a reason: We hypothesized that males might be excessively susceptible to HCC's at all ages, including prenatally. (It is of interest here that male rats appear especially susceptible to experimental magnetic fields (8, p. 182) (16), as do embryos (17).) If males are more susceptible, they might frequently be aborted when pregnancy occurs at a HCC, but pregnancy at a LCC would allow the most susceptible males to be born and then to develop cancer later when exposed to a situation with higher current nearby. This hypothesis is consistent with the male excess in category 1 above.

Category 2 is presumed to provide a potentially similar situation: Where primary wires are found running near a house (in 1976), it is always possible that these wires were first installed or were "beefed up" at some time *after* the subject's birth. Or if they were present all along, the current they carry may sometimes have increased with time. If any of these things happens, the postnatal current flow near the house will be increased over the prenatal flow, even without a change in residence. Should this happen, the susceptible male who escaped abortion during pregnancy might develop cancer, and this would explain the male excess in category 2.

Substations. Power carried at higher voltage is stepped down to produce increased current at two points in our electrical distribution system: at the distribution substation, and again at the neighborhood transformers. As indicated, cancer cases were found in excess close to the "first span" wires issuing from the transformers. An even stronger trend was found for substations.

None of the 702 control addresses visited (including our unused extra controls) was within 150 meters of a substation. This is to be expected since probably less than one home in 1000 in the Denver area is that near a substation. What is surprising is that six of 491 case addresses were found within 150 meters of a substation and, in each case, less than 40 meters from the large primary wires issuing from that substation. These six are shown in table 3. Each cancer case had lived at the substation address within three years or less of his illness. Although these numbers are small, they are striking.

Blind studies. It should be noted that our Denver-area study, being exploratory, was not done blind. This could lead to error, although our observations were reasonably unambiguous. To check just how reliable our coding was, an assistant observed and coded 70 case and 70 control addresses randomly chosen from those previously coded by the principal inves-

tigator. The assistant did not know the case-control status of the addresses she coded. Her coding agreed with ours in 128 (91 per cent) of the 140 instances. In five of the 12 instances of disagreement, the assistant's judgment favored the hypothesis of a HCC-cancer correlation, while ours did not. In seven instances, the reverse was true.

Also, a blind study was done (for birth addresses only) in Colorado Springs and Pueblo. This study showed the same correlation as the Denver study, similar in degree but less significant due to the smaller numbers; 32 per cent of the 65 cases and 18 per cent of the 65 controls showed HCC's. The correlation was strongest for cases with onset before six years of age, possibly because many of the older cases had been gone from their birth addresses for many years before their cancer onset.

DISCUSSION

It is not clear *how* residence near a HCC might affect the development of cancer, but several possibilities should be considered:

1) Some association of both cancer and HCC's with a third factor may spuriously account for our correlation. Although we found no indication of such a third factor in our analyses of social class, neighborhood, congested streets, or family make-up, the possibilities have not been exhausted.

2) The magnetic fields produced by wire currents may somehow directly "cause" cancer. There is, however, no independent evidence or theoretical understanding which seems to support this possibility. The evidence concerning mutagenic effects of extremely low frequency magnetic fields, for instance, is ambiguous, but probably negative (18).

3) Carcinogenic activity may be associated with some *indirect* effect of the HCC's. For example, fields around power

lines might change some ambient environmental carcinogen, such as particles which emit ionizing radiation. (However, the fields near domestic wires are too weak to make this seem probable.) Or the increased current flowing in the plumbing might locally affect the drinking water. (There is often a small amount of lead in copper water pipes, for instance, due to imperfect soldering. And lead in the water supply is correlated with cancer, at least geographically (19). However, it is not clear that AC current in pipes could affect this small amount of lead enough to make a difference.)

4) AC magnetic fields might affect the development of cancer indirectly, through some effect on physiologic processes. It is conceivable, for instance, that contact-inhibition of cellular growth, or the basic immune reaction of recognizing "self" from "not self," involves electrical potentials occurring at cell surfaces. Against an electromagnetic background different from that provided during evolution, any such cell mechanism might be altered.

Whatever the basis for our observed correlation, it should be emphasized that, although the risk of cancer appears to be increased for children living near HCC's, it is rarely increased by a factor of more than two or three. Therefore, if in the general population one child in 1000 is likely to get cancer before age 19, no more than two or three in 1000 living near a HCC would be expected to get it. The practical significance of the correlation, if any, lies in the high prevalence of HCC's, not in any very high risk posed by most HCC's.

REFERENCES

1. Polk C: Sources, propagation, amplitude and temporal variation of extremely low frequency (0-100 Hz) electromagnetic fields. In *Biological and Clinical Effects of Low Frequency Magnetic and Electric Fields*. Edited by JG Llauro, A Sances Jr. Springfield, IL, Charles C Thomas, 1974, pp 21-48

2. Cook ES, Fardon JC, Nutini LG: Effects of magnetic fields on cellular respiration. *In* Biological Effects of Magnetic Fields. Edited by MF Barnothy. New York, Plenum Press, 1969, pp 67-78
3. Sheppard AR, Eisenbud M: Biological Effects of Electric and Magnetic Fields of Extremely Low Frequency. New York, New York University Press, 1977
4. Goodman EM, Greenebaum B, Marron MT: Effects of extremely low frequency fields on growth and differentiation of physarum polycephalum. Naval Electronic Systems Command, Technical Report Phase I, April 1975. Available from NTIS as ADA 010187
5. Coate WB: Seed germination and early growth study. *In* Project Sanguine Biological Effects Test Program Pilot Studies, Naval Electronics Systems Command, Final Report, November 1970, pp H-1 to H-10. Available from NTIS as ADA 717409
6. Krueger WF, Giarola AJ, Bradley JW, et al: Influence of low level electric and magnetic fields on the growth of young chicks. *Biomed Sci Instrum* 9:183-186, 1972
7. Yates VJ, Chang PW, Chen HJ, et al: Influence of ELF magnetic and electric fields upon the *in vitro* growth rate of chicken embryo cells. *In* Naval Electronics Systems Command, Technical Report Phase I, March 1975, pp 60-99. Available from NTIS as ADA 007578
8. Persinger MA, Lafreniere GF, Ossenkoff K: Behavioral, physiological and histological changes in rats exposed during various developmental stages to ELF magnetic fields. *In* ELF and VLF Electromagnetic Field Effects. Edited by MA Persinger. New York, Plenum Press, 1974, pp 177-225
9. Lenzi M: A report of a few recent experiments on the biologic effects of magnetic fields. *Radiology* 35:307-314, 1940
10. Batkin S, Tabrah FL: Effects of alternating magnetic field (12 gauss) on transplanted neuroblastoma. *Res Commun Chem Pharmacol* 16:351-362, 1977
11. Guralnick L: Mortality by occupation and cause of death among men 20 to 64 years of age: United States, 1950. *Vital Statistical Special Reports* 53, #3, 1963
12. Denver Regional Council of Governments, Office of Data Services: Profile of the Denver Region, 1960-1970. May, 1973
13. Fasal E, Jackson EW, Klnuber MR: Birth characteristics and leukemia in childhood. *J Natl Cancer Inst* 47:501-509, 1971
14. MacMahon B, Newill VA: Birth characteristics of children dying of malignant neoplasms. *J Natl Cancer Inst* 28:231-244, 1962
15. Blumer M, Blumer W, Reich T: Polycyclic aromatic hydrocarbons in soils of a mountain valley: Correlation with highway traffic and cancer incidence. *Environ Sci Tech* 11:1082-1086, 1977
16. Barnothy JM: Development of young mice. *In* Biological Effects of Magnetic Fields. Edited by MF Barnothy. New York, Plenum Press, 1964, pp 93-99
17. Reno VR, Nutini LG: Tissue respiration. *In* Biological Effects of Magnetic Fields. Edited by MF Barnothy. New York, Plenum Press, 1964, pp 211-217
18. Naval Electronics Systems Command: Navy-sponsored extremely low frequency biological and ecological research summary (update). May 1976, pp 44-53. Available from NTIS as ADA 02761
19. Berg JW, Burbank F: Correlations between carcinogenic trace metals in the water supply and cancer mortality. *Ann NY Acad Sci* 199:249-264, 1972

Bradley Westfall
Route 1 Box 434
Rudolph, Wisconsin 54475

March 17, 1979

Gloria Woida

C. U. R. E.
Saulk Center, Minnesota 56378

Dear Mrs. Woida:

Effect of EHV line on cattle reproduction

As a background: My father purchased this basic farm for dairying in 1934 and added 20 acres, then I added 38 acres and 120 acres and now have sold the 120 acres so as to maintain the last (original) 146 acres. The farm was basically a dairy farm throughout the years. Though we started artificial breeding in 1955 and started a hereford herd through artificial breeding to consume the extra feed we were producing and to take up the extra barn space during the winter. In 1970 we started in to the purebred Simmental beef for sale as breeding stock using the hereford herd as foundation animals. This was a very successful venture in the beginning as we sold the first two open one year old heifers for \$3700.00 and prices for other simmental breeding stock continued to be great. I added some excellent holstein milk cows to the original guernsey herd when my father retired in October of 1975. The milking herd was sold individually between October and December of 1977. The Simmental herd that remained was sold as a group in March of 1978. We now only cash crop our land except for four animals, two simmental steers, a simmental heifer, and a guernsey heifer from which we hope to keep ourselves in beef and milk.

During 1968 and 1969 we experienced our first breeding problems with our dairy and beef animals. Abortions, (abortions in late pregnancy were the only ones we were aware of and looking for at this time), sterile (apparently, but could have been caused by early abortions which we were not looking for), and weak or crippled calves. We blamed the poor conceptions on the A. I. technician and weak calves on the bulls the A. I. stud kept. The veterinary checked for all possible causes that he could think of and always sent samples of blood and tissue for testing to the state lab at Madison, Wisconsin. We never found an infectious cause and our herd has always been calfhood vaccinated for Bangs. Because of the problems we began looking for another artificial breeding organization. None other had good service in the area at the time, so I went to the ABS technician school. From April 1, 1970 on I did all the A. I. work in our herd and for a time worked for American Breeders Service. The results were tremendous and I thought we had solved the problems. First service conceptions started out at 75% and climbed to a high of 90% for the first two years. Then all our problems emerged and kept getting worse no matter what we tried. The cattle turnover because of abortion caused sterility was getting to great. Calf losses from abortions were also cutting into our replacement calf numbers and we redoubled our efforts to find a infectious cause, but to no avail. The discovery of what we think is now our problem came quite accidentally when we had to move our cattle to new late fall pastures during the dry falls of 1975, 1976, and 1977. The cattle one week after being in the new pasture would cycle normally and we again had as high as 90% first service conceptions. The only difference was that they were never under the EHV lines that were in and along their normal summer pastures. The good breeding records would hold while they were in the barn during the winter. This breeding difficulty was

disastrous for our beef operation as very few cattle calved in the spring and calves were not at the right age when they were supposed to sold or ready for breeding. The dairy herd calving intervals were too long to make them worth continuing as a dairy herd. We then proceeded to sell both herds as quickly as possible.

Looking back we found that the herds had been in the pastures under the power lines in 1968 and 1969 then out during 1970 and 1971 and back in these same pastures from 1972 until sold. The cattle were not in the pastures with the EHV lines, 1970 and 1971, because of crop rotation and reseeding of these pastures. This is 345,000 volt transmission line and is across and along our fields. The breeding problems and problem calves that we blamed on the A. I. technician and the A. I. Stud were apparently caused by the presence of the transmission line. As the same problems resumed from the summer of 1972 into the present. The two heifers we currently have would not breed this summer and they were still in the pasture under the EHV lines. Cattle less than 3 months pregnant would abort when put from the barn into the pasture during the Spring. Less than 2% would become pregnant (including virgin heifers) during the time under the EHV lines and carry calves to full term. This as opposed to 70% to 90% previously. Uneven and false cycles were persistent and didn't change until the cattle were removed from the pasture to another or put in the barn when conception would again jump to 70% - 90% range.

We believe that a state or national study or studies should be done under controlled conditions. Without the influence or possibly even the knowledge of the electric utilities until completion.

Our Simmental beef herd is in another part of the state and will be checked by myself for the breeding and calving results the past year. They will be a good control group for confirmation of my conclusions. I must stress here that I have absolutely no doubts about the effects of EHV transmission lines to my cattle. I will present my breeding records and interpret them for anyone that wants to take the time or pay my travel expenses to their location and I will lecture or give speeches if they wish and show our veterinary expenses which were unusually high during this period per animal.

Big power generation plants require EHV lines. So to eliminate the problem of EHV transmission lines, small plants should be built by cities or counties and operated without a profit, a true public utility. I feel the only safe transmission line is one that a small bird will perch up on.

Sincerely,

Bradley H. Westfall
Bradley H. Westfall

BHW/bw

Additional reference: Louise Young, 755 Sheridan Road, Winnetka, Ill. 60093
KNOWLEDGE of study done on small animals.

Study supposed to have been completed by the Ohio Department of Agriculture.

Study on humans up to 1000 feet from EHV power lines supposed to have been printed in Newsweek during June or July 1978.

* Some cows would abort at 7 months with some visible malformations after becoming pregnant, during the winter.

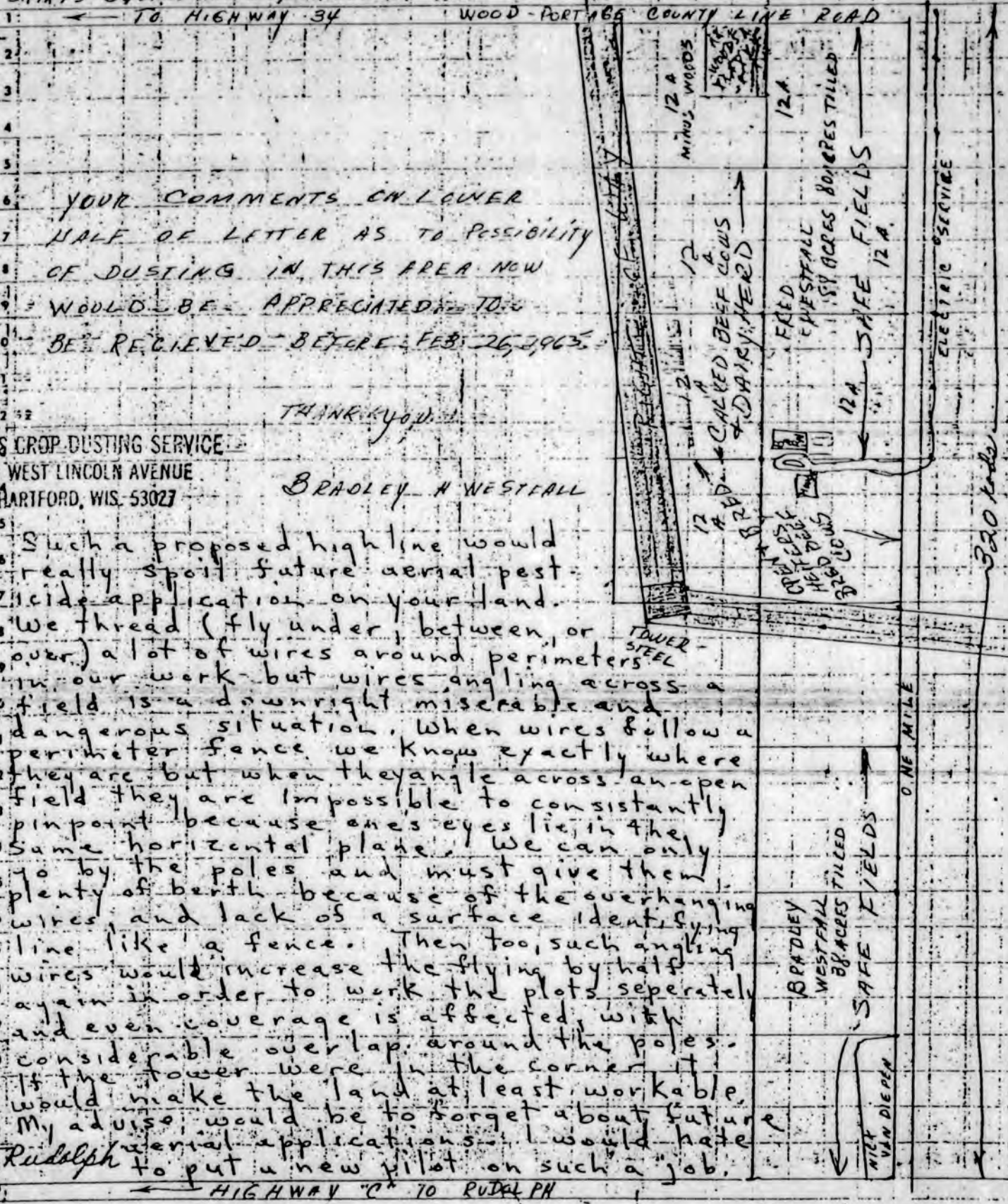
QUALITY CONTROL WORKSHEET

Date: 2-19-65

Page: of

By: BAW

DESCRIPTION FRED & BRADLEY WESTFALL FARMS NEAR RUDOLPH - 1 RED IS POWER LINE RIGHT-OF-WAY, BLUE IS (4) POLES, TOWER & CABLES OF E.H.V. LINE. TELEPHONE LINE ALSO SKIRTS SQUARE MIXE PERIMETER.



B 23 REC'D
B H W.

6 YOUR COMMENTS ON LOWER
7 HALF OF LETTER AS TO POSSIBILITY
8 OF DUSTING IN THIS AREA NOW
9 WOULD BE APPRECIATED TO
10 BE RECEIVED BEFORE FEB. 26, 1965.

THANK YOU

MILES CROP DUSTING SERVICE

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BRADLEY H WESTFALL

15 Such a proposed highline would
16 really spoil future aerial pest-
17 icide application on your land.
18 We thread (fly under, between, or
19 over) a lot of wires around perimeters
20 in our work but wires angling across a
21 field is a downright miserable and
22 dangerous situation. When wires follow a
23 perimeter fence we know exactly where
24 they are but when they angle across an open
25 field they are impossible to consistently
26 pinpoint because ones eyes lie in the
27 same horizontal plane. We can only
28 go by the poles and must give them
29 plenty of berth because of the overhanging
30 wires and lack of a surface identifying
31 line like a fence. Then too, such angling
32 wires would increase the flying by half
33 again in order to work the plots seperately
and even coverage is affected, with
considerable overlap around the poles.
If the tower were in the corner it
would make the land at least workable.
My advise would be to forget about future
aerial applications. I would hate
Rudolph to put a new pilot on such a job.

OB (10M 7-43)

← HIGHWAY C TO RUDOLPH

THE KILLER ELECTRIC

Is your electric toaster hurting your sex life? Don't laugh, it isn't funny! This investigation details the damage being done to your body and mind—from impotence and headaches to cancer and deformed children—by the invisible electric pollution in the air around you. Even more terrifying, the Pentagon and Kremlin are locked in a secret arms race to create electric weapons that may turn future conflicts into a war of wizards.

An investigative report by Lowell Ponte

Electricity is all around you. Invisible threads in the wires behind your walls, running like generals to your bidding—light the house, run on the television, cook your food, keep you warm at night. The only problem, civilian scientists are now discovering, is that the electromagnetic radiation emitted by all our uses of electricity may be slowly killing us—much as atomic radiation would.

This is no all-purse to the Pentagon or the CIA. They have spent more than twenty years, and many millions of dollars, studying how electric mind control and other means of electric warfare could be used against all enemies, foreign and domestic. The Soviet Union has done likewise, and the U.S. and USSR have long been locked in a secret war involving the use of these new weapons of electromagnetic radiation (EMR)—which now promise to give nations possessing them the power to alter the weather, generate earthquakes, and even disrupt the thought processes of entire enemy populations. Is this why the evidence of electric's damage to our health has been suppressed?

Nobody is sure when the Electric War began, what weapons using EMR

were first used by one nation against another. Perhaps it was begun unknowingly when the British first aimed a primitive radar beam (radar emits short electromagnetic waves—microwaves) toward attacking Nazi ships. But a major battle of the war began in 1943 when the CIA agents, using electronic devices, made a routine sweep of the US Embassy in Moscow for eavesdropping devices and discovered that the Soviets were beaming powerful microwaves into the top of the building. Technically, this act was an act of war; the embassy is legally US territory, and to attack it is the same as invading New York City or Los Angeles. What the hell were the Russians doing? Using the beams to pick up voice vibrations on wall-to-wall? Using the microwaves to a great extenting devices hidden deep in the walls? Or were they using American diplomats and their families as guinea pigs in some unknown experiment?

That microwaves could be harmful was well known. Soldiers had died from walking too close to the beams of powerful radars; their brains melted like hamburgers, the blood in their eyes looked hard. Even in smaller doses this energy vibrates in the electromagnetic spectrum between the

wavelengths of ordinary radio waves and visible light could induce nausea, vomiting, and strange buzzings in the head. And it could kill sperm, as was believed by many Navy radar technicians who sold "treatments" to shipmates bound for shore leave; the trouble was, as researchers have found, such microwaves deform the genetic material in sperm, and this leads not to no babies, but to grossly deformed ones. The U.S. Navy has for many years used its powerful radar beams to "paint" Soviet trawlers with microwave radiation.

But U.S. military experts prior to 1963 had assumed that the destructiveness of microwave radar beams depended on their power, their intensity. Certainly men working right near radars could develop vision-destroying cataracts as the clear fluid in their eyeballs—biochemically similar to the white

of an egg—was cooked to opaque whiteness by repeated microwave exposure. A few experts had quietly fretted during the Fifties that some touring fairs in praise of "progress" were treating the public to displays of how, with unshielded microwave beams, eggs could be fried before their eyes. "Pass your hand through the invisible beam," onlookers were told. "It's not dangerous unless you feel heat." As a youngster I remember doing that at one of those fairs; I remember, too, sneaking repeatedly into a downtown shoe store where, under an ever-on fluoroscope, I could see the bones inside my feet. With each viewing I built up to a dose of radiation now recognized as potentially lethal. (Thomas Edison's assistant died from demonstrating this invention too many times.) But that was the feeling back then, that in small doses all such radiation was harmless.

This was what confused the CIA about the radiation into the embassy they would code-name Moscow Signal: it was not powerful enough to do great harm, at least not by U.S. Public Health Service standards. The Soviet beam apparently reached an average intensity of four milliwatts per square centimeter within the embassy; the U.S. health standard, set almost arbitrarily and based on the estimate of the American electrical industry, called ten milliwatts per square centimeter a safe dose. But the Soviets, who have elaborately researched the effects of EMR for thirty years, considered a dose *one-thousandth* the size of the U.S. standard to be dangerous to the human body and set strict standards, limiting the number of minutes a worker was permitted near high voltage lines, large power transformers, or radar equipment. By Soviet standards, the U.S. Embassy was receiving a severely dangerous dose of EMR; by U.S. standards the same radiation was insignificant.

The CIA was aware of what the Soviets were doing, but it chose to disclose nothing to State Department workers who, along with their children, were being incessantly irradiated. Instead, the CIA instituted a study it called Project Pandora, named for the woman of Greek mythology who defied the gods and opened the box that unleashed disease and pestilence into the world. The name would prove prophetic.

Under Pandora the CIA began irradiating monkeys and other animals with microwave radiation of the same intensity and on the same wide array of frequencies as the Moscow Signal. The full results of these tests, some of which were done at the Walter Reed Army Institute of Research in Washing-

ton, D.C., have never been made public. But a few civilian scientists in the U.S., doing similar studies, have replicated results reported by Soviet research: that even at these low levels, EMR can disturb heartbeat and biorhythms, can cause convulsions and disorientation, can alter the chemical composition of the blood, can induce cancer, and can cause deformed births.

Under Pandora the CIA used ruses to gather samples of blood and genetic material from people working at the embassy in Moscow. Those tests, reports science writer Paul Brodeur in his excellent book on microwaves, *The Zapping of America*, showed "lots of chromosome breaks," an indication that the people were suffering genetic damage likely to cause mutations in their unborn children, abnormal development in their young children, and cancer in all.

In 1973, a full decade after the CIA discovered the Moscow Signal, columnists Jack Anderson and Les Whitten broke the story. They reported that the CIA feared the radiation was being used to brainwash U.S. diplomats, or at least to impair their efficiency, as the Pandora experiments had shown that it could warp the minds of laboratory monkeys.

As reporters looked into the situation, and as embassy employees fearfully sought medical consultation, an ominous picture emerged. Like his two predecessors, Ambassador Walter J. Stoessel, Jr. had come to Moscow in good health. Now he suffered from nausea, dizziness, and headaches, and was known to be bleeding periodically from his eyes. He would soon be transferred to a new post amid reports that he was suffering from leukemia, cancer of the blood. The two ambassadors before him, Charles Bohlen and Llewellyn Thompson, both died of cancer.

The Department of State ordered blood tests of all embassy employees. The tests revealed that on average their blood "lymphocyte count was 40 percent higher than the count in other foreign service personnel," and that other indexes of blood chemistry were also wildly abnormal. Soviet scientists have published studies that show this change in the white blood cell count to be caused by microwave bombardment and that it foreshadows a host of serious symptoms. The State Department refused to blame the increase on the microwaves—which by then the White House had officially protested—and it described the alteration in blood chemistry as beneficial, for white cells work as part of the body's immune system. The unusually high counts, however, suggest that the bodies of the embassy employees were fighting against

HOME ON THE ELECTRIC RANGE

We've all seen signs warning the wearers of heart pacemakers to stay out of places where microwave ovens are used. But we all have natural pacemakers that order our heartbeat, regulate our sense of time and space, and keep our mind and moods stable. The invisible "electric smog" emitted by household appliances subtly affects our natural pacemakers, leaving us irritated, exhausted, unable to think clearly, and sometimes even ill.

The most common sources of electronic radiation are things run by electric motors. Inside those motors electromagnetic energy jumps across thousands of tiny gaps every second, so every motor, to a greater or lesser degree, is bombarding you with pulsating electric pollution.

Consider a partial list of everyday items with electric motors or spark gaps:

- Automobile motor
(especially the ignition system)
- Motorcycle
- Moped
- Elevator
- Power lawn mower
- Trucks
- Electric saw
- Electric trains
- Chain saw
- Air conditioner
- Washing machine
- Electric carving knife
- Electric hair dryer
- Electric toothbrush
- Electric clock
- Record player
- Electric refrigerator
- Garbage disposal
- Dishwasher
- Automatic garage door opener

unseen invaders, perhaps the body's own irradiated cells, that unless checked might become cancers.

Why weren't they told? Many angry embassy employees wanted to know, and several are now suing the government for imperiling them. But, in fairness to the CIA, the reason is simple enough, apart from its desire to decipher Soviet motives by analyzing this action. The microwave level was, by U.S. standards, entirely safe. To admit its hazard could have far-reaching consequences, for right now millions of Americans live and work with more radiation than was beamed at the Moscow embassy. Those in the thousands of high-rise buildings in hundreds of U.S. cities, those at nearly eye level with television station transmission antennas and microwave relay horns, are daily irradiated with far more microwave energy than were the Moscow victims.

"It's the biggest can of worms, environmentally and politically, we'll face in this century," a Rand Corporation consultant told me. "Our whole society, our culture, our machinery — they're all electric. And from the Pentagon point of view, all our radars, satellites, communication systems — all the stuff we need for national defense — it's all high-power electric. So what happens if you come along and show people that their TV set will give them cancer and kids with two heads? A lot of them are going to say, 'Unplug the damned electricity.' But we can't unplug it! The whole momentum of our civilization is toward more electricity, not less. It holds us together like a giant electromagnet. Turn off the power and we crash into a million incoherent pieces."

A few scientists now have begun to utter the unspeakable — that there is a serpent in our electric Garden of Eden, that instead of living better electrically, as the advertisements promise, we may die quicker. Recall that we used to speak of "Better Living Through Chemistry," a slogan used by the explorers of inner landscapes via LSD, a fad that lost popularity when the government issued reports showing that lysergic acid caused chromosome damage and could cause deformed births. But it's one thing to quit an entertainment like LSD and quite another to unplug the electric lifeblood of our whole technology.

Soviet scientists hypothesize that the human body has its own natural resonant frequencies. After all, our brains and central nervous systems interact with each other and the environment through exchanges of electrical impulses. We are both senders and receivers of electric energy. Thus, it stands to reason that when electrical energy emitted nearby is on wavelengths resonant

with ours, we will "feel" the signals as symptoms — buzzing, heat, headache, impotence, disorientation, nervousness, illness. Such are the felt symptoms of EMR exposure found by Soviet research.

Each year the amount of electricity used in the United States increases by about 5 percent, and much of that ever-growing total seeps back into the environment as electric smog, a vast and swelling invisible garbage dump of electromagnetic radiation in which we all must live.

When electricity was first being introduced, many people resisted it as dangerous. The reason: it was said that if you removed the light bulb from its socket, electricity would "leak" into the room. Likewise, when radio made its debut, stories held that people with fillings in their teeth found themselves "receiving" local stations.

It is now clear that these tales were somewhat correct. Electricity does "leak." Wherever it flows through wires, whether high-voltage lines or the wiring in your home, it generates radio-frequency electromagnetic fields that extend far beyond the wire itself. Wherever it flows through complex circuitry, as in your television set or stereo equipment, a wide range of such radio frequency energies may be emitted.

And the notion that people can be resonant with some of these frequencies is also apparently correct, although those critical wavelengths and the sensitivity of the receiver will vary widely from person to person.

In school most of us were taught to perceive ourselves essentially as *chemical* beings made up of so many grams of iron, so many pounds of calcium, so many gallons of water. "Rendered down, you are worth \$2.38 for your constituent chemicals," the science teacher would say — a figure now bolstered by inflation and by the discovery that we include some rare amino acids worth \$800 an ounce. As chemical beings we were taught to take chemical drugs to cure sickness, to change moods or to charge our metabolism.

But our science teachers may have failed to teach us we are also *electric* beings. A chain of electrical impulses enables your eyes to scan this page and your brain to decipher the meaning of the squiggles on this paper. The poet Walt Whitman knew it more than a century ago. "I Sing The Body Electric," he wrote. And so it is.

Religious figures have for millennia been portrayed in art with halos, fields of light or energy, surrounding them. In 1939 the Soviet researcher Semyon Kirlian discovered a method of photography that makes visible the pattern of electricity that is emitted by all objects,

more brightly by living things than by inanimate objects. By studying changes in these Kirlian "aura" photographs, Soviet investigators have claimed that they can predict the emergence of several illnesses for which no other physical symptoms are detectable and that they can show what seems to be a transfer of electrical or "bioplasmic" energy from the hands of a psychic healer into the body of an ailing patient.

Precisely what such photographs show is debated by scientists, but it is clear that some electrical phenomena involving the body are being recorded on film and they seem to change markedly when the subject is intoxicated or sober, sick or well, calm or angry. This "aura" or electric body seen in the photographs can extend several inches beyond the surface of the skin, and it tends to flare most brightly — as one might expect — at juncture points in the body's own telephone exchange and intercom, the central nervous system. (These points also correspond precisely to those the Chinese have targeted for countless centuries in the practice of acupuncture, which is based on the idea that health is restored by removing blockages in the body's invisible energy circulatory system.) It is clear, too, that this mysterious electrical field

MICRO-TIDAL WAVE

Microwaves, which mounting evidence now shows can cook your goose in small doses just as they cook your rump roast in the slightly larger doses in home microwave ovens, have begun to pervade our lives. No longer limited to the military, airport, and police speed-trap radars, their sources around the home include:

- Automobile motors
- Microwave ovens
- Television sets (color and black and white)
- Stereo equipment
- Citizens Band radio transmitters
- Amateur radio transmitters
- Soldering irons
- Telephones and their wiring
- Electric wiring
- Diathermy devices

In some of the above, the dose of microwaves given off is small, but recent evidence shows that tiny doses can have lethal and perhaps cumulative effects — each exposure doing a permanent bit of genetic damage to your body's cells. The Consumers Union, publishers of *Consumer Reports* magazine, has refused to give ratings to any microwave oven because such ratings would encourage people to buy them at a time "when nobody is really sure what a safe dose of microwaves is."

interacts with the environment.

Our grandparents read by candlelight and heated their homes with firewood or coal, much as people have done for thousands of years. We are the first generation to live in an environment intensely charged with human-made electricity, which we have plugged in and turned on without knowing what effect it could have on the evolution of our species. As a result, the body of a human living today in New York or Los Angeles, Houston or Cleveland, Detroit or Philadelphia, Boston or San Francisco, Minneapolis or St. Louis, Chicago or Washington, D.C., or any of a hundred other great cities of the post-industrial world is dosed daily with up to 100 million times more electromagnetic radiation than our ancestors soaked in from sunlight and starlight. Who can doubt that this has a large, and probably negative, effect?

"Man may soon enter an era of energy pollution of the environment comparable, in public health and ecological implications, to the chemical pollution of today," warned the White House Office of Telecommunications Policy in March 1973, the same year the CIA's Project Pandora became public.

The question is, at what point do we say the threat is great enough to begin pulling out the plugs — and whose plugs do we pull? Microwave ovens, for example, are deemed safe by the U.S. Public Health Service if they leak microwaves into their surroundings at a level 25 percent more intense than the Moscow Signal. But though they may leak that much when new, in everyday use the shields may be damaged, the seals worn, the doors loosened, and as a result the ovens would pour more invisible radiation out at a rate a hundred times higher than the U.S. safety standard, 100,000 times higher than the Soviet safety standard. Thus, the Consumers Union, publishers of *Consumer Reports*, has refused to approve any microwave oven because, say they, "nobody is really sure what a safe dose of microwaves is."

That statement may be imprecise. The Pentagon and CIA may know. So may the electrical industry. But for them to say it is to invite explosive political protest and a tidal wave of lawsuits from radar technicians, pilots, and others whose health has been damaged by exposure to what they were told was harmless EMR radiation. Three such lawsuits by radar-involved workers have already been won, based on evidence by New York University ophthalmologist Dr. Milton Zaret that cataracts can be caused by supposedly "safe" microwave doses.

As of 1972, wrote investigative reporters Joel Griffiths and Richard Ballantine, the typical city-dwelling Amer-

ican already gets a constant dose of electromagnetic radiation of at least ten milliwatts per square centimeter, the maximum level called safe by the Public Health Service. This is from microwaves ricocheting off buildings, from radio and television transmitters, and from power lines above or under the streets. The amount increases yearly as we use more and more electricity. And the evidence increases yearly that this accumulation of radiation has a cumulative effect on our bodies, just as atomic radiation does. When genetic material is mutilated or destroyed, it does not merely disappear. Damaged organ or brain cells remain, weakening or damaging the whole living organism.

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the wire itself.

Microwaves are the most dramatic form of EMR pollution: you can cook with them and hence kill with them, as a California woman recently proved by savagely putting her pet dog into her microwave oven for punishment. The poor dog, said reports, "exploded."

But energy radiating anywhere along the electromagnetic spectrum can have severe effects. Recently, for example, farmers in Minnesota followed the lead of protesters in Upstate New York and Illinois in opposing construction of high-voltage power lines near or over their land. "We're being asked to live with an unknown danger so people in the city can have more dumb gadgets," one farmer shouted at a line of police brought to thwart threatened attacks on the construction crew, an event covered on network television. Among the risks of power lines are these: vast amounts of electrical energy radiate around the wires, enough in many cases to light an unconnected neon bulb held in bare hands — as science writer Louise B. Young demonstrated on the cover of her 1973 book, *Power Over People*, a study of the disregard many electric companies have for the health and well-being of people living near their power lines. Because these lines are subject to natural forces, they often develop weak points where more than

a million volts of electrical potential may be radiating off the wires — enough to severely shock a farmer driving a tractor underneath, enough to shock a child in the playgrounds the City of Los Angeles thoughtfully built underneath high-voltage lines "so as not to waste this valuable space."

Power lines also change the electrical charges in the air, and medical evidence shows the impact this has on human health. We tend to feel vibrant, alive, full of bounce and energy when breathing air in which the molecules carry a negative electrical charge — negative ionization, this is called — a condition commonly found near waterfalls, near the ocean surf, and high in mountains. Conversely, we tend to feel sick, weak, depleted, and depressed when the air is positively ionized, a common condition during hot and humid or hot and dry days. In parts of the world where annual hot winds bring heavy positive ionization of the air — in Arabia and parts of Switzerland, for example — the laws for centuries have dealt more gently with those whose crimes took place during the months of "craziness" carried by the winds, write Fred Soyka and Alan Edmonds in their book, *The Ion Effect*.

High-voltage lines positively ionize the air around them, thus impairing the health of living things nearby. But with modern technology we have learned how to bring such "devil winds" into our homes and workplaces as well, with the flip of a switch. Where electrical elements are used for heating — in ovens, air conditioning systems, hair dryers, and radiant heaters, among other places — we fill the air with ions that deplete the body's own vital electricity. We make ourselves restless, tired, irritable, and often unable to relax and think clearly.

But the greatest problem with power lines is in that question of what I call "bioresonance." For those whose bodies are resonant with some of the emissions of nearby power lines, a host of health problems can result: fatigue, headaches, impotence, and other maladies.

Research done at the University of California in Los Angeles by neurophysiologist Dr. Ross Adey, for example, showed that the kind of simple power lines that carry electricity to apartments or homes like yours often generate an electromagnetic field that reaches for several hundred yards beyond the line itself and that can oscillate at seven Hertz (cycles per second). Dr. Adey experimented with monkeys, training them to perform simple tasks repetitively precisely every five seconds. He then put the monkeys in a room into which was beamed a very

(continued on page 102)

THE KILLER ELECTRIC

(continued from page 44)

low intensity radio signal of seven Hertz frequency. The results: the monkeys' sense of time and rhythm was wildly distorted by the signal, which was considerably milder than the Moscow Signal. When West German researchers did similar experiments with humans, their subjects reported intense feelings of time disorientation, some reporting that a twenty-four-hour period in a room permeated with seven Hertz electromagnetic waves felt like the passage of sixty hours. Perhaps 200 million or more North Americans live within, or in the course of a typical day travel through, such electrical fields, fields which interact with their own body electricity and influence their biorhythms in subtle ways. It is so much a part of modern civilization that we never question it. We are all, so to speak, on the same drug and all perceiving the same distorted reality. We are trapped in an electric spider web of our own making, a web on which we depend even as it threatens our health and well-being and our survival as a species.

What can harm us accidentally can also be used deliberately as a weapon against selected people. The awesome thing about the Moscow Signal was not only its microwave energy, but also its oscillation—a fact seldom mentioned. These were not continuous microwave beams that the Soviets aimed into the U.S. Embassy. They were pulsed beams, either turned off and on or frequency-shifted so they would "flicker" at rates between one and fifteen Hertz. The significance: this is the frequency range of normal human brain waves—Alpha waves range from eight to twelve Hertz, Beta from twelve on up, Theta from four to seven Hertz, and Delta from one to four Hertz. By pumping electrical energy into people's heads in this way, using energy already resonant with the electrical wavelengths of their central nervous systems, it seems likely that mental and biological distortions and disorientations could be produced. "Brainwashing" was the word invoked by journalists Jack Anderson and Les Whitten to describe the CIA's concern over these signals, and it seems apt.

In CIA research with human subjects, it was found that each person has critical frequencies that unlock doors in the mind to tranquility, to bliss, to anxiety, to disorientation, and to intense pain. The Pentagon had long known that such responses could be tapped in a person. The Navy, after all, had

The Soviets, who have elaborately researched the effects of electromagnetic radiation for thirty years, considered a dose one-thousandth of the size of the U.S. standard to be dangerous to the human body.

funded extensive research by Yale University physiologist Dr. José M.R. Delgado and others who showed that such reactions could be induced in any brain to which you could attach electrodes. In his book, *Physical Control of the Mind: Toward a Psychocivilized Society*, published in 1969, Dr. Delgado waxed eloquent about how he could gently shock into goodness any wrong-thinking individual. But the CIA went further, finding that you could change a person's mind without attaching electrodes to the frontal lobes at all. Through Project Pandora's research, the CIA took a long step toward electrical control of the mind and opened further the dark box of a future psychocivilization.

But the Soviets have researched electromagnetic radiation effects far longer than have the CIA or Pentagon, and in October 1976 they began an experiment that dwarfs anything the U.S. military has contemplated. The Soviets began tampering with Earth's magnetic field.

From a configuration of four incredibly high-powered transmitters, three of them laid out in a giant triangle with points in cities northwest of Moscow, the Soviets began to send out coordinated radio pulses. The signals disrupted shortwave radio broadcasts and amateur wave bands throughout the world and stirred controversy and protest.

The Soviets were testing a theory set forth by the eccentric genius Nikola Tesla, revered as the Slavic Thomas Edison. Tesla invented the Tesla coil, much of the theory behind television, and the technology of alternating current. He also claimed to be in communication with people from Venus. Shortly after the turn of this century, Tesla theorized that by using coordinated radio impulses it should be possible to manipulate the part of Earth's magnetic field that resides at the edge of space up in the ionosphere by gen-

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erating giant electric standing waves. These waves, said Tesla, could then be manipulated to change the course of giant wind patterns, like the jet stream, that shape our weather. By 1976 the Soviets were prepared to try any idea that promised to redeem their worsening weather; by all indications the planet had been growing colder since the Forties and was threatening a new ice age that would all but destroy the Soviet Union as a world power. As I predicted in my book, *The Cooling*, in 1976, weather problems would soon force the Soviets to try some desperate technological gamble, and they did.

In December 1976 the Soviets launched three new satellites to coordinate the signals from their ground-based transmitters. The impulses that followed were a classic experiment based on the frequency wavelengths Tesla theorized. The jet stream, already distorted by decades of expanding cold air over the Arctic, locked into the odddest bend of this century—far north in the Pacific, bringing record winter warmth to Alaska, and far south over the eastern United States, bringing snow for the first time ever seen in Miami, Florida, and in the Bahamas. Weather was remarkably good that winter in the Soviet Union, which until then had suffered repeated crop failures in the Seventies and had been forced to beg food from the United States.

As the 1977 winter approached, the Soviets began a new series of configured high-energy transmissions. On November 21, a new huge wave stretched along Earth's ionosphere from the western tip of Alaska to northern Chile in South America. Rain returned to California after two years of record drought, flooding towns, while waves tore apart beachfront homes. In many parts of the eastern U.S., cold records set the year before fell, as did a number of buildings under the weight of never-before-seen snowfall. Hurricane-force winds tore across Europe, killing dozens of people and bringing bizarre snowfall to Spain and southern Italy.

But during that time, earthquakes seemed to erupt everywhere on the planet, one of nine-point-one magnitude in the Indian Ocean being the strongest ever recorded. Dr. Andrew Michrowski, an expert on Tesla who works as a technologies specialist in the office of Canada's Secretary of State in Ottawa, told me, "The Soviet experiment got out of their control. They created these giant changes in the Earth's magnetic field, but then they could not

dissipate the standing waves, although they tried to neutralize them with new waves. But this is the reason for both the crazy weather and the earthquakes—and the airquakes, too."

Airquakes are strange booms first heard off the northeast coast of the United States in December 1977. They are, Michrowski believes, experiments by the Soviets in how to use coordinated radio pulses to generate an incredible release of electromagnetic energy in one spot of the Earth's magnetic field—"like an explosion," he told me. I would prefer to accept Pentagon explanations that the booms came from jet airplanes or swamp gas or flying saucers or something else. But when these booms happened, many smoke detectors in the region were triggered, detectors that react to ionization, to a

IONIC MAN

Agrowing number of scientists agree that the state of human health reflects the electricity in the air you breathe, on its "ionization." Where the fine dust and molecules in the air carry a negative electrical charge, our bodies feel vigorous, alert, full of energy. Where the air carries a positive electrical charge, the body tends to feel depleted, exhausted, and a person is more likely to be irritable, headache, and disoriented. (The body will also age more rapidly in a positive ion environment and is more likely to develop cancer.)

In parts of the world where annual hot winds bring heavy positive ionization—in Arabia and parts of Switzerland, for example—the laws for centuries have dealt more gently with those whose crimes came during the months of "craziness" the winds carry.

With modern technology, we have learned how to create such crazy, positively-ionized air in our own homes and workplaces, bringing madness and sadness as near as the electric switch. Among the things that flood our environment with positive ionization are:

- Power lines
- Electric air conditioning, including fans
- Electric heaters, especially radiant-type
- Electric broilers and ovens
- Hair dryers
- Electric hair curlers
- Television sets
- Electric blankets
- Electric heating pads
- Electric toasters
- Sunlamps



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See "Weather Shock" by Lowell Ponte, *Gallery*, December 1977.

We are the first generation to live in an environment intensely charged with human-made electricity, which we have plugged in without knowing what effect it could have on the evolution of the species.

rapid change in the electric charges in the air. "If I'm right," says Michrowski, "the Soviets are on the verge of a breakthrough into a new weapons technology that will make missiles and bombers obsolete. It would allow them to destroy up to five American cities in a day just by sending out radio impulses. They could also induce panic or illness in whole nations."

The U.S. has had its own opportunities to study such phenomena, and what has been reported seems to confirm Tesla's theories. A U.S. high-energy transmitter in Antarctica studied by Stanford University physicist Dr. Robert Helliwell does indeed generate a "rain of electrons" from the ionosphere, in effect a new magnetic flux. And just as Tesla predicted, in some configurations its signal becomes amplified by realignment of the planet's own magnetic field. Unacquainted with Tesla's work, Helliwell expressed surprise that the "signals were somehow amplified up to a thousand times" by unexpected natural forces during his experiments.

The U.S. Navy, worried for years at its inability to communicate in an emergency with submarines submerged on the far side of the planet, has tried repeatedly to build a foolproof buried radio system with antennas dug in over thousands of square miles. The system, variously called Project Sanguine and Project Seafarer, has, by public protest, been prevented from being built in Nevada, Texas, Michigan, and Wisconsin. As proposed, it would use very high power on Extremely Low Frequencies (ELF), in the Hertz range of human brainwaves. A prototype was built in Wisconsin, but it, too, came under fire when Senator Gaylord Nelson (D., Wisconsin) forced the U.S. Navy to reveal its suppressed test data showing abnormal blood chemistry in nine of the ten men who had worked on it. Some of these men showed the same symptoms as per-

sonnel in the Moscow embassy. Spearheading the protest against Sanguine, environmentalists also produced evidence that its transmissions would be powerful enough to disrupt the migrations of birds, the mating habits of squirrels and other animals nearby, and even the reproductive cycle of plants.

The Navy has been reluctant to discuss precisely how Sanguine is supposed to work, but this much is evident: it is supposed to fill the entire cavity between the ionosphere above the Earth and the planet's stony mantle with electrical impulses capable of reaching a submarine twelve thousand miles away under thousands of feet of water. To believe it can do this, the Navy must know something the public does not, something about the nature of a type of radio transmission generally assumed to be disruptive to the environment. They want to saturate the entire planet's environment with such transmissions, and that should give us pause.

We should pause, too, at the tales of "satellite killers" used to cloak what the U.S. military knew about the December 1976 Soviet satellite launches and concomitant news stories about the development of "particle beam" death rays. We and the Soviets have indeed been in a race to develop ray weapons, but as a former Pentagon consultant myself, I have reason to suspect that neither laser light nor intense beams of particles are at the cutting edge of U.S. research. Both methods are too subject to the oddities of the atmosphere, to thermal bending effects, clouds, and the like. People have forgotten that the laser — light generated by energy-stimulation of the right sorts of atoms — has an older brother. Two years before discovery of the laser, Hughes Aircraft scientists in California announced development of the working prototype of the maser, a device that stimulated atoms to emit an incredibly powerful beam of microwaves able to "shatter material." Suddenly nothing more was said about the discovery, and virtually nothing to this day has appeared discussing it. This seems odd, for a maser beam could slice through the clouds and mirrored surfaces that would thwart lasers, particle beams, and the like. It makes one wonder, doesn't it? But somehow I can't quite clear my mind about how to put all these puzzle pieces together. Perhaps the Electric War is already over, and somebody else has won. □

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FROM: THE PROGRESSIVE
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Trouble on the Land:

Confrontation on the Prairie

PAUL DAVID WELLSTONE and LAMONT TARBOX

Farmers in western Minnesota are up in arms. Their anger is directed not against low crop prices or bad weather, but against a more tangible enemy that may be just as hard to beat. The farmers are fighting two large electrical utilities — Cooperative Power Association (CPA) and United Power Association (UPA) — that want to build a power line across prime crop lands and, in some cases, virtually over the roofs of their homes.

The proposed line is part of a huge effort by the utilities to meet the expected demand for electricity in Minnesota in the 1980s. The plan is to strip-mine coal in North Dakota, build electrical generating plants there, and then send the power to Minnesota's Twin Cities, Minneapolis and St. Paul, through gigantic overhead transmission lines. The project is expected to cost CPA-UPA at least \$800 million.

The transmission line towers, if built, will rise 150 feet above the ground and cross 8,000 acres of Minnesota farmland. The size of the line and the volume of current flowing through it pose special problems not associated with smaller power lines. The Minnesota Department of Natural Resources (DNR) says deer will not pass under the line and birds will not nest near it because of the build-up of static electricity in the air; therefore, all state-owned wildlife areas have been exempted from the proposed route.

The farmers are indignant because the same concern has not been extended to them. They fear the massive electrical current will cause significant chemical reactions in the air around the line, creating dangerously high con-

centrations of ozone. They also have other worries: Large pieces of equipment, buildings, and fences may have to be grounded to prevent a build-up of static electricity and to keep current from jumping from the line to the ground. Advanced irrigation systems may be rendered useless, and aerial spraying may have to be curtailed. The towers may enhance the risk of serious accidents whenever heavy machinery is used. The line may create a noticeable noise that bothers livestock, and decrease the value of the farmlands. And the farmers are deeply disturbed about the way the utilities have tried to steam-roller permission to construct the line from local and state officials.

The farmers have responded in their own way. Citizens' groups involving hundreds of families have sprung up in several counties. Farmers have testified at local and state hearings. They have raised large sums of money to hire a battery of lawyers to explore all possible legal means of stopping the line. They have persuaded the state legislature to pass a new law covering the routing of future power lines. They have even obstructed the work of utility survey crews in the fields, destroyed equipment, and gone to jail to keep the line off their lands.

The utilities have the upper hand in the courts, and see no need to compromise. But they have underestimated the farmers all along, and the fight is not over. If the farmers lose in court and the utilities proceed with construction, there will be more confrontation on the prairie.

Farmers here and throughout the Midwest are conventionally regarded as conservative, but their conservatism is of a special sort, based on the life they lead and their productive relationship with the land. Their ownership of land and responsibility for its successful cultivation foster an independence not found in most other segments of today's America. They value hard work, independence, self-sufficiency, and self-reliance. Farming is more to them than a livelihood. It is the source of their lifestyle

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and the legacy they hope to pass on to their children. Some farmers perceive the land as a "sacred trust" they hold for themselves, their children, and the rest of the nation. To threaten their land is to threaten everything they have, everything in which they believe.

Though farming encourages independence, experience has taught them the value of collective action. They have had organizational experience in the Farm Bureau, the National Farmers Organization, and various fuel, fertilizer, and marketing cooperatives. But the strongest inducement to collective action has come from the common perception of the threat posed by the utility companies. One farm woman, Carolyn Koudela of Douglas County, told us, "We've been told the farmer is about the most independent person there is. But when it comes to something that's going to bother them, or hurt their welfare or their family's welfare, they can join together faster than anybody or any labor union or anything else."

The story of how the opposition to the power lines organized itself bears her out. The utilities' plans first came to the farmers' attention in the summer of 1974 when Jim Nelson, a farmer in Grant County, heard about them at a county commissioners' meeting. At the meeting, the utilities made their request for permission to build a power line through the area, and Nelson discovered that the line was to be routed right across the top of his home. The commissioners took no action at that meeting.

The next day, Nelson went to Jerry Bates, a neighbor who sold crop insurance and knew many people in the country. "Between the two of us, we started a kind of chain reaction thing of notifying everyone along the route," Nelson recalls. Initially, they contacted farmers who were to be right under the line. The utility companies held an "informational meeting" ten days later, and 100 farmers crowded into the Grant County courtroom to voice their opposition. One week later, Nelson and his neighbors had formed their own organization, No Power Line (NPL), with an initial membership of 150. At the first meeting, each family contributed \$25 or \$50.

Farmers in neighboring counties also organized. In Stearns County, a few farmers heard that a power line might be coming through and that a township official had a map of the proposed route. They borrowed the map, made a copy, and began to inform their neighbors that the line would cross their land. The farmers of Stearns County quickly organized and formed an organization, Keep Towers Out (KTO).

Pope County, located between Grant and Stearns counties, turned out to be the center of protest. For one thing, Pope County commissioners were opposed to the line and effectively used a zoning ordinance to delay consideration of the companies' requests for permits. Farmers formed their own organization, Towers Out of Pope Association (TOOPA), in late February. The president, Harold Hagen, expressed the group's position in *The Pope County Tribune*: "TOOPA aims to completely eliminate the power line from coming through the county. We aren't

against a power line going to the metro area, but we want the line to go through areas less suitable to agriculture."

Members of each of these groups began attending county commission, zoning board, and planning commission meetings in their own areas. Sometimes farmers from one county traveled to meetings in other counties to testify against the line and show their support for their fellow farmers. NPL discovered that the zoning ordinance in Pope County was helpful to farmers there, so it obtained passage of a similar ordinance in Grant County.

In March 1975, the various county groups joined together in a multi-county organization, Counties United for a Rural Environment (CURE). Each county had one representative on the board of CURE, and Harold Hagen of TOOPA was elected president. CURE hired a lawyer and began to consider legal strategies, though most of the farmers concentrated on attending local meetings, where they tried to prevent local officials from granting the utilities permission for the line.

The response varied. Stearns County officials were inclined to support the power companies from the start, and farmers were unable to stop officials from granting the necessary permits. In Grant County, farmers won enough support from local officials to pass the new zoning ordinance and hold extensive hearings — some of them attended by as many as 200 citizens. But the county commissioners were not opposed to the line, and it seemed likely the utilities would be granted permits, though with some restrictions: keeping the line 500 yards from farmsteads; barring construction during muddy times of the year, and requiring that all topsoil be carefully replaced.

In Pope County, the commissioners stood fast in opposition to the line throughout the permit proceedings. The farmers had won support from people living in the small towns of the county. Without a permit in Pope County, the whole project was threatened — so the utilities came up with a strategy that was, in effect, an end run around local authorities and made local opposition easier to overcome.

In April 1974, the Minnesota legislature passed a Power Plant Siting Act, which provided that the Minnesota Environmental Quality Commission (MEQC) would make a final determination on power line routes after extensive public hearings. The Act required a "certificate of need" from the Minnesota Energy Agency; hearings to establish a twenty-mile wide corridor that would contain several possible routes for a power line; hearings to determine the actual route of the line, and an environmental impact statement. But even though the Act was passed before the line was built in western Minnesota, the utilities managed to keep the power line outside its jurisdiction; they claimed that since construction in North Dakota had preceded the legislation, they had a "grandfather privilege" to adhere to the old arrangements of local approval for the line.

The companies did not expect the determined opposition they continued to encounter. Local officials dragged their feet, and it seemed likely that Pope County would refuse to grant permits. In April 1975, the utilities

'People have distrust for government now that has never existed before'

reversed their earlier position toward the Minnesota Environmental Quality Commission, renounced their right to be "grandfathered," and asked the MEQC to take over consideration of the line. The Commission accepted jurisdiction and the struggle shifted from the county to the state level.

MEQC established a forty-nine-member Citizens Advisory Committee and held hearings during the summer and fall of 1975. At the same time, farmers in northern Grant County and Douglas County formed two new organizations, Preserve Grant County (PGC) and Save Our Countryside (SOC). These groups were prompted by fear that other farmers' organizations would succeed only in moving the power line off its original target and onto farms elsewhere. All of the farmers' organizations mistrusted the state agency. As the MEQC held hearings around the state, the farmers followed, attending every meeting. In one case, they discovered that the transcript of a hearing omitted two-thirds of the testimony presented, most of it in opposition to the power line. The farmers suspected MEQC was playing the power companies' game.

In late September, the Citizens Advisory Committee made its recommendation. Harold Hagen, president of CURE, described it this way: "It's not far enough north to suit most of us but with the guidelines we had it was the best we could do. . . . We were limited by the outside boundaries established by the EQC and our route runs pretty much along the northern edge of that boundary. . . . If we didn't pick anything we would have lost the opportunity for input into the issue." But on October 3, MEQC rejected the corridor chosen by the Citizens Advisory Committee and chose a path close to the one requested by the power companies.

In December, MEQC announced the precise route of the line, and six months later — in June 1976 — the power companies began survey work. The anger that had been building up among farmers exploded when the survey crews appeared on the land. Farmers gathered around the crews and turned on chain saws so the surveyors could not hear each other. Others parked their grain trucks to obstruct the surveyors.

"It was a spontaneous reaction," Harold Hagen says, "that came right in the neighborhood when someone felt that here is something that shouldn't be and he gave a call and soon there was a network of calls and the people just sort of rolled in from all over in a matter of just short minutes." Fighting erupted wherever the crews tried to work. Because of these confrontations, Governor Wendell Anderson intervened and persuaded the power companies to halt survey work, at least temporarily, in Stearns County.

When the companies resumed surveying in other counties in September, farmers again blocked their work. In Pope County, a local judge issued an injunction against the farmers' civil disobedience and ordered the sheriff to enforce it, but the sheriff and the county board said they did not have the manpower to control the demonstrations. There was speculation the governor might send in the National Guard.

In January 1977, the new governor, Rudy Perpich, made several "mystery trips" to visit farmers in western Minnesota. He conferred with members of CURE and CPA-UPA, and they agreed to meet with an arbitrator. The meetings broke down in March, however; the farmers walked out because the power companies had begun condemnation proceedings in North Dakota and parts of western Minnesota.

Since March, the struggle has moved into the courts. A three-judge panel appointed by the state supreme court ruled against the farmers, and in August the state supreme court heard arguments from both sides. The court has not yet decided the case, but the farmers plan to appeal to the Federal level, if necessary, and will continue their legal battle as long as they can. Pending a final court decision, construction on the power line has stopped, but many farmers in the area are not optimistic about the long-range prospects. John Tripp, one of the farmers, says, "People have a distrust for government now that has never existed before."

They also have a new appreciation of the effectiveness of collective action and militant protest. Jim Nelson, one of the younger farmers, says, "I'm part of the generation that opposed the Vietnam war fairly seriously, and civil disobedience was a big part of that. . . . I never did it myself, but it was always acceptable to my generation." Dennis Rutledge says the farmers' protest movement "showed that we were strong in our convictions but also sensible and law-abiding citizens as much as the law was going to let us be. The law had stepped on us and forced us to that hill out there, but we weren't going to go so far as to seriously break the law. We were only going to break it enough to show that we were serious. And that's exactly what we did."

Still, some farmers are talking about shotguns and dynamite. One of them says, "I think it would be a big blunder on the part of our state government to try and force the line through here. We might have another Attica." Another farmer explains, "There are two varieties of resistance at that point, one of which is substantially more honorable than the other. One is the civil disobedience type of thing, and the other is the dark-of-night type of thing. And they are both good possibilities." □

Powergate
or
Beyond the Limits of Legitimate Authority

In western Minnesota, over 100 persons have been arrested for alleged illegal activities while protesting the construction of a 800 KV DC powerline from North Dakota to Delano, Minn. Their resistance has revealed gross illegal actions by the courts, state agencies, and the utilities. Misuse of this authority has furthered an energy policy that was conceived in deceit, is potentially dangerous to those who must bear its ill effects, and will lead to the development of a centralized energy system controlled by a few. Ironically, the persons protesting the illegitimate construction of this line are the ones formally being charged with illegal actions.

Two licenses must be granted by state agencies before a utility can begin construction of generation and distribution facilities. United Power Assn. (UPA) and Central Power Assn. (CPA) of Minnesota obtained the first of these, a Certificate of Need, from the Minnesota Energy Agency (MEA) after construction had already begun and without establishing sufficient need. The utilities were issued the second of these, a construction permit, from the Minnesota Environmental Quality Board (MEQB) without adequate public participation or transcripts.

According to law, a utility must apply for and receive a Certificate of Need before applying for a corridor designation and a construction permit.¹ By requiring this, the State of Minn. through the MEA insures its citizens against abuse from private corporations providing public services. The Certificate of Need was not issued by the MEA until April 2, 1976 while UPA/CPA had applied for their construction permit on Dec. 9, 1975.

The MEA is required by law to establish its own statistics to evaluate need independent from those of the utilities.² Dr. Paul Steinbeck, Energy Facility Analyst of the MEA wrote the following in an open letter dated Jan. 31, 1978 that

The Energy Agency rules containing assessment of need criteria (EA6 00, 300, 900, 1000) do not mention an Agency forecast. This makes them illegal. The Agency has not established a forecast of energy need for the days of peak demand for any electric service area. Because there has been no Agency forecast and illegal criteria were used, the Certificate of Need granted is void as a consequence of such illegal process.

Not only has the MEA failed to provide the legally required statistics, but it has yet to establish a forecasting approach whereby such statistics may be acquired. While these utilities insist the need for electricity from this line is immediate and urgent, Northern States Power has delayed completion on on five of its major generation facilities due to lack of need.

Extreme irregularities surround the issue of cost as it relates to the Certificate of Need. Energy Agency Regulation 611 requires the applicant to

In regard to the selection of the entry point, there were no public hearings held or transcripts made. The MEQB sent a letter to the North Dakota Public Service Commission stating:

We have learned that a substantial portion of the right-of-way from the point of crossing westerly has been acquired. Because of this fact, the Commission would be compelled to accept this route. . .

Furthermore, UPA/CPA did not apply for exemption from North Dakota law until Sept. 4, 1975. Two months prior, at a public meeting of the MEQB on June 10, opponents of the line were informed that the point of entry had already been fixed, and the line was exempt from N. Dakota law. This application for exemption was denied by the N. Dakota PSC the following March. When taken to court concerning this, the Supreme Court again ruled in favor of the MEQB. A three judge panel set up to hear appeals concerning the powerline controversy wrote a memoranda relative to this case. "Early in the proceedings, before the corridor was even designated, it was generally known where the anticipated point of entry would be located."⁷ Somehow the court is able to justify this blatant illegality and write a bit farther on in their memo, "We cannot find in the record that any decision was arbitrary, capricious, or contrary to existing law."⁸

The MEQB is obligated under law to keep a complete record, including official transcripts of all proceedings leading to the issuance of a construction permit.¹⁰ On July 12, 1976, the MEQB stated that the transcripts of the hearings in Paynesville and Litchfield on April 13 and 14 of that year had been destroyed. The next month, they reopened the public hearings to compare tapes made by a local resident, Virgil Fuchs, with the official transcript. In October, the Office of Hearing Examiners for the State certified that the official transcripts failed to contain all of the testimony from these hearings.

As a result of their findings, a very interesting and unusual transcript was entered into the records. Judge Kennedy of Stearns County ordered the MEQB to transcribe the testimony contained in the Fuch's tapes into the official transcript. This corrected transcript contains over 150 gaps and "unintelligibles" regarding testimony given by farmers concerning the effect of the line upon their lives and livelihoods, as well as testimony given by expert witnesses as to effects on health, noise levels, television and radio interference--the very information the hearings were designed to collect:

The Supreme Court again ruled in favor of the MEQB despite other additional violations of Statutory law. The panel of three of judges found the transcripts were "in substance a complete record", while citing the case of Reserve Mining Co. vs. Herbst, "Decisions of administrative agencies enjoy a presumption of correctness, and deference should be shown by the courts to the agency's expertise." The

UPA/CPA is currently under scrutiny concerning its involvement in a highly centralized energy coordination system known as the Mid-continent Area Power Pool (MAPP). MAPP is composed of fifty-five municipal, public and private electric utilities in the upper Mid-west. They have testified many times that the electricity from this line will be used by their own 33 member co-operatives and that the proposed construction was not for the purposes of profit. The UFA/CPA system plugs into the MAPP network of transmission lines, and power is sold back and forth between the members.

The licenses discussed in the previous pages have been issued by state agencies to UPA/CPA. Statutes require that applications for these permits contain a "statement of ownership of the line and an affidavit that the applicant is authorized to act on behalf of the owner."¹² Mn. RCF Sec. 19.01 also requires that the conditions under which those who are subject to services shall be joined as a party in the action. UPA/CPA has signed a contract committing their line for use by other MAPP members. This contract calls for fees for the use of the line. The voting system within MAPP allows CPA only 6% of the vote. And there is no limitation on use of the line by members of MAPP only.

This brings us to the most publicized of all the illegalities--those alleged to have been committed by the people protesting this line. These people are defending the right of all persons to health, safety, and control over their own lives. They are in direct conflict with those few who intended to build a powerline for their own interests. Those few are supported by the courts, the government, and the law enforcement officials. The conflict has only just begun, the powerline will not be built, and the people of western Minnesota will emerge victorious!!

Footnotes:

- 1) Cert. of Need Hearings Dec. 4, 1975
- 2) Supreme Court Powerline Decision 1977.
- 3) Cert. of Need Hearings Dec. 4, 1975.
- 4) Supreme Court Powerline Decision 1977.
- 5) Mn. Statute 116C.55 subd. 2.
- 6) " " 116C.55, .58, .59, .06, .60, 15.0419.
- 7) Supreme Court Decision 1977. p: 45.
- 8) Ibid
- 9) Mn. Stat. 116 C.06, subd. 2, 116C.50, 15.0418, 15.0419, 15.0421.
- 10) Docket No. CU-TR-1
- 11) Mn. Stat. 116C.6 1
- 12) Mn. Reg. MEQB (g) (a).

Biological Effects of Static and Low-Frequency Electromagnetic Fields: An Overview of United States Literature

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ENERGY RESEARCH and DEVELOPMENT ADMINISTRATION

**BIOLOGICAL EFFECTS OF STATIC AND
LOW-FREQUENCY ELECTROMAGNETIC FIELDS:
AN OVERVIEW OF UNITED STATES LITERATURE**

EPRI EA-490-SR

Special Report

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FOREWORD

As part of its program of research on biological effects of electric fields, EPRI is sponsoring research on large animals at the BATTELLE Pacific Northwest Laboratory. A parallel project using small animals is being sponsored by ERDA at the same location. Together these two efforts make the research study the largest ever performed in this field.

In preparation for a visit of Soviet scientists also performing research in this area, the Principal Investigator of this study, Dr. Richard D. Phillips, and his colleague, Dr. William T. Kaune, were asked to prepare an overview of United States literature on biological effects of electromagnetic fields at powerline frequencies. This review appears on the following pages. Both the ERDA and EPRI project managers believed that this brief and timely overview would be of sufficient interest to warrant early publication as a joint EPRI/ERDA document.

W.E. Feero, Project Manager
ERDA

H.A. Kornberg, Project Manager
EPRI

PREFACE

This document was prepared for the US/USSR Scientific Exchange Program, Problem IV, Topic 2 on the Biological Effects of Static and Low-Frequency Electromagnetic Fields. The purpose of the exchange is to evaluate current knowledge and to develop cooperative research programs with the Soviet Union to assess the possible health hazards of exposure to static and low-frequency electromagnetic fields. Following an exchange of national literature surveys, of which this document is a part, there will be an exchange of visits by experts of both countries. Six experts from each country will then meet in a joint workshop to review the state of knowledge and current research on this topic and propose a cooperative research program to solve unanswered problems. The cooperative research program proposed at the joint workshop will be initiated in 1978.

Both authors are participants in the Exchange Program, Topic IV.2, and are being provided support by the Electrical Energy Systems Division of Conservation, Energy Research and Development Administration. Funds to prepare this report were provided by the Energy Research and Development Administration and the Electric Power Research Institute.

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BIOLOGICAL EFFECTS OF STATIC AND LOW-FREQUENCY
ELECTROMAGNETIC FIELDS: AN OVERVIEW OF UNITED STATES LITERATURE

by

Richard D. Phillips and William T. Kaune

INTRODUCTION

There has been a rapid growth of power and communication systems in the United States over the last several decades and this growth is expected to continue. With this growth there has been an increasing level of static and low frequency electromagnetic fields to which people and other life forms may be exposed. Recently, questions have been raised concerning possible deleterious effects of exposure to such fields. Of particular concern has been the large electric, low magnetic fields in the vicinity of power transmission systems and the small electric and magnetic fields produced by communication systems. In recognition of this concern and need for definitive information, a number of new research projects have been initiated to assess the potential biological effects of static and low-frequency electromagnetic fields. The goal is to supplement our current knowledge and obtain a scientifically sound data base for establishing reliable and valid exposure limits in order to insure public safety and health.

Several major symposiums and reviews of the literature on the biological effects of static and low-frequency electromagnetic fields have been published in recent years (Bridges, 1975a,b; Sheppard and Eisenbud, 1977; Liboff and Rinaldi, 1974; Llaurodo, Sances and Battocletti, 1974; Persinger, 1974; Kornberg, 1976; Bridges, 1977; Antoian, 1977; Benedick and Greenberg, 1974). These symposiums and reviews cover a broad area of research interests, ranging from interactions of biological systems with naturally occurring electromagnetic fields arising from atmospheric electricity and geomagnetism to biological responses to directly applied electrical currents. The scope of this overview will be more limited; it will focus on past and ongoing research in the United States concerned with the biological effects of static and low-frequency electromagnetic fields produced by power transmission systems and low-frequency communication systems. The fields produced by these systems, particularly by the power transmission systems, are the highest 60-Hz fields to which people and other life forms may be exposed.

POWER TRANSMISSION SYSTEMS

60-Hz Electromagnetic Fields

There are currently more than 40,000 circuit miles of overhead AC (60 Hz) transmission lines in the United States operating at extra-high voltages (EHV), 345 to 765 kV (Anon, 1975b). Typical values of the maximum vertical electric fields at 4 feet above ground level under EHV transmission lines range from 5 to 9 kV/m (Bridges, 1975a; Anon, 1974;

Anon, 1975b; Bracken, 1976). The corresponding ground level magnetic fields do not depend on the transmission line voltage but on the line current, spacing between phases, and height above ground. At midspan under a typical 765-kV transmission line, the ground level 60-Hz magnetic field is about 0.3 Gauss for a current of 2000 amperes in each phase (Bridges, 1975a).

The total current induced by the electric field between ground and a man standing in electrical contact with ground, known as the short-circuit current, is about 16-20 $\mu\text{A}/\text{kV}/\text{m}$ (Anon, 1975b). Magnetic fields produce circulating electric currents in the body with the current density reaching its maximum value near the surface of the body (Guy, 1976). Based on estimates from calculations on models, the current density from the magnetic field at the hips of an erect man under a 765-kV transmission line ($E = 9 \text{ kV}/\text{m}$, $B = 0.3 \text{ Gauss}$) would be about 10% of the current density induced by the electric field (authors).

The situation is somewhat different in EHV switchyards where the electric fields are not uniform and can range from typical values of 2 to 9 kV/m (Anon, 1975b) to as high as 14.6 kV/m (Miller, 1974). Total body currents induced in switchyard workers and live line maintenance workers can be appreciably higher than those occurring in persons standing under transmission lines (Barnes, 1967; Miller, 1967).

Appreciable research has been conducted on the induction of currents in humans and animals by 60-Hz electric fields (Anon, 1975b; Bracken, 1976; Barnes, 1967; Deno, 1975; Miller, 1967; Anon, 1972a; Anon, 1972b; Deno, 1977; Phillips, 1976a; Kouwenhoven, 1966). Induced currents from

transmission lines are too low to represent a serious shock hazard. At least 5 mA are required to produce a shock which is disabling and 60 mA or more is needed to cause fibrillation of the heart in adult humans (Keeseey and Letcher, 1970). Currents of this magnitude would flow through the body only in fields greater than 350 kV/m and 4 MV/m, respectively (Deno, 1977). Several reports have summarized the effects of AC shocks on humans and animals (Reilley, 1977; Dalziel, 1968), and the subject will not be reviewed in this paper.

Secondary shocks, or spark discharge shocks, resulting from touching objects at different potentials have been studied by a number of investigators (Anon, 1975b; Bracken, 1976; Anon, 1972a; Phillips, 1976a; Reilley, 1977). Although such shocks are not life threatening and do not appear to produce permanent harm, they may produce a general stress response with repeated experiences which could account for some of the biological effects of electric field exposures reported in the literature.

Exposure to high-strength 60-Hz electric fields can produce nerve stimulation, due to piloerection and hair oscillation, and a tingling at the body surfaces next to clothing. These sensations become annoying to a small percentage of people starting at field strengths of about 8-10 kV/m (Zaffanella, 1972; Anon, 1975b). It has been suggested by several scientists that some of the reported biological effects of 60-Hz electric fields, particularly in furred animals, may be responses to this hair stimulatory effect (Bridges, 1975a, 1977; Antoian, 1977; Kornberg, 1976).

good,

In 1962 studies were initiated by the American Electric Power Company on safety practices, field intensities, body currents and working environments related to high voltage transmission lines. In one of these studies medical examinations were conducted over a 9-year period on 11 linemen working on 138 and 345 kV transmission lines (Kouwenhoven, 1967; Singewald, 1973). Four of the men regularly worked on live lines while wearing conducting clothing and gloves, exposing their heads to 60-Hz electric fields up to 470 kV/m. The other men worked mostly with hot sticks and were exposed to maximum fields of 70 kV/m. During the period, seven extensive medical examinations were conducted at Johns Hopkins Hospital. No significant changes of any kind were found.

As part of the research program sponsored by the American Electric Power Company, a study was made (Knickerbocker, 1967) to determine whether exposure of mice to high-strength 60-Hz electric fields over a long time period affected reproductive ability or produced tissue damage. Twenty-two male mice were exposed to 160 kV/m for 6.5 hours/day, 5 days/week, for 10.5 months. An equivalent number of animals was sham exposed. All exposed and sham exposed male mice were bred to nonexposed virgin females during the nonexposure periods. Exposure to the electric field had no effect on reproductive ability. Body weights of the exposed and control mice did not differ. Gross and microscopic pathological studies made at the end of the experiment showed no relevant lesions. The only observed effect of electric field exposure was that the male progeny of the exposed animals had a lower body weight than male progeny of control animals. No differences were observed in the female progeny.

Few other studies were made in the 1960s to assess the biological effects of 60-Hz electric fields on experimental animals. Moos (1964) examined the effects of 60-Hz fields at 0.8 to 1.2 kV/m on activity of mice. In a series of five experiments involving alternating exposure (field-on) and control (field-off) periods ranging from 1 day to 1 month, Moos reported mice were more active during the dark period with the field on than with the field off. Results of daylight activity between field-on and field-off conditions were not consistent. In a second study, Moos investigated the effect of electric field exposure on the mortality response of mice previously treated with 900 R of ionizing radiation. No significant effect was observed.

In a recent study (Marino, 1976a) mice were allowed to mate, gestate and rear their offspring for three successive generations while being exposed to 60-Hz electric fields. Mice exposed to 15 kV/m vertical electric fields exhibited decreased body weights at 35 days postpartum and increased mortality rates during the first week after birth for three successive generations. Mice exposed to 10 kV/m horizontal electric fields exhibited decreased body weights for two successive generations but not increased mortality rates. The authors suggested the depressed body weights and increased mortality rates may have resulted from the microcurrents the animals experienced during exposure while eating and drinking.

In another study (Marino, 1976b) body growth, serum proteins and serum corticosterone levels were measured in rats after continuous exposure to vertical, 60-Hz electric fields at 15 kV/m for 30 days. In

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a series of four replicate experiments, body weights of exposed rats were significantly less than those of controls in two experiments. Serum albumin was lower in the exposed rats. Serum corticosterone levels of exposed rats appeared to be lower than levels in controls in three experiments, but no measure of variance was made to allow an estimate of significance. When exposed animals were subjected to cold stress, the serum corticosterone levels in both experimental and control groups rose markedly and equally. This suggests the exposed animals were not suffering from the general adaptation syndrome as a result of chronic exposure to a nonspecific stressor.

Marino et al. (in press) reported on a total of 10 experiments which suggested exposure of rats to vertical, 60-Hz electric fields at 15 kV/m for 30 days may result in decreased corticosterone levels, *oxygen* increased serum albumin and serum glutamic oxaloacetic transaminase, *lactate* increased pituitary and adrenal weights, decreased water consumption and decreased body weights. However, only the decrement in water consumption was regularly demonstrated, suggesting the animals may have received shocks or perceived current flow when they drank during exposure. The other results were inconsistent. *Male acid cause still*

Gann and LaFrance (1976) examined the cardiovascular response of dogs to controlled bleeding (10 ml/kg over 3 minutes) after a 5-hour exposure to 60-Hz electric fields at 15 kV/m. The cortisol secretion response to ACTH was not affected by exposure to the electric field. Several cardiovascular changes were observed at the end of the bleeding. Mean arterial pressure fell 5.9 mm Hg in the control group and 16.0 mm Hg

in the exposed group. Arterial pulse pressure fell 0.9 mm Hg in the control group and 10.9 mm Hg in the exposed group. Heart rate decreased about 9 beats/min in the control group but increased about 57 beat/min in the exposed group.

Several studies have been made on the effects of 60-Hz electric fields on in vitro preparations. Bassett and Herrmann (1968) reported an increased DNA and collagen production in cultures of fibroblast cells exposed to 100 kV/m. Gann and LaFrance (1975) exposed cultures of rat subcutaneous areolar cells to 60-Hz electric fields at 200 and 600 kV/m. Cell morphology and regenerative rates were not affected in the cultures exposed to 200 kV/m, but growth stopped and the cells died in the cultures exposed to 600 kV/m within 7 days after the start of exposure. Durfee et al. (1975) found cell growth was inhibited in cultures of embryonic chicken fibroblasts exposed to 60-Hz electric fields at 1 and 10 V/m. A similar inhibitory effect was observed in embryonic chicken kidney cells exposed to 60 Hz at 1 V/m, but not at 10 V/m. Growth rates of cultures exposed to 75 Hz at 1 V/m were also inhibited, but at 10 V/m growth rates were enhanced in both types of tissue cultures.

Several surveys of limited scope have been made to examine the influence of 60-Hz electric fields from EHV transmission lines on farm crops and animals. Busby et al. (1974) questioned 18 farmers on land near a 765 kV line. Responses by the farmers indicated no alterations in crop productivity, cattle, hogs, or in dairy production of grazing animals could be attributed to the electric fields from the transmission

line. Ware (1974) surveyed 125 farmers on land near a 765-kV transmission line and 116 reported no problems related to the grazing of their animals.

There is currently a lack of unanimity by U.S. scientists as to whether or not 60-Hz electric fields associated with transmission lines produce any adverse biological effects. Results from earlier studies are somewhat conflicting and contradictory. The need for additional biological research to clarify the situation has been recognized. This fact, in conjunction with the development of ultra-high-voltage (UHV) transmission systems capable of transmitting power at 1100 to 1500 kV, has led to the initiation of a number of new research projects to obtain definitive answers concerning possible health hazards of these low-frequency electromagnetic fields.

A major research project is in progress at Pennsylvania State University to investigate the ecological influence of electric fields. A number of experiments have been made to evaluate the effects of 60-Hz electric fields on meadow voles and birds (Bankoske, 1976). Exposure of meadow voles to 50 kV/m for 4 weeks had no effect on body weight, activity, behavior, or on the progeny of exposed voles born both during and after the exposure period. Results of the avian studies were mostly negative. Short-term exposures of developing chicken embryos to fields as high as 67 kV/m had no significant effect on hatchability, time to hatch, hatching weight, early weight gain, activity or gross behavior. Chronic exposure of newborn chicks to 40-80 kV/m for 8-22 days had no effect on growth or

electroencephalogram (EEG) patterns. Activity of chicks was found to be depressed for about 1 week after removal from a 22-day exposure to 40 and 80 kV/m. A transitory enhanced growth rate was observed in male chicks during a 20-day exposure to 40 and 80 kV/m, but no significant effect on weight was observed at the end of the exposure period. Similar results were reported by Krueger et al. (1972) where body weights of chicks exposed to 3.4 kV/m at 60 Hz or 3.6 kV/m at 45 Hz did not differ from controls at the end of a 28-day exposure period.

In another study by Krueger et al. (1975a), fecundity of chicken was investigated after males and females had been exposed to 60-Hz electric fields at 16 kV/m for 84 days. Egg production was reduced in exposed hens. No effect was observed in fertility, hatchability, gross embryonic morphology, sex ratios, or egg shell quality.

Durfee et al. (1975) exposed chicken eggs to 60- and 75-Hz electric fields at 1, 10 or 3600 V/m throughout the holding and incubation period. No significant effects were observed on hatchability, embryonic mortality, memory consolidation or posthatching body weights.

Carter and Graves (1975) exposed chicks to 60-Hz electric fields at 0, 40 or 80 kV/m continuously from 1 day after hatching until 22-24 days after hatching, at which time electroencephalograms (EEG) and electrocardiograms (ECG) were made. Detailed evaluation of the EEGs did not disclose any significant differences among treatment groups. Heart rates of birds exposed to 40 or 80 kV/m were significantly higher than those of unexposed controls, with the 80 kV/m group having a significantly higher rate than the 40 kV/m group. The authors also investigated the heart rate

response of the birds to auditory stimuli, a broody hen call and a 500 Hz tone, but no clear differences in responses among treatment groups were evident.

Three major research projects have recently been started at Battelle, Pacific Northwest Laboratories. One project is concerned with possible ecological effects of a 1100-kV transmission line test facility and the other two projects are laboratory studies designed to investigate the biological effects of 60-Hz electric fields on small and large animals. In the small animal study (Phillips, 1976b), a large multidisciplinary research team is conducting a comprehensive series of screening experiments on rodents to cover areas of hematology, serum chemistry, immunology, central nervous system function and structure, neurophysiology, animal behavior, endocrinology, pathology, bone structure and function, cardiovascular function, metabolism, prenatal and neonatal growth and development, and teratology. The large animal project (Phillips, 1976c) will involve continuous exposure of miniature swine to 60-Hz electric fields over several generations with routine measurements made relative to reproduction, growth and development, behavior, hematology and serum chemistry. In addition, any effects observed in the small animal study will be evaluated in the miniature swine.

Several experiments of the Battelle studies have been completed. Acute exposure of swine to large 60-Hz electric fields produced no gross behavioral effects (Phillips, 1976a). A field of 50 kV/m produced hair stimulation (piloerection and hair oscillation), and preliminary data was obtained that indicated swine may perceive the presence of electric fields at 30-35 kV/m. In the small animal studies (Phillips, al., 1977),

heart rate measurements were made on rats after exposure to 60-Hz electric fields at 80 kV/m for 8 hours/day for 5 days. No effect was observed at the end of 8 or 40 hours of exposure. In another experiment it was found that rats spend more time in the shielded (unexposed) side of a two-compartment shuttle box than in the unshielded (exposed) side at fields of 90, 105 and 130 kV/m, but no side preference was observed at lower field strengths.

Several other research projects have been initiated recently to evaluate possible biological effects resulting from exposure to 60-Hz electric fields (Kornberg, 1976). The effects of electric fields on bee behavior and honey production under natural conditions are being studied. An epidemiological study of health of linemen and switchyard workers is now in progress. Another research group is investigating the effects of electric fields on cardiac pacemakers implanted in nonhuman primates. Scientists at the Brain Research Center in Los Angeles are investigating the effects of 60-Hz electric fields on animal behavior and on central nervous system function. A study at Battelle is being made to examine genetic effects of 60-Hz and static electric fields on bacteria and fruit flies.

It is anticipated that results of these and other studies will help clarify the current uncertainties about the possible biohazards of electric fields and provide the baseline data needed to establish criteria for safe exposure limits for humans and other life forms.

Static Electric Fields

Electrical power in the United States is transmitted primarily at 60 Hz. The only EHV direct current (EHV-DC) transmission system currently

in operation is the +400 kV Celilo-Sylmar Intertie between northern Oregon and southern California. Little meaningful biological research has been conducted that simulates exposure to such a system. Factors in addition to the static electric and magnetic fields must be considered, such as ion currents, air ions, and possibly ozone. Studies are in progress at Bonneville Power Administration to characterize EHV-DC systems for subsequent biological investigations (Bracken, in press).

Several biological studies concerned with electrostatic fields have been published. Lott and McCain (1973) investigated the effect of a static electric field at 10 kV/m on the EEG and hypothalamic electrical activity of rats as indices of the animal's perception of the field. During exposure EEG activity increased and posterior hypothalamic activity appeared to decrease. No significant effects were noted in ECGs, respiratory function or rectal temperature. *governance
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Marino et al. (1974) exposed groups of rats for 30 days to static electric fields at 0.3 to 19.7 kV/m. Vertical (0.6-19.7 kV/m) or horizontal (0.3-9.8 kV/m) exposures had no effect on growth rate or final body weight. Changes were reported in the serum protein fractions of rats exposed to vertical fields: albumin was elevated in groups exposed to 2.8, 5.6 and 19.7 kV/m; alpha and gamma globulin fractions were depressed in the group exposed to 19.7 kV/m; beta globulins were elevated in the groups exposed to 5.8 and 19.7 kV/m. It is not known if these changes are significant, since measurements were made from pooled blood samples and no estimates of population variability could be made. The authors also noted an unexpected

incidence of secondary glaucoma in animals exposed to vertical fields. This glaucoma only affected the right eye and was not observed in controls or in the group exposed to horizontal fields. It is possible the secondary glaucoma could have developed from pre-existing uveitis commonly found in a small fraction of laboratory rats.

In another experiment (Marino, 1974), female mice were injected with Erhlich ascites tumor cells and then exposed to horizontal static electric fields at 8 to 11 kV/m for 14 days. More chromosomal abnormalities in tumor cells were observed in exposed than in control mice. No host animal cells showed chromosomal abnormalities.

There is a need for additional research on the possible bioeffects of exposure to static fields, particularly with respect to exposure to DC transmission systems. For the latter studies potential sources of bioeffects need to be identified and appropriate exposure systems need to be designed to simulate in the laboratory the environment under an EHV-DC transmission line.

COMMUNICATION SYSTEMS

Considerable biological research has been conducted in conjunction with the development of an extra-low-frequency (ELF) communication system known as Project Sanguine. The system will transmit signals at 45-75 Hz from a grid antenna system buried in the earth. The electric field strength in the ground and air above the antenna grid is about 0.07 V/m, decreasing with distance from the grid. The magnetic fields above the lines are about 0.13 Gauss. A detailed description of the antenna system has been reported by Baker (1974).

Although the electric and magnetic fields that would be produced by this communication system are small, there has been considerable concern about possible effects on biological and ecological systems. A comprehensive research program to assess possible bioeffects of exposure to low-level electromagnetic fields at low frequencies was started in 1968 and still is in progress. Rozzell (1974) has summarized the research program, and results from studies completed to date have been compiled into three large volumes (Anon, 1975a, 1977a) and also have been summarized (Anon, 1977b).

An abbreviated summary of research studies and results on physiology, growth and development, behavior, genetics and biochemistry is given in Tables I-V.

Except for the studies by Coate et al., (1970) and Noval et al., (1976), no effects were observed in the physiology studies (Table I). The only significant effect observed by Coate et al. was a higher lactation index in the second generation of the exposed group than in the control group. The meaning of this difference is unclear. In the study by Noval et al. (1976), exposed rats gained weight at rates 20-30% slower than controls and had less abdominal fat. Reduced choline acetyltransferase in the brain stem and elevated liver tryptophase pyrrolase were also noted in the exposed animals. Mathewson et al. (1977) were unable to confirm these findings in a subsequent study.

Coate et al. (1970) investigated the effects of low frequency electromagnetic fields on germination, growth and development of corn, buckwheat and sunflowers. Although no effects were found on corn or buckwheat,

seedling growth of sunflowers was retarded (Table II). Rosenthal et al. (1975) repeated the experiment with sunflowers and were unable to confirm the results of the earlier study.

A series of experiments have been made on the response of the slime mold Physarum polycephalum to 60- and 75-Hz electromagnetic fields (Table II). The time interval between successive mitotic divisions of exposed cultures was appreciably longer than that of controls after 90-120 days of exposure (Goodman, 1975, 1976a; Marron, 1975). Sexual and asexual life cycles were not affected, but a retardation in reversible protoplasmic streaming was observed. Apparently the changes were not permanent; cultures removed from the electromagnetic field recovered in about 30-50 days. Additional studies were made at lower field strengths, five- and twenty-fold weaker, and no effects were observed.

In another experiment, Goodman et al. (1976b) investigated mitotic rate, protoplasmic streaming, respiration in microplasmodia, and glucose transport across the cell membrane of Physarum polycephalum exposed to 45-, 60- and 75-Hz sinusoidal or modulated 76-Hz electromagnetic fields at 0.14-0.7 V/m and 0.4-2 Gauss. They found the mitotic cycle was lengthened, the shuttle streaming period was slowed, and the rate of respiration was depressed. Also, modulated fields appeared to induce the alterations sooner and at lower intensities than sinusoidal waves.

No behavioral effects have been observed in rats, pigeons or primates exposed to 45-75 Hz electromagnetic fields at strengths up to 100 V/m and 10 Gauss (Table III). However, some marine animals do perceive electric fields in water at about 10-20 V/m (Coate, 1970). Turtles that perceive such fields will leave the field area and fish orient their bodies to

minimize the head-to-tail potential difference (Coate, 1970). The perception threshold for amoeba is about 500 V/m at 1-100 Hz (Friend, 1975). Significant membrane disturbances occur at twice this level, and the amoeba starts to become elongated in a direction perpendicular to the applied field at levels above 1000 V/m. Other marine animals, such as shrimp, snails, crabs, scallops, etc., perceive current densities between 1-50 mA/cm², depending on the species and frequency of the field (Straub, 1972). McCleave et al. (1974) found that Atlantic salmon (Salmo salcer) and American eels (Anguilla rostrata) detect ELF electric fields at 0.007-0.07 V/m but not magnetic fields at 0.5 Gauss. Neither activity nor circadian rhythm were altered by electromagnetic fields at these levels.

Gavalas-Medici et al. (1970, 1976) demonstrated a frequency-dependent effect of electromagnetic fields on schedule-controlled behavior of primates. The interresponse times of monkeys in lever press responses in an operant behavioral task were significantly shorter and less variable during exposure to 7-Hz fields at 10 V/m than during no field (unexposed) time periods. No effects were observed at any frequencies tested at 1 V/m, nor at 60 nor 75 Hz at 10 V/m. The effect at 7 Hz appeared to be dose dependent, with higher field strengths producing even shorter interresponse times. At 56 V/m, a significantly shorter interresponse time was observed at 75 Hz, but not at 60 Hz.

In an early study, Coate et al. (1970) reported an increased sex-linked lethal mutation rate in fruit flies exposed to low frequency electromagnetic fields (Table IV). Subsequent studies by Bender (1976) and Mittler (1971, 1972) failed to confirm this finding. No cytogenetic effects were observed in bacteria (Coate, 1970) or plants (Miller, 1976).

Bawin and Adey (1976) exposed in vitro preparations of cat and chick brain tissues to 6-75 Hz electric fields at 5-100 V/m for 20 minutes and observed a reduced calcium efflux at 6 and 16 Hz. Thresholds were about 10 and 50 V/m for chick and rat tissues, respectively.

Several studies have been made to evaluate possible effects of electromagnetic fields on human psychobiology and performance. In one study (Beischer, 1973) 10 subjects were exposed to 1 Gauss at 45 Hz for periods up to 24 hours. A large battery of physiological and psychological tests were made throughout the study. No effects were seen except for elevated serum triglycerides in 9 of the 10 exposed subjects at 24 to 48 hours after the exposure period. Similar trends were not seen in any of the 5 control subjects. In a second study (Gibson, 1974) psychomotor performance tests were made on human subjects exposed to 1 Gauss at 45 Hz for 24 hours. There were no significant performance decrements attributable to the exposure.

A number of studies and surveys have been made at the Sanguine Test Facility in Wisconsin over the last 9 years to evaluate possible effects of the electromagnetic fields on the ecosystem in the area. No adverse effects have been produced on plants (McCormick, 1971; Rosenthal, 1976b), soil arthropods or annelids (Greenberg, 1972, 1973, 1974a), local birds or mammals (Seale, 1976), nor on wood lice, redworms, earthworms, slugs or red-backed salamanders (Greenberg, 1974b, 1976). A clinical evaluation was made on personnel working at the Sanguine Test Facility and no effects attributable to the electromagnetic fields were found (Krumpe, 1974).

Some effects on bird orientation were noted on pigeons (Graue, 1974), ring-billed gull chicks (Southern, 1975) and migrating birds (Williams, 1976). Pigeons and some migrating birds changed their flight orientation slightly when close to the energized antenna.

CONCLUSIONS

Based on a long history of experience with electric fields by the utility industry, it appears that intermittent and repeated exposures to strong 60-Hz electromagnetic fields from present power transmission systems have no obvious adverse effect on the health of man. It has been recognized recently that this belief must be tested by carefully designed and executed experiments under laboratory conditions where precise control can be exercised over coexisting environmental factors. A number of studies have been initiated in response to this need to evaluate possible effects from both acute and chronic exposures.

Considerably more attention needs to be paid in future studies to the details of the interactions of an animal and its environment with applied electric fields. For example, it has now been shown that rats individually housed in close proximity to each other can have their short-circuit currents reduced by about 35% due to mutual shielding (Phillips, 1977). The possibility of transient discharges between an animal and its watering system has existed in many past studies. In addition, substantial steady-state 60-Hz currents may pass between certain kinds of watering systems and a drinking animal. Watering systems must be designed to eliminate these artifacts, reducing these currents as much as possible and quantitatively documenting

any residual current. Animal exposure systems must be carefully designed and surveyed to insure that they are free of corona discharge and ozone formation. Finally, one must be alert for the possibility of stress-induced biological effects due to hair stimulation or other forms of electric field perception; the mechanisms of these phenomena and their physiologic effects have yet to be fully elucidated.

All past experiments exposing animals to electric fields have been characterized by simply reporting the unperturbed field strength; that is, the field strength with no animals present. In many cases, details of how this quantity was determined were not given. However, the electric field strength at the surface of the body is the relevant quantity for determining the induced currents and fields inside the body and for understanding surface phenomena such as hair stimulation. This quantity depends not only on the magnitude of the unperturbed field but also on the shape of the animal body and its orientation with respect to the applied field. Since the shape and orientation of an erect human in a given field is very different from that of a laboratory animal, detailed measurements of the perturbed field and induced currents in the animal must be made before results obtained with that species can be translated to the human situation.

REFERENCES*

- Anon. 1972a. Electrostatic effects of overhead transmission lines. Part I - Hazards and effects. IEEE Transactions on Power Apparatus and Systems PAS-91(2): 422-426.
- Anon. 1972b. Electrostatic effects of overhead transmission lines. Part II - Methods of calculations. IEEE Transactions on Power Apparatus and Systems PAS-91(2): 426-444.
- Anon, 1974. Research of Corona and Electric Field Effects of EHV Transmission in Eastern Long Island. Report AST 74-951. Advanced Systems Technology, Westinghouse Electric Corporation, Pittsburg, PA.
- Anon, 1975a. Compilation of Navy Sponsored ELF Biomedical and Ecological Research Reports. Volumes I, II. Navy Medical Research Development Command. Report EMPRO-2, February 1975, National Naval Medical Center, Bethesda, MD.
- Anon, 1975b. Transmission Line Reference Book - 345 kV and Above. Electric Power Research Institute, Palo Alto, CA.
- Anon. 1977a. Compilation of Navy Sponsored ELF Biomedical and Ecological Research Reports. Volume III. Naval Medical Research Development Command. Report EMRPO-1, January 1977, National Naval Medical Center, Bethesda, MD.
- Anon. 1977b. Navy Sponsored ELF and Ecological Research Summary, February 1977. Naval Electronics System Command, Department of the Navy, Washington, DC.
- Antoian, G. E. 1977. Are there biological and psychological effects due to extra high voltage installations? Presented at the IEEE Power Engineering Society Winter Meeting, New York, NY, January 30 - February 4, 1977. Paper Number F 77-195-1.
- Bankoske, J. W., G. W. McKee and H. B. Graves. 1976. Ecological Influence of Electric Fields. EPRI EA-178, Project 129, Interim Report 2. Electric Power Research Institute, Palo Alto, CA.
- Baker, R. E. 1974.. Project Sanguine: Overview and status of the Navy's ELF communication system concept, pp. 83-90. In: Biologic and Clinical Effects of Low-Frequency Magnetic and Electric Fields, J. G. Llauro, A. Sances, Jr., and J. H. Battocletti (eds.). C. C. Thomas, publisher, Springfield, IL.
- Barnes, H. C., A. J. McElroy and J. H. Charkow. 1967. Rational analysis of electric fields in live line working. IEEE Transactions on Power Apparatus and Systems, PAS-86(4): 482-492.

* NTIS documents are available from the National Technical Information Service, U.S. Department of Commerce, P.O. Box 1553, Springfield, VA 22151.

- Bassett, C. A. L., and I. Herrmann. 1968. The effect of electrostatic fields on macromolecular synthesis by fibroblasts in vitro. Journal of Cell Biology 39: 9a (Abstract).
- Bawin, S. M., and W. R. Adey. 1976. Sensitivity of calcium binding in cerebral tissue to weak environmental electric fields oscillatory at low frequency. Proceedings of the National Academy of Sciences 73: 1999-2003.
- Beischer, D. E., J. D. Grissett and R. E. Mitchell. 1973. Exposure of Man to Magnetic Fields Alternating at Extremely Low Frequency. Naval Aerospace Medical Research Laboratory, Report NAMRL-1180. (NTIS Document AD 770140).
- Beischer, D. E., and R. J. Brehl. 1975. Search for Effects of 45 Hz Magnetic Fields on Liver Triglycerides in Mice. Naval Aerospace Medical Research Laboratory, Report NAMRL-1197. (NTIS Document ADA 007514).
- Bender, H. A. 1976. A Study of the Effect of ELF Electromagnetic Fields upon *Drosophila melanogaster*. University of Notre Dame, Final Report (NTIS Document ADA 035956).
- Benedick, M. H., and B. Greenberg. 1974. The Sanguine biological-ecological research program. IEEE Transactions on Communications, COM-22(4): 570-577.
- Bracken, T. D. 1976. Field measurements and calculations of electrostatic effects of overhead transmission lines. IEEE Transactions on Power Apparatus and Systems, PAS-95(4): 494-504.
- Bracken, T. D., A. S. Capon and D. V. Montgomery. Ground level electric fields and ion currents on the Celilo-Sylmar \pm 400 kV DC intertie during fair weather. IEEE Transactions on Apparatus and Power Systems (in press)
- Bridges, J. E. 1975a. Biological Effects of High Voltage Electric Fields. EPRI Project 381-1, Final Report. Electric Power Research Institute, Palo Alto, CA.
- Bridges, J. E. 1975b. Bibliography on Biological Effects of Electric Fields. EPRI Project 381-1, Final Report. Electric Power Research Institute, Palo Alto, CA.
- Bridges, J. E. 1977. Environmental considerations concerning the biological effects of power frequency (50 or 60 Hz) electric fields. Presented at the IEEE Power Engineering Society Winter Meeting, New York, NY, January 30 - February 4, 1977. Paper Number F 77-256-1.
- Busby, K., D. Driscoll and W. D. Washborn. 1974. A field survey of farmer experience with 765 kV transmission lines. Agriculture Resources Commission Report, State of New York, State Campus, Albany, New York.

- Carter, J. H., and H. B. Graves. 1975. Effects of High Intensity AC Electric Fields on the Electroencephalogram and Electrocardiogram of Domestic Chicks: Literature Review and Experimental Results. Pennsylvania State University, University Park, PA.
- Coate, W. B., et al. 1970. Project Sanguine Biological Effects Test Program Pilot Studies. Final Report. Hazelton Laboratories, Inc. (NTIS document AD 717408).
- Dalziel, C. F. and J. B. Lagen. 1941. Effects of electric current on man. Electrical Engineering 60: 63-66.
- Dalziel, C. F., and W. R. Lee, 1968. Reevaluation of lethal electric currents. IEEE Transactions on Industry and General Applications IGA-4(5): 467-476.
- Deno, D. W. 1975. Electrostatic effect induction formulae. IEEE Transactions on Power Apparatus and Systems PAS-94(5): 1524-1536.
- Deno, D. W. 1977. Currents induced in the human body by high voltage transmission line electric field - Measurement and calculation of distribution and dose. Presented at the IEEE Power Engineering Society Winter Meeting, New York, NY. January 30 - February 4, 1977. Paper Number F 77 258-7.
- deLorge, J. 1972. Operant Behavior of Rhesus Monkeys in the Presence of Extremely Low Frequency-Low Intensity Magnetic and Electric Fields: Experiment 1. Naval Medical Research Laboratory, Report NAMRL-1155. (NTIS Document AD 754058).
- deLorge, J. 1973a. Operant Behavior of Rhesus Monkeys in the Presence of Extremely Low Frequency-Low Intensity Magnetic and Electric Fields: Experiment 2. Naval Aerospace Medical Research Laboratory, Report NAMRL-1179. (NTIS Document AD 764532).
- deLorge, J. 1973b. Operant Behavior of Rhesus Monkeys in the Presence of Extremely Low Frequency-Low Intensity Magnetic and Electric Fields: Experiment 3. Naval Aerospace Medical Research Laboratory, Report NAMRL-1196. (NTIS Document AD 774106).
- deLorge, J. 1974a. A Psychobiological Study of Rhesus Monkeys Exposed to Extremely Low Frequency-Low Intensity Magnetic Fields. Naval Aerospace Medical Research Laboratory, Report NAMRL-1203. (NTIS Document ADA 000078).
- deLorge, J., and M. J. Marr. 1974b. Operant methods assessing the effects of ELF electromagnetic fields, pp. 145-175. In: ELF and VLF Electromagnetic Field Effects, M. A. Persinger (ed.). Plenum Press, New York, NY.
- Durfee, W. K., R. W. Chang, C. Polk, L. T. Smith, V. J. Yates, P. R. Plante, S. Muthukrishnan, H-J. Chen, L. T. Miller and P. J. Martin. 1975. Extremely Low Frequency Electric and Magnetic Fields in Domestic Birds. Technical Report. University of Rhode Island, Kingston, RI.

Durfee, W. K., C. Polk, C. T. Smith, T. J. Keefe and S. Muthukrishnan. 1976. Influence of Extremely Low Frequency Electric and Magnetic Fields upon Growth, Development and Behavior in Domestic Birds. University of Rhode Island. Final Report. (NTIS Document ADO 34526).

Friend, A. W., Jr., E. D. Finch, and H. P. Schwan. 1975. Low frequency electric field induced changes in the shape and motility of amoebas. Science 187: 357-360.

Gann, D. S., and T. F. LaFrance. 1975. Effect of 60 Hz electrostatic fields on growth and survival of cells in tissue culture. Personal Communication.

Gann, D. S., and T. F. LaFrance. 1976. Personal Communication.

Gardner, W. R. and R. F. Harris. 1975. Responses of Plants and Soil Microorganisms to Extremely Low Frequency Electric Fields. University of Wisconsin-Madison, Final Report (NTIS Document ADA 006994).

Gavalas, R. J., D. O. Walter, J. Hammer and W. R. Adey. 1970. Effect of low-level, low-frequency electric fields on EEG and behavior in Macaca nemestrina. Brain Research 18: 491-501.

Gavalas-Medici, R., and S. R. Day-Magdaleno. 1976. Extremely low frequency weak electric fields affect schedule-controlled behavior of monkeys. Nature 261: 256-259.

Gibson, R. S., and W. F. Moroney. 1974. The Effect of Extremely Low Frequency Magnetic Fields on Human Performances: A Preliminary Study. Naval Aerospace Medical Research Laboratory, Report NAMRL-1195. (NTIS Document ADA 005898).

Goodman, E. M., B. Greenebaum and M. T. Marron. 1975. Effects of Extremely Low Frequency Electromagnetic Fields on Growth and Differentiation of Physarum polycephalum. University of Wisconsin-Parkside. Technical Report Phase I (NTIS Document ADA 010187).

Goodman, E. M., B. Greenebaum and M. T. Marron. 1976a. Effects of Extremely Low Frequency Electromagnetic Fields on Physarum polycephalum. Technical Report. University of Wisconsin-Parkside. (NTIS Document ADA 021457).

Goodman, E. M., B. Greenebaum and M. T. Marron. 1976b. Effects of extremely low electromagnetic fields on Physarum polycephalum. Radiation Research 66: 531-540.

Graue, L. C. 1974. Orientation of Homing Pigeons (Columbia livia) Exposed to Electromagnetic Fields at Project Sanguine's Wisconsin Test Facility. Bowling Green State University, Final Report. (NTIS Document AD 780948).

Greenberg, B. 1972. Impact of extremely low frequency electromagnetic fields on soil arthropods. Environmental Entomology 1: 743-750.

Greenberg, B. 1973. Do extremely low-frequency electromagnetic fields affect soil arthropods? Ongoing studies at the Wisconsin Test Facility. Environmental Entomology 2: 643-652.

Greenberg, B., and N. Ash. 1974a. Impact of extremely low frequency electromagnetic fields in nature. Environmental Entomology 3: 845-853.

Greenberg, B. 1974b. Extremely low frequency antenna operation: test for possible impact on five naturally-exposed animal populations. Journal of Invertebrate Pathology 23: 366-370.

Greenberg, B. 1976. Metabolic Rates in Five Animal Populations after Long Term Exposure to Sanguine/Seafarer ELF Electromagnetic Fields in Nature. University of Illinois at Chicago Circle. (NTIS Document ADA 024955).

Grissett, J. D., and J. deLorge. 1971a. Central Nervous Systems Effects as Measured by Reaction Time in Squirrel Monkeys Exposed for Short Periods to Extremely Low Frequency Magnetic Fields. Naval Aerospace Medical Research Laboratory, NAMRL-1137. (NTIS Document AD 731994).

Grissett, J. D. 1971b. Exposure of Squirrel Monkeys for Long Periods to Extremely Low Frequency Magnetic Fields: Central Nervous System Effects as Measured by Reaction Time. Naval Aerospace Medical Research Laboratory, Report NAMRL-1146. (NTIS Document AD 735456).

Guy, A. W., M. D. Webb and C. C. Sorensen. 1976. Determination of power absorption in man exposed to high frequency electromagnetic fields by thermographic measurements on scale models. IEEE Transactions on Biomedical Engineering BME-23(5): 361-371.

Halberg, F., L. Catkomp, W. Nelson and R. Sothorn. 1975. Circadian Rhythms in Plants, Insects and Mammals Exposed to ELF Magnetic and/or Electric Fields and Currents. University of Minnesota, Final Report. (NTIS Document ADO 019958).

Keeseey, J. C. and F. S. Letcher. 1970. Human thresholds of electric shock at power transmission frequencies. Archives of Environmental Health 21: 547-552.

Knickerbocker, G. G., W. B. Kouwenhoven and H. C. Barnes. 1967. Exposure of mice to a strong ac electric field - An experimental study. IEEE Transactions on Power Apparatus and Systems PAS-86(4): 498-505.

Kornberg, H. A. 1976. Biological effects of electric fields. Revue Générale de L'Électricité, Numéro Special, Juillet 1976, pp 51-64.

Kouwenhoven, W. B., C. J. Miller, H. C. Barnes, J. W. Simpson, H. L. Rorden and T. J. Burgess. 1966. Body currents in live line working. IEEE Transactions on Power Apparatus and Systems PAS-85(4): 403-411.

Kouwenhoven, W. B., O. R. Langworthy, M. L. Singewald and G. G. Knickerbocker. 1967. Medical evaluation of man working in ac electric fields. IEEE Transactions on Power Apparatus and Systems PAS-86(4): 506-511.

Krueger, W. F., J. W. Bradley, A. J. Giarola and S. R. Daruvalla. 1972. Influence of low level electric and magnetic fields on the growth of young chickens. Biomedical Sciences Instrumentation 9: 183-186.

Krueger, W. F., A. J. Giarola, J. W. Bradley and A. Shrekenhamer. 1975a. Effects of electromagnetic fields on fecundity in the chicken. Annals of the New York Academy of Sciences 247: 391-398.

Krueger, A. P., and E. J. Reed. 1975b. A study of the biological effect of certain ELF electromagnetic fields. International Journal of Biometeorology 19: 194-201.

Krumpe, P. E., and M. S. Tockman. 1974. Evaluation of the health of personnel working near Project Sanguine Beta Test Facility from 1971 to 1972, pp. 98-122. In: Biological and Clinical Effects of Low-Frequency Magnetic and Electric Fields, J. G. Llaurodo, A. Sances, Jr., and J. H. Battocletti (eds.). C. C. Thomas, publisher, Springfield, IL.

Liboff, A. R., and R. A. Rinaldi (eds.). 1974. Electrically mediated growth mechanisms in living systems. Annals of the New York Academy of Sciences, Volume 238.

Llaurodo, J. G., A. Sances, Jr., and J. H. Battocletti (eds.). 1974. Biological and Clinical Effects of Low Frequency Magnetic and Electric Fields. C. C. Thomas, publisher, Springfield, IL.

Lott, J. R., and H. B. McCain. 1973. Some effects of continuous and pulsating electric fields on brain wave activity in rats. International Journal of Biometeorology 17: 221-225.

Marino, A. A., T. J. Berger, J. T. Mitchell, B. A. Duhacek and R. O. Becker. 1974. Electric field effects in selected biologic systems. Annals of the New York Academy of Sciences 238: 436-443.

Marino, A. A., R. O. Becker and B. Ullrich. 1976a. The effect of continuous exposure to low frequency electric fields on three generations of mice: a pilot study. Experientia 32: 565-566.

Marino, A. A., T. J. Berger, B. P. Austin, R. O. Becker and F. X. Hart. 1976b. Evaluation of electrochemical information transfer system. I. Effect of electric fields on living organisms. Journal of the Electrochemical Society 123(8): 1199-1200.

Marino, A. A., T. J. Berger, B. P. Austin, R. O. Becker and F. X. Hart. In vivo bioelectrochemical changes associated with exposure to extremely low frequency electric fields. Bioenergetics and Bioelectrochemistry (in press).

Marr, M. J., W. K. Rivers and C. P. Burns. 1973. The Effect of Low Energy, Extremely Low Frequency (ELF) Electromagnetic Radiation on Operant Behavior in the Pigeon and the Rat. Georgia Institute of Technology, Final Report. (NTIS Document AD 759415).

Marron, M. T., E. M. Goodman and B. Greenebaum. 1975. Mitotic delay in the slime mold Physarum polycephalum induced by low intensity 60 and 75 Hz electromagnetic fields. Nature 254: 66-67.

Mathewson, N. S., G. M. Oosta, S. G. Levin, M. E. Ekstrom and S. S. Diamond: 1977. Extremely Low Frequency (ELF) Vertical Electric Field Exposure of Rats: A Search for Growth, Food Consumption and Blood Metabolite Alterations. Armed Forces Radiobiology Research Institute, Defense Nuclear Agency, Bethesda, MD. (NTIS Document ADA 035954).

McCleave, J. D., E. H. Albert and N. E. Richardson. 1974. Perception and Effects on Locomotor Activity in American Eels and Atlantic Salmon of Extremely Low Frequency Electric and Magnetic Fields. University of Maine, Final Report. (NTIS Document AD 778021).

McCormick, F., G. Rosenthal, D. A. Miller and A. R. Valentino. 1971. Pilot Ecological Field Surveys. Technical Memorandum #1, IITRI Project E6159, IIT Research Institute. (NTIS Document AD 748334).

McKinney, H. 1977. Tadpole metamorphosis, D1. In: Compilation of Navy Sponsored ELF Biomedical and Ecological Research Reports, Vol III. Naval Medical Research and Development Command, EMRPO-1, February 1977.

Miller, C. J. 1967. The measurement of electric fields in live line working. IEEE Transactions on Power Apparatus and Systems, PAS-86(4): 493-498.

Miller, D. A. 1974. Electric and magnetic fields produced by commercial power systems, pp. 62-70. In: Biological and Clinical Effects of Low Frequency Magnetic and Electric Fields, J. G. Llaurodo, A. Sances, Jr., and J. H. Battocletti (eds.). C. C. Thomas, publisher, Springfield, IL.

Miller, M. W., M. M. Reddy, G. Yettewich and G. E. Kaufman. 1976. Lack of effect of extremely low frequency electric and magnetic fields on roots of Vicia faba. Environmental and Experimental Botany 16: 83-88.

Mittler, S. 1971. Failure of magnetism to influence production of X-ray induced sex-linked recessive lethals. Mutation Research 13: 287.

Mittler, S. 1972. Low Frequency Electromagnetic Radiation and Genetic Abberations. Northern Illinois University. Final Report (NTIS Document AD 749959).

Moos, W. S. 1964. A preliminary report on the effects of electric fields on mice. Aerospace Medicine 35: 374-377.

Noval, J. J., A. Sohler, R. B. Reisberg, H. Coyne, K. D. Straub and H. McKinney. 1976. Extremely Low Frequency Electric Field Induced Changes in Rate of Growth of Brain and Liver Enzymes of Rats. Temple University School of Medicine. (NTIS Document ADA 035959).

Persinger, M. A. (editor). 1974. ELF and VLF Electromagnetic Field Effects. Plenum Press, New York, NY.

Phillips, R. D., R. L. Richardson, W. T. Kaune, D. L. Hjeresen, J. L. Beamer and M. F. Gillis. 1976a. Effects of Electric Fields on Large Animals: A Feasibility Study. EPRI EC-131, Final Report to Electric Power Research Institute, Palo Alto, CA by Battelle, Pacific Northwest Laboratories, Richland, WA.

Phillips, R. D., W. T. Kaune, J. R. Decker and D. L. Hjeresen. 1976b. Biological Effects of High Strength Electric Fields on Small Laboratory Animals. BNWL-2149. Battelle, Pacific Northwest Laboratories, Richland, WA.

Phillips, R. D., M. F. Gillis, C. H. Allen, J. L. Beamer, R. L. Richardson, W. T. Kaune and T. W. Jeffs. 1976a. Effects of Electric Fields on Large Animals. EPRI EA-331, Project 799, Interim Report to Electric Power Research Institute, Palo Alto, CA by Battelle, Pacific Northwest Laboratories, Richland, WA.

Phillips, R. D., W. T. Kaune and D. L. Hjeresen. 1977. Biological Effects of High Strength Electric Fields on Small Laboratory Animals. Interim Progress Report, April 1977. Battelle, Pacific Northwest Laboratories, Richland, WA.

Reilley, J. P. 1977. Electromagnetic coupling effects at 60 Hz - An acute effects classification guide. IEEE Working Group on Electrostatics and Electromagnetics, January 1977 draft. To be published.

Riesen, W. H., C. Aranyi, J. L. Kyle, A. R. Valentino and D. A. Miller. 1971. A Pilot Study of the Interaction of Extremely Low Frequency Electromagnetic Fields with Brain Organelles. IIT Research Institute, Technical Memorandum #3, IIT Project E6185. (NTIS Document AD 748119).

Rosenthal, G. M. 1975. Germination and Early Growth of Sunflowers in Weak ELF Electromagnetic Fields. University of Chicago, Final Report. (NTIS Document ADA 023092).

Rosenthal, G. M. 1976a. Soil Microorganism Population Dynamics in Weak ELF Electromagnetic Fields. University of Chicago. Final Report (NTIS Document ADA 035957).

Rosenthal, G. M. 1976b. An Ecological Survey of Plants Exposed to ELF Electromagnetic Fields. University of Chicago, Final Report. (NTIS Document ADA 035958).

Rozzell, T. C. 1974. Biological research for extremely low frequency communication systems, pp. 91-97. In: Biological and Clinical Effects of Low Frequency Magnetic and Electric Fields, J. G. Llauro, A. Sances, Jr., and J. H. Battocletti (eds). C. C. Thomas, publisher, Springfield, IL.

Seale, D., J. R. Gauger and C. A. Damberger. 1976. Pilot Survey of Small Mammal Populations in the Chequamegon National Forest during 1971 and 1972. IIT Research Institute, Project E6357-TR4 (NTIS Document ADA 024530).

Sheppard, A. R., and M. Eisenbud. 1977. Biological Effects of Electric and Magnetic Fields of Extremely Low Frequency. New York University Press, NY.

Singewald, M. L., O. R. Langworthy, and W. B. Kouwenhoven. 1973. Medical follow-up study of high voltage linemen working in ac electric fields. IEEE Transactions on Power Apparatus and Systems PAS-92(4): 1307-1309.

Southern, W. E. 1975. Orientation of Gull chicks exposed to Project Sanguines electromagnetic field. Science 189: 143-145.

Straub, K. D., J. Z. Kendrick and H. Jackson. 1972. Effects of Low Frequency Electrical Current on Various Marine Animals. Naval Air Development Center, NADC 72126-Cs (NTIS Document AD 749415).

Straub, K. D., and P. Carver. 1975. Effects of electromagnetic fields on microsomal ATPase and mitochondrial oxidative phosphorylation. Annals of the New York Academy of Sciences 247: 292-300.

Ware, B. J. 1974. Effects of 765 kV Transmission Lines on Animal Grazing Habits. American Electric Power Service Corporation Report, December 11, 1974.

Williams, T. C., et al. 1976. A Radar Investigation of the Effects of Extremely Low Frequency Electromagnetic Fields on Free Flying Migrant Birds. Swarthmore College, Final Report (NTIS Document ADA 035725).

Zaffanella, L. E. 1972. Discussion of electrostatic effects of overhead transmission lines. IEEE Transactions on Power Apparatus and Systems PAS-91: 431-432.

TABLE I. Summary of Physiology Research

| Test Subject (Investigator) | Electromagnetic Field | | | Exposure Time | Parameters Examined | Results |
|--------------------------------|-------------------------------------|---------------------|-------------------|-------------------------------------|---|---|
| | Electric (V/m) | Magnetic (Gauss) | Frequency (Hz) | | | |
| Dogs (Coate, 1970) | 10, 20 plus 0.5 mA current | 1, 2 | 45, 75 | 16 h/d, 5 d/w, for 3 weeks | Behavior, body weight, EEG, ECG, testis, eyes, clinical chemistry, hematology, pathology, body temperature, blood pressure | No effect |
| Rats (Coate, 1970) | 10, 20 | 1, 2 | 45, 75 | 16 h/d, 5 d/w, for 3 weeks | Fertility, reproduction and development | Increased lactation index exposed rats in second generation |
| Rats (Noval, 1976) | 0.1-100 | -- | 45 | 30-40 d | Body weight, brain and liver enzymes | Reduced growth rate, reduced amount of abdominal fat, reduced choline acetyltransferase (brain stem) and elevated liver tryptophane pyrrolase |
| Rats (Mathewson, 1977) | 0-100 | -- | 45, 60 | 28 d | Body weight, hematology, serum chemistry, pathology | No effect |
| Mouse (Krueger, 1975) | 100 | -- | 45, 75 | to 36 d | Body weight, blood chemistry, susceptibility to virus infection | No effect |
| Mouse (Beischer, 1975) | -- | 1 | 45 | 1-7 d | Body weight, liver weight, liver tri- glycerides, behavior, pathology | No effect |
| Primate (Grissett) | 20 | 2 | 72-80 | 1 yr + | Body weight, blood chemistry, ECG, EEG, body temperature, respiration rate, blood pressure | No effect to date. Study still in progress. |

**FUEL SUPPLY FOR THE COAL CREEK GENERATING STATION
OF
THE COOPERATIVE AND UNITED POWER ASSOCIATIONS**

By

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**Before the
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Detroit Lakes, Minnesota**

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The environmental impact of high voltage lines

LOUISE B. YOUNG and H. PEYTON YOUNG

"Man may soon enter an era of energy pollution of the environment comparable, in public health and ecological implications, to the chemical pollution of today."

This prediction was made in a report to Congress by the White House Office of Telecommunications Policy in May 1974. The principal sources of the energy pollution described in this report are radio and television transmitters, radar installations, microwave ovens, and electrical power lines. Of all these sources, electric power lines have received the least attention and, considering the thousands of miles of extremely high voltage lines which are now being planned for the near future, this source of energy pollution should receive immediate and careful consideration.

The largest transmission lines that are being built and operated today carry 765,000 volts (765 kilovolts) and lines are under development that will carry 1,500 kilovolts and even 2,000 kilovolts. There are two important health hazards associated with these lines: (1) air pollution resulting from chemical reactions that take place in the corona discharge, and (2) electromagnetic effects, particularly the strong electric field that exists in the vicinity of these lines. This article will consider only the latter problem. The first is very interesting and important, but is so complex that it should be dealt with separately in another article [1].

Extremely high voltages—carried on bare, unshielded conductors—pass overhead in many places no more than 40 feet above roads and farms and cause very strong electrostatic fields in the space around these lines. There is a very high voltage difference between one point in space and another point, say a meter away. The potential difference between these two points may be as high as 50,000 volts under a 765 kilovolt line. This alternating electrostatic field in air induces 'charging currents' in all objects near the line. There are small but continuous currents running through the ground, the plants, the rocks, the farmer on his tractor.

The presence of the electric field can be dramati-

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cally demonstrated by walking in the vicinity of a high voltage transmission line holding an ordinary fluorescent bulb. The bulb will light up without cords, batteries, or metallic connections to ground, and this will occur at a considerable distance off the right-of-way. Many people have their back to their gardens, and the fields where they work for many hours a day in regions where light bulbs will light up in your bare hand.

What does it do to living things to spend a great deal of time in such intense electric fields as are produced by lines subjected to electric currents running continuously through them? Considering the importance of the question, one might assume that it had been thoroughly investigated by the power companies before such lines were built. But a search of the scientific literature reveals that this subject has not been adequately studied. The few research papers that have been done show that there probably are profound effects caused by these fields.

About 10 years ago when American utility companies were starting to use extra-high-voltage transmission, two studies were conducted by the power companies. In one experiment they exposed male mice to strong electric fields for 6½ hours a day over a 10½ month period [2]. These mice were bred at regular intervals with females that had not been exposed. The number and size of the progeny produced were considered to be measures of the latent effects which might have been passed on to the exposed fathers. The average size of the progeny was found to be significantly smaller than normal. It was also noted in the report that the exposed mice tended to sleep more than the control mice. On the basis of these findings, the scientists recommended that further studies be conducted, but no follow-up studies have been reported in the literature.

It is a significant fact that in this experiment the female and baby mice were never exposed to the electric fields. Fetuses and very young animals are known to be especially sensitive to radiation. Furthermore, since each mating involved one animal that had not been exposed, any recessive genetic changes due to the electric field would have been masked by genes that had not been affected by the exposure.

The other study conducted by the power com-

FUEL SUPPLY FOR THE COAL CREEK GENERATING STATION
OF
THE COOPERATIVE AND UNITED POWER ASSOCIATIONS

It is indeed a pleasure for me to speak to you today regarding the fuel supply for the Coal Creek Generating Station being built by the Cooperative and United Power Associations near Underwood, North Dakota. The CU project is an exciting story about the coal and electric power industries working together to solve a critical national problem -- the energy shortage -- through research, new technologies, financial innovation, and imaginative management. The North American Coal Corporation and The Falkirk Mining Company are proud to be a part of this project.

The entire fuel requirements of the Coal Creek Generating Station will be provided by The Falkirk Mining Company under a Coal Sales Agreement which was executed with the Cooperative and United Power Associations on July 1, 1974. This Agreement provides for the delivery of up to 6 million tons of coal annually over a 35-year term, with production commencing in 1978.

The Falkirk Mining Company is an Ohio corporation qualified in North Dakota, and is a wholly-owned subsidiary of The North American Coal Corporation, which is based in Cleveland, Ohio. North American is the second largest independent mining company and the ninth largest coal producer in the United States.

Since 1967, North American's Indian Head Mine near Beulah,

North Dakota, has produced the entire fuel requirement of the UPA's generating plant near Stanton, North Dakota, via daily unit train shipments.

Today, I will outline the activities and progress of The Falkirk Mining Company, as well as the financial and management techniques being employed to provide the fuel supply to the Coal Creek Generating Station. Furthermore, since Falkirk's operations in North Dakota reflect the coal industry's Western activities, I will also briefly survey the promise and problems associated with this Western coal development and how we are working to solve them.

Let's begin by looking at the reasons why we are in North Dakota together.

The United States Bureau of Mines estimates that 44 per cent of the nation's total recoverable coal deposits underlie the three Northern Great Plains States of North Dakota, Montana, and Wyoming. We estimate that North Dakota alone has about 25 billion economically surface-mineable tons of coal with today's technology.

Our current national energy shortage is stimulating coal development on the Northern Great Plains. The United States, with only 6 per cent of the world's population, consumes about 35 per cent of the global energy output. The shortage of domestic oil and natural gas, which increases our dependence on imported oil, continues to worsen despite reduced total energy demand resulting from the economic recession. It must be pointed out, however, that while the recession lowered energy use; economic recovery will boost it.

The national interest clearly dictates the need to shift our energy base from gas and oil to coal and nuclear. And with atomic power's delays and uncertainties, coal -- our most abundant energy source -- has become vital. Coal deposits comprise 88 per cent of our United States indigenous energy reserves. Yet, the coal industry supplies only 18 per cent of our current energy needs. Clearly, coal's role is due to expand dramatically -- particularly in the West.

National Electric Reliability Council figures show that between 1950 and 1973 coal consumption by utilities has escalated from 100 to 375 million tons. The Council projects that utilities will need 700 million tons by 1983. The National Coal Association shows total coal demand leveling out at 1.5 billion tons by 1985. Because of Federal air quality standards and coal industry economics, the West must supply much of this coal.

Eastern and Midwestern electric utilities cannot obtain sufficient quantities of low-sulphur coal from Appalachia. To meet pollution control regulations, steam coal users must blend lower-sulphur Western coals with established high-sulphur Eastern supplies.

Further, coal industry costs are skyrocketing in the East. The Federal Coal Mine Health and Safety Act of 1969 has typically increased underground mining costs \$2.50 to \$3.00 per ton. Its effect on Western surface mining has been negligible.

Western surface-mined coal also has the advantage of being capital intensive rather than labor intensive. Of the total cost of thin-seamed

Eastern underground-mined coal, 50 to 60 per cent is comprised of labor costs. This compares to 20 to 35 per cent labor-related costs for Western surface-mined coal. While the productivity of typical Western surface mines is 100 to 130 tons per man per day, the productivity of the typical Eastern underground mine is only 8 to 15 tons of coal per man per day.

You may ask why it is advantageous to be capital intensive rather than labor intensive. First, wage and benefit increases repeatedly won by labor have increased the cost of Western surface-mined coal by only half the cost increase for Eastern underground mined coal. This margin continually widens with the passage of time because of the labor intensiveness of Eastern underground mining. Furthermore, most Eastern underground-mined coal is produced from operations which have been organized by the United Mine Workers of America. In my opinion, this Union has brought unwarranted disorder to the industry. To wit, my Company alone lost over one million tons of production in 1974 at our Ohio and Pennsylvania operations due to illegal, unauthorized wildcat strikes by the UMWA. To put this lost tonnage figure into perspective, our Company produced only 11.3 million tons of coal during the year. This Union must accept its responsibilities to manage and govern its membership. Four major coal companies, including North American, recently filed suit in Federal court to make the UMWA International Union immediately liable for all illegal future strikes at any of our mines.

Within this context, new coal utilization technologies -- extra

high voltage electrical transmission, gasification, liquefaction, solvent refining -- are also contributing to making coal's Western move possible. Until recently, North Dakota's lignite could only meet local needs. Its high moisture content and resultant low heating value makes it impractical for shipment to distant markets. Now extra high voltage transmission (particularly DC) and coal gasification are close to reality. The transporting of Western coal to distant markets in railroad cars and barges will rapidly become obsolete. Gasified coal in pipelines or electrified coal via wire is the Western coal marketing concept of the immediate future. This will make Western coal competitive with other fuels over wide sections of the United States.

At North American, we are basing our growth on the development of these new coal utilization technologies. North American and its subsidiaries -- The Coteau Properties Company and The Falkirk Mining Company -- currently have under lease over 300,000 acres of proven, economically-mineable North Dakota lignite reserves. These reserves are currently estimated to contain about four billion tons of coal, much of which is earmarked for gasification by the American Natural Gas Company.

The developments in North Dakota represent a new direction for North American and signal the change within the coal industry. More than 90 per cent of our production last year originated from underground mines in Ohio and Pennsylvania. Since 1967 we have been producing only slightly

more than one million tons annually in North Dakota. As you know, at that time our Indian Head Mine began supplying the United Power Association's generating station near Stanton, North Dakota.

When coal gasification and extra high-voltage transmission become realities, North American's operations in North Dakota will be the major factor in our Company. This development, however, cannot be fully realized without the solution of many complex problems.

What are our problems? Some we share with other industries, such as material shortages. We face long delivery lead times. For example, two large excavator manufacturers are now building five 100-yard draglines for us, and yet we cannot receive delivery of the first of these machines until 1978.

Accompanying the critical need for capital equipment is an equally critical skilled labor need. Competent technicians in every phase of this specialized industry are in extremely short supply.

The availability of skilled labor is not the only labor problem which could deter the development of the coal deposits of the Northern Great Plains. Large labor unions, such as the United Mine Workers of America, the International Union of Operating Engineers, the International Brotherhood of Electrical Workers, and Progressive Mine Workers, have their sights on coal development in the West, which has been relatively free of labor strife.

Our Indian Head Mine, which is located some 30 miles west of the

site of The Falkirk Mining Company, was struck by the United Mine Workers of America from January 12 through June 7, 1975. However, we did resume operations at the mine during the period with management personnel and later with permanent replacement employees.

During the strike, the United Mine Workers insisted on a number of demands, the most objectionable of which was a so-called "accretion" or "coal lands" clause which has heretofore been agreed to by every coal company in the United States under contract with the UMWA. This clause stated that any future operations of our Company or its subsidiaries in North Dakota, including The Falkirk Mining Company, must automatically be under the jurisdiction of the United Mine Workers when the first man is hired. This provision clearly would preclude any future employee's right to determine his own bargaining agent or union representation, if, in fact, he would want any.

We are pleased to inform you that the terms and conditions of the agreement eventually negotiated covers only operations of our Indian Head Mine, and that there is no accretion or coal lands clause in the contract which gives the United Mine Workers any jurisdiction at any other operation of North American or its subsidiaries in North Dakota, including The Falkirk Mining Company.

As you know, at this moment some 40,000 UMWA workers are participating in illegal, unauthorized strikes in the Appalachian Region. As I mentioned previously, our Company lost one million tons of production

last year due to these illegal work stoppages, and has lost nearly this amount of production so far this year. Should the United Mine Workers of America gain the strength in North Dakota that they currently enjoy in the Eastern coal fields, the continuity of our operations, and hence, of your coal supply, cannot be assured. It is for this reason that we at The Falkirk Mining Company are deeply committed to the preservation of non-union status.

The new managerial approach which we are developing for Falkirk is not merely an attempt to keep the union out. It is a positive effort of restructuring our employees' relations to increase productivity and motivation. Lines of authority will still exist between managers and miners, but we are attempting to develop a mutual trust with our employees which will break down the divisions of labor which have evolved with unionism. By adopting these more sophisticated industrial relations concepts and techniques, and through salary, benefit, and job security programs, we hope to avoid the costly wildcat strikes, rigid work rules, grievance procedures, general worker dissatisfaction, and decreased productivity, which have stemmed from the traditional adversary relationship of management and union.

In addition to the above typical business problems, we have other problems unique to our industry, which are impeding Western coal development. These center on environmental and socio-economic impacts, public

opinion, and government action.

The development of Western coal reserves must not -- and need not -- result in any environmental deterioration. The environmental ethic must be recognized as a fact of life by all coal developers, particularly the concern for mined land reclamation.

The following series of slides depicts the steps in the reclamation process at our Indian Head Mine near Beulah, North Dakota. These same techniques will also be employed in the reclamation work at The Falkirk Mining Company.

Topsoil Removal

Grading

Topsoil Replacement

Tilling and Seeding

Slides of Completed Work

Although we can -- and are -- restoring mined land to its original or better topography, reclamation must be measured by the ultimate productivity of the land. It is reasonable to believe, however, that if all topsoil and subsoil, which contain the nutrients essential to native plant growth, are restored, then reclaimed land should be as productive as it was originally. Two of the primary questions are: (1) "How much topsoil and subsoil should be restored to achieve this?", and (2) "What methods should be employed to prevent contamination of this surface material?"

To find the answers, we are cooperating with universities and government agencies in conducting reclamation research. North American is currently working with the various departments of the North Dakota State University, Montana State University, (through a United States Environmental Protection Agency grant), the Agricultural Research Service of the U. S. Department of Agriculture, the Soil Conservation Service, the North Dakota Geological Survey, and the North Dakota Mined Land Planning Group. Aspects of reclamation under investigation in these instances include natural succession of reclaimed lands, root zone hydrology, surface water run-off, surface manipulation, aquifer analyses, segregation of topsoil and subsoil, reforestation, nurse crops, refertilization, soil amendments, seed varieties, and vegetative covers.

By 1978, when large-scale mining begins we should have the answers and the necessary technology to restore the land to its original productivity.

In response to public demands, reclamation legislation at both the State and Federal levels has rapidly evolved which may, in fact, impede effective mined land reclamation. In many instances, these regulations are not based on current scientific evidence, and they also do not permit the flexibility required from area to area to achieve satisfactory reclamation. This "cart before the horse" philosophy of passing laws before the technology is available must be changed if we are to solve mined land reclamation problems and if the surface coal mining industry is to grow in the West.

Other problems which must be solved if Western coal development is to accelerate are those involving the social and economic impacts in the affected areas. There is no question that funds must be generated from the coal development projects to cover these impacts and the need for services and facilities in the impacted communities. However, many in government use this concern for the socio-economic impacts to promote legislation which, in fact, may eliminate coal development altogether.

But state and local problems aren't coal development's only stumbling blocks. Federally-controlled lands containing huge coal reserves checker-board many privately-held leased lands. Yet the Federal government has no firm leasing policy and has had a moratorium on Federal coal leasing since 1971. Fortunately, however, there are less than 1,000 acres of Federally-controlled lands in the reserves of The Falkirk Mining Company.

The coal industry, and, indeed, those genuinely concerned about the energy problems confronting this nation, have had much difficulty convincing the Congress of the seriousness of the situation. It is imperative that cooperation, rather than confrontation, mark the future relationship between our industry and government.

Assuming the myriad of environmental, public opinion, and governmental problems can be solved, the development of these large electric power generation and gasification projects proposed for the West, and particularly the Northern Great Plains, may actually be undertaken.

At this time, I would like to outline the steps in the actual development and construction of The Falkirk Mining Company project.

The first step was an extensive exploration program by The North American Coal Corporation of the potential coal reserves within a five-mile radius of the city of Underwood, North Dakota. An initial drilling program was carried out to determine the presence and quality of the coal deposits and the type and depth of overburden in the area.

As was mentioned earlier, the coal reserves of North Dakota are of a very low grade, known as lignite. While lignite contains only about 60 per cent of the calorific value in BTU's per pound of typical Eastern bituminous coal, it lends itself to very economical mining. This is due to the fact that lignite is typically found in comparatively thick seams in relatively close proximity to the surface, and is overlain primarily by sandy shales and clays which are easy to mine.

Our initial exploration and drilling program revealed that these reserves in the vicinity of Underwood, North Dakota had great potential for development. We determined that over 300 million tons of economically-mineable coal exists in a block within a five mile radius of the city of Underwood. Also, this lignite was found to contain approximately 6500 BTU's per pound, 39 per cent moisture, 7 per cent ash, only 0.6 per cent sulphur, and a very low sodium oxide content in the ash. This analysis indicates that these reserves will be a very satisfactory boiler fuel.

This slide shows the reserves which we defined, and which were eventually to become the reserves of The Falkirk Mining Company and the fuel supply for the Coal Creek Station. This view shows the outcrop and extent of these reserves with reference to the City of Underwood and to Falkirk's coal delivery point.

Based on our newly-acquired information regarding the quantity, quality, and mineability of the reserves in the vicinity of Underwood, an extensive surface and coal lease acquisition program was undertaken. Also, an initial mining plan was developed and capital and mining cost projections were prepared.

At about the same time North American was conducting its exploration and surface and coal land acquisition programs, the Cooperative and United Power Associations were considering the siting of a new mine-mouth generating facility in North Dakota. As a result, North American's entire package was presented to the Cooperative and United Power Associations.

Based on the attractive mining costs achievable from these reserves, the proximity of these reserves to an excellent water supply, and the location of these reserves to our customers' markets, the Cooperative and United Power Associations indicated a definite interest in these reserves as a potential fuel supply.

At this point, a wholly-owned subsidiary of North American, The Falkirk Mining Company, was incorporated to negotiate a Coal Sales Agree-

ment with CPA-UPA. The Agreement eventually negotiated is extremely complicated and includes provisions by which The Falkirk Mining Company is to be financed.

Historically, the coal industry has experienced low profit margins. Even though North American has existed for more than 60 years, we have never been able to establish the net worth required to finance operations such as The Falkirk Mining Company, which will cost about \$128 million to build, based on current price levels. As a result, we have necessarily resorted to methods of financing not guaranteed or secured by North American. Typically, North American will assign the coal reserve to a subsidiary company, such as The Falkirk Mining Company, and this subsidiary will execute a cost-plus, long-term coal sales agreement with the utility customer. The Falkirk Mining Company has the responsibility for constructing the operation and for mining the required coal, while CPA-UPA must provide the required financing either directly or via loan guarantees.

In order to assure efficient mining operations and the lowest possible coal costs to CPA-UPA, incentive provisions are included in our extremely complex contract. Depending on how The Falkirk Mining Company performs compared to a standard cost of production negotiated at the end of the mine development period, Falkirk can make more or less than the standard profit set forth in the agreement. Through these financing arrangements, a low-cost feedstock or boiler fuel is provided the utility while our company is able to expand.

I am convinced that through this contractual arrangement, and in view of the comparatively favorable mining conditions to be encountered at the Falkirk site, the lignite delivered to the mine-mouth Coal Creek Station will be one of the lowest cost coal boiler fuels available in the United States.

Following the consummation of the Coal Sales Agreement and the financing arrangements, the actual construction of The Falkirk Mining Company has been undertaken. Additional exploration drilling is now being assembled to further define and analyze the coal reserves for actual mining, to identify and evaluate associated aquifers, and to determine the physio-chemical properties of sub-surface materials lying above the coal seam. This information is being used to develop final mining plans and methods, and to determine mining equipment specifications.

The mining system, methods, and equipment to be employed are similar to those currently in use at our Indian Head Mine, although the Falkirk operation will be five times the size of the Indian Head Mine and will be far more complicated, which I will explain later.

The following series of slides shows the mining operations at our Indian Head Mine:

1. As previously mentioned, the first step in the coal mining operation is carried out with reclamation in mind. Here a tractor-scraper removes the topsoil and suitable sub-soil.

The soil is stockpiled for replacement later during the reclamation process.

2. In the next step, a large shovel, called a dragline, removes layers of soft sandy-shale overburden material until it reaches the coal seam, as much as 135 feet below the surface.

I previously mentioned that the operations at The Falkirk Mining Company will be somewhat more complicated, in addition to being five times larger than those at our Indian Head Mine. These complications are, in part, the result of the fact that much of the overburden at the site of The Falkirk Mining Company consists of glacial alluvium or till, i.e., a very sandy unconsolidated material strewn with boulders. This material is very unstable, particularly when wet, and therefore sloughing of pit high walls will undoubtedly be a problem, and, more importantly, very flat angles of repose will result for the high wall and spoil piles. These flat angles of repose have necessitated the use of extremely large draglines for the overburden removal operation.

The two primary overburden draglines on order for The Falkirk Mining Company will be the largest machines of their class ever built and will be similar, but larger, than those shown

in this series of slides. These two Marion Power Shovel Company Model 8750-30 machines will have 105 cubic yard buckets capable of lifting approximately 152 tons per bite, and will be powered by electric motors totalling 13,000 horsepower. Due to the flat angles of repose to be encountered, as previously described, these machines will have the longest booms ever ordered for a dragline. The booms will be 350 feet long, giving each machine a 328.5 foot operating radius. Imagine, one of these machines could be positioned between two football fields placed end to end, and it would be able to lift 152 tons from well in the end zone of one football field and place it deep in the end zone of the second football field over 218 yards away.

These machines must be large because, based on the thickness and depth of the coal to be mined, these two machines must remove nearly 50 million cubic yards, or 75 million tons of overburden annually to produce the six million ton annual coal requirement.

3. Another complication to be encountered in the mining sequence at the Falkirk operation is the fact that the reserves occur in two distinct seams, as shown in this slide of a typical pit cross section. The top seam will normally be about 8 feet in

thickness and the bottom seam will be only about 3 feet in thickness. These seams will be separated by a clay parting which must be removed by two smaller 18 cubic yard crawler-mounted draglines as depicted in this slide.

This is another slide of the 300 million ton reserve of The Falkirk Mining Company showing the extent of the clay parting over the property.

4. After the strata overlying the top coal seam is removed, a coal drill will next sink blast holes in the coal seam and light explosives will be placed in the holes, as shown. The coal is blasted only just enough to fracture the seam for easy loading.
5. Then a power shovel loads the coal into trucks for transportation to the truck dump hopper and preparation plant facility, as shown here.
6. After the top seam is removed, the clay parting between this seam and the lower seam must then be removed as previously depicted. The bottom seam will then be ripped with bulldozers, blasted where necessary, and loaded with large front-end loaders into haulage trucks.

7. The haulage trucks will discharge into one of three dump hoppers, one or more of which must normally be empty. Primary and secondary crushers under the truck dump hopper will crush the coal to a top size of $1\frac{1}{2}$ inches.
8. From the crushing facility, the coal is fed onto a conveyor belt which transfers the coal to a huge 16,000 ton coal storage silo. It is from the silo that the coal will be fed onto the conveyor extending from the surface facilities of The Falkirk Mining Company to the Coal Creek Station.
9. Of course, after the coal has been extracted, the mining sequence continues with the entire reclamation process as has been previously described.

Although I have depicted the mining and reclamation sequence that will be implemented at The Falkirk Mining Company, these operations obviously will not commence for some time.

Where are we today? We have acquired about 1800 acres of surface lands, complete with a mascot and a farm house, which will be used as a temporary office. This slide presents "Falkirk" a proud collie who is definitely a non-union canine.

We are in the preliminary engineering and construction phases of mine development. On July 14, 1975, The Falkirk Mining Company was

granted a zoning map amendment by the McLean County Planning and Zoning Commission. This authorization permitted the re-zoning of the site of the surface facilities from an agricultural to an industrial classification.

The following series of slides depict the various sites for our proposed:

Railroad branch,

Truck-dump,

Highway underpass,

Dragline erection site,

Access and haulage roads,

as well as the sites for the mine's office, shop, and warehouse buildings.

Further, our staff has been busy in obtaining approvals of the various budgets, specifications, contracts, and purchase orders necessary for this early stage of mine development.

On August 11, 1975, twenty-one trained, non-union employees were transferred from our Indian Head Mine to The Falkirk Mining Company. They have been working on the construction of permanent mine access and haulage roads, the establishment of the railroad spur grade, and the initial maintenance and office facilities. These employees are being supervised by skilled, experienced members of our managerial and engineering staffs.

Appropriate permits and licenses are also currently being obtained. These include the license to mine, water permits, reclamation plan approval,

water discharge permits, explosives permits, zoning conditional use and construction permits, and other numerous licenses required to meet Federal, State and local requirements.

A computerized critical path will be established to chart the status of the project. The chronological development of detailed mining plans can be incorporated into this mode to accurately determine potential problem areas and maintain project schedules.

A concise baseline data system of all the areas affected by the mining project is being implemented. This study includes a complete environmental assessment, past and present land productivity studies, climatological data, economic patterns, air and water quality studies, soil types, animal and plant studies, community studies, and land uses.

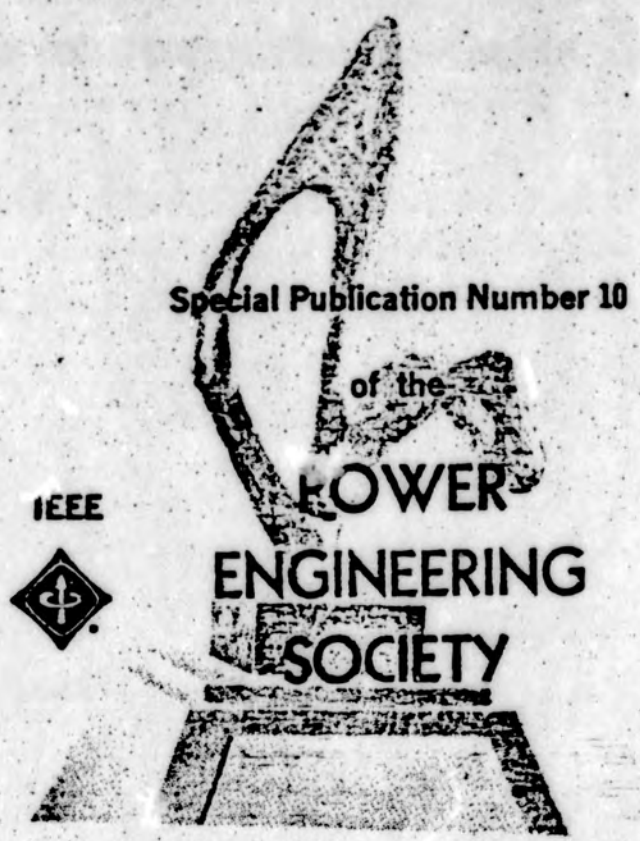
Notwithstanding the many problems and hurdles lying ahead, The Falkirk Mining Company must and will be ready to produce the tonnage required by the Coal Creek Station prior to the 1978 commencement of operations of that facility. Furthermore, we are confident that we will achieve the lowest possible fuel costs at our operation, with a minimum of environmental and socio-economical impact.

Thank you for inviting me to this fine meeting.

STUDY IN THE USSR OF MEDICAL EFFECTS OF ELECTRIC FIELDS ON ELECTRIC POWER SYSTEMS

Translations from Russian
by
Dr. G. G. Knickerbocker

RECEIVED
JAN 26 1977
Executive Officer,
Min. Dept. of Health



Presented as a Public Service
by the
Electrical Safety and Life Sciences Subcommittee
of the
Power and Environmental Sciences Committee

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FOREWORD

H. C. Barnes

At the 1972 International Conference on Large High Voltage Electric Systems (Conference Internationale Des Grands Reseaux Electriques a Haute Tension, commonly known as CIGRE) Paper 23.06 by V. P. Korobkova, Yu. A. Morozov, M. D. Stolarov and Yu. A. Yakub of the USSR was entitled, Influence of the Electric Field in 500 and 750-kV switchyards on Maintenance Staff and Means for its Protection. The authors' introduction and conclusions are:

INTRODUCTION

The studies of EHV switchyards electric field effects on human beings have been carried out in the USSR since 1962. Besides the direct influence of the electric field, the influence of electrical discharges appearing when touching different objects, structures, equipment and so on, due to the difference of potentials relative to ground on these objects and on a man is being studied.

The studies have shown that the increase in the operating voltage of the switchyard brings about the increase in the electric field influence. This fact should be taken into account when designing UHV switchyards.

CONCLUSIONS

1. 500 and 750-kV switchyards electric field has an unfavourable effect upon the human organism resulting from the direct field influence after long-time working on it, as well as from the influence of electrical discharges.

2. The degree of the electric field influence upon a man should be assessed by the value of its intensity. At $E \leq 5$ -kV/m the field does not influence a man.

3. At the majority of working places at 500 and 750-kV switchyards the electric field intensity considerably exceeds the threshold value. This is why screening is necessary as a means of biological protection.

4. At present the devices for screening working places and special clothing for individual screening are used in the USSR. The latter is not widely applied due to a number of shortcomings.

The discussion of this paper as reported in the proceedings of the 1972 CIGRE Conference is reproduced in Appendix I of this publication.

As a contribution of the IEEE Power Engineering Society toward better understanding of CIGRE Paper 23.06, copies of the medical references of that paper were obtained in the original language and translated by G. G. Knickerbocker, Chairman of the PES Electrical Safety and Life Sciences Subcommittee and members of the Johns Hopkins staff that had conducted a 9-year study of linemen working in electrical fields. These translations were reviewed by 23.06 author Yu. A. Yakub after which he granted permission for IEEE publication. They are contained herein along with other information deemed to be pertinent, including (Appendix II) summaries of later medical papers from the USSR.

No effort is made here to evaluate these papers; that is left to the reader. However, in evaluating these contents, it is important to consider carefully the commentary that follows by the members of the Johns Hopkins Hospital staff, particularly when considering the influence upon persons who may be in the vicinity of lines rather than in substations to which access is restricted to authorized personnel.

ADDENDUM

(To Foreword)

On February 18-19, 1975, the USA-USSR Working Group on UHV Transmission met in Washington, D.C. Papers presented by the USSR representatives included one entitled:

ELECTRICAL FIELD AS A PARAMETER CONSIDERED IN DESIGNING ELECTRIC POWER TRANSMISSION OF 750-1150 KV; THE MEASURING METHODS, THE DESIGN PRACTICES AND DIRECTION OF FURTHER RESEARCH

Yu. I. Lyskov, Yu. S. Emma—the "Energoset'proekt" Institute—M. D. Stolyarov—ORGRES

This established higher acceptable gradient standards for transmission lines in accordance with these direct quotations:

In designing the O. H. 750-1150 kV line, considering that cumulative effect of the field due to an infrequent and nonsystematic exposure of the local population and

the agricultural workers can practically be disregarded, as permissible magnitudes of the field intensity the following higher standards were accepted:

20 kV/m for difficult terrain,
15-20 kV/m for non-populated regions,
10-12 kV/m for road crossings.

The permissible field strength must not be exceeded at the center of the span at the height of 1.8 meters above ground and at the lowest sag (at the maximum 15 year temperature).

The permissible values of field intensity were chosen with consideration of favorable operating experience in over 150,000 km/years in O. H. 500 kV lines, for which the designed field intensity is for similar conditions from 10 to 14 kV/m.

Comment by Johns Hopkins Study Team

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This series of Russian medical papers contains much subjective material which makes it difficult to reach any firm conclusions from this work. Notable especially is the absence of comparable data on workmen not exposed to electric fields. As we have commented elsewhere, analysis of data that does not take into consideration working conditions and social, political, and environmental influences must be viewed with great caution.

We can only reaffirm the conclusions from our project that we did not find any disease of any ill effect from high voltage line exposure in a study of ten linemen over a period of nine years beginning in 1963 and dealing with system voltages up to and including 765-kV. Further, we have ascertained that these ten linemen are at present time (September 1974) all working

and are healthy and have lost no time from work. Significant is the fact that these men worked in field gradients far in excess of any encountered at ground level.

It should be understood that our study involved exposures many times more severe than that reported by the Russians as our study was concerned with linemen working adjacent to or in direct contact with energized conductors whereas the Russian workers were exposed to lower fields at ground level. Significant to the subjectivity of the data of 23.06 is this statement by one of the Russian authors in a personal letter. "The staff maintaining 500 and 750-kV lines in the USSR in contradiction to the staff maintaining substations of the same voltages do not complain of their health changing for the worse under the influence of the electric field".

THE STATE OF HEALTH OF PERSONS WORKING IN THE ELECTRIC FIELD OF OUTDOOR 400 AND 500 kV SWITCHYARDS

P. Asanova and A. I. Rakov, Leningrad

It is worthy of note that 1/3 of the men examined in the age of 30-40 years complained of sexual weakness, which developed after 8 to 10 months of work under the conditions of influence of high voltage electric fields. In the histories of these people there was no indication of disease of the urinary tract, venereal disease, psychotic trauma, or other aggravating factors. Besides this, the examinees complained fairly frequently of palpitations, painful phenomena in the cardiac region (piercing, aching, squeezing), irritability, and poor appetite after work.

It must be noted that we carried out the medical examinations in summer. Therefore, meteorological factors might play a role in the character of the complaints. Taking this into consideration, we utilized data from medical examination of the substation personnel done in local polyclinics in different seasons in the preceding two years. Analysis of these data showed that these same neurological disorders were noted in the examinees in the autumn and winter.

Neural pathology was diagnosed in 28 of the subjects. In more than half of the examinees (in 26 of 45) functional disruption of the central nervous system was determined, appearing clinically chiefly in the form of autonomic dysfunction and significantly less often (in 6 cases) in the form of neurasthenic syndrome. In the usual neurological examination, in a majority of the persons, the phenomenon of autonomic dysfunction was of moderate degree. Thus, in these there was noted: stable red dermograph, instability of the pulse and arterial pressure, hyperhidrosis in the armpits and on the palms, fine tremors of the extended hand. Only in four persons were vasomotor and secretory disorders of a more marked character.

The neurasthenic syndrome established in four examinees might be evaluated as hypersthenic. These people complained of headaches, sluggishness, fatigue, irritability, uneasy superficial sleep, and sexual weakness. Objectively, enhanced tendon reflexes with an extended range, coarse tremor of the fingers, mild instability with closed eyes, and higher emotional excitability were noticed in these persons. These symptoms match moderate autonomic disorder. Moreover, in two men over 50, initial signs of sclerosis of vessels of the brain together with arteriosclerotic cardioclerosis was observed. Symptoms of organic damage to the nervous system were not seen. It must be noted that we were not successful in establishing increased neurological complaints and neuropathology with increased work experience under the influence of high voltage electric fields. More marked neurodynamic changes were seen in maintenance people who had the greatest daily exposure to the electric field.

In examination of internal organs, pathology was noted in 18 persons. Diseases of the cardiovascular system were the most frequently encountered (in 14 persons). Among them,

the neurogenic state of hypertensive disease was established in four men, aged 35-37, with 2 to 4 years work experience in the electric field. Arteriosclerotic cardioclerosis was noted in 3 examinees over 50. In 6 persons with etiologically aggravated history, myocardial dystrophy was found (In 4 of these their histories showed chronic tonsillitis in 2—alcohol abuse). A mitral defect (compensated) was found in one.

Studies of the cardiovascular systems of substation personnel revealed a lability of pulse and arterial blood pressure. Bradycardia was noted in 12 persons, tachycardia in 5. Upon blood pressure measurement, hypotension was noted in 7 people, hypertension in 4. Studying the data of medical examinations for 1961-62, it may be noted that lowered arterial pressure in 14 persons, hypertension in 2, were observed previously among the examinees. Thus, besides frequently noting variance of pulse toward bradycardia in substation personnel, transient hypotension was observed in half of the cases. The tendency toward hypertension was observed only in isolated individuals.

Electrocardiographic studies showed sinus bradycardia in 14 persons, slowed atrial and ventricular conduction in 10. Besides this diffuse changes of the myocardium were seen in some persons. The observation of ECG changes compels us to regard them with great caution and to explain whether they were temporary and reversible and whether they will not lead to further, more marked organic damage to the regulatory apparatus of the cardiovascular system and cardiac musculature. It is not possible to answer these questions at this time, in as much as more extensive studies and further dynamic observations are needed.

The influence of high voltage electric fields of commercial frequency upon the human organism has received little study. But this question is quite pertinent, for the contingent of people working under the influence of such fields increases all the while. Considering the importance of the clinical elucidation of this question, we carried out a medical examination* of the personnel of 400-500 kV substations (at two hydroelectric stations on the Volga) under field conditions.

The group examined by us consisted of 45 persons (41 men and 4 women). They were, by profession, mainly electricians (maintenance or attendants) and to a lesser number, signalmen and secondary personnel. They were distributed by age in the following fashion: up to 30 years of age—10 persons, 30-40 years—29 persons, over 40 years—6 people. Substation experience consisted of: 9 persons up to one year, 20 persons from one to three years, 11 from three to five years, more than five years—5 persons. Thus, the examined group basically consisted of middle aged people (to 40 years) with relatively short employment in an electric substation.

The average daily exposure to the electric field was the most (5 hours) in maintenance personnel. For attending personnel, it was, on the average, two hours a day. Signalmen and secondary personnel were not in the field constantly, nor for prolonged periods. It is clear that substation personnel, when

*A therapist, neuropathologist, and oculist took part in the medical examination.

on the territory of 400-500 open switching structures, are subjected to the action of high voltage of commercial frequency. As a result, a current, dependent upon the capacitive coupling of the person with the parts under working voltage and ground, flows through the worker.

Measurements by S. A. Levedev (Leningrad Institute of Labor Protection) showed that, depending on his location in the switching station, a person sustains an electric field of varying intensity. The highest potential of the field at the height of the person reaches 26 kV, the average potential is 14-18 kV. Consequently, the strength of the current flowing through the person maximally, reaches 230 microamperes; but the current strength corresponding to the average potential at the height of man equal 125-115 microamperes. Maintenance personnel working in the switching areas on disconnected equipment sustain the effect of an electric field with an average potential of 2 kV. The strength of the current flowing through the body is 15 microamperes. The maximum potential which maintenance men experience on disconnected equipment reaches 4 kV, which corresponds to a current strength of 35 microamperes.

In substation personnel we carried out a complete clinical study of peripheral blood, roentgenography of the organs of the chest and electrocardiography. First of all, our attention was drawn to the frequency of subjective disorders. Some kind of complaint was expressed by 41 of the 45 examinees. Complaints of a neurologic character (headache, sluggishness, fatigue, sleepiness) occupied first place by frequency. Thirty-seven people presented these. Then complaints of disrupted activity of the digestive tract and cardiovascular system followed.

Neurological disorders were variable. Usually they occurred at the time the person was in the electric field, in the middle or at the end of the working day, and disappeared relatively quickly after the person left the field and rested. Headaches had a quite variable character (prolonged, pulsating, compressing) with varying localization, but most frequently were noted as pain in the temporal and parietal regions. The intensity of the headaches increased in proportion to the duration of time that personnel were in the electric field. In only a few persons, were headaches accompanied by nausea. Some people noted that after work sleepiness and sluggishness de-

veloped so strongly that upon returning home, they were not in any state to engage in any sort of activity and were forced to go to bed. After sleep, as a rule, the unpleasant phenomena disappeared.

Variability of the pulse and arterial pressure, and ECG changes in persons not having organic cardiovascular disease are provisionally considered as functional disorders of the cardiovascular system. They are evidently connected with disorders of central autonomic regulation. The impression is created that changes in the cardiovascular system are encountered more frequently and are more marked in persons systematically subjected to the influence of electric fields (maintenance personnel), than those exposed sporadically (signalmen, attendants).

Regarding changes in other organs, diseases of the digestive tract were noted in 6 people (chronic gastritis, colicystitis). Ophthalmological examinations did not reveal any sort of changes in the organs of sight. A series of changes were seen in studies of peripheral blood. Moderate thrombocytopenia and changes of the white blood cells in the form of moderate neutrophilic leukocytosis or leukopenia with neutropenia were most frequently encountered. Lymphocytosis and monocytosis were also observed. Changes in red blood cells were seen more rarely, and here a tendency toward reticulopenia and moderately lowered hemoglobin and erythrocytes were noted. A retarded sed rate (from 1 to 3 mm) was found in 19 examinees. It is difficult to explain this now, for this requires more extensive studies (studies of the functional state of the liver, blood protein fractions, etc.). Marked spherocytosis was found in 17 of 28 persons in which cytometric studies of erythrocytes were carried out.

Thus, data of these examinations gives leave to assume that being in a high voltage electric field of commercial frequency is an adverse influence upon the working person. This is manifest by disorders of the functional state of the nervous and cardiovascular systems. Qualitative and quantitative changes of peripheral blood also merit attention.

For final resolution of the question of the nature of the influence of high voltage electric fields, further dynamic observations of the workers examined by us and an accumulation of more widespread material by examination of personnel of other similar substations are necessary.

A PHYSIOLOGICAL ASSESSMENT OF THE WORK CONDITIONS IN 400-500 kV OPEN SWITCHING YARDS

T. E. Sazonova

With the advent of the transmission of high voltage 50 Hz ac (400-500 kV) complaints of a degrading state of health began to occur from the attending personnel of open switchyards, specifically fatigue, somnolence, and headache. There are no data on the biological effects or the extent of harm of high voltage 50 Hz electric fields in either the Soviet or the foreign literature. A physiological study of the attending personnel of several 400-500 kV substations was carried out to elucidate the effects of such fields.¹

Current switching structures are located along transmission lines on open ground about 1000 square meters in area. In the work area of switching structures a nonuniform electric field of significant intensity is present. While working under these conditions an electric current passes through the person, the magnitude of which is established by the potential of the electric field at the given point and the capacitance of the person relative to ground. Measurements showed (1) that attending personnel are subjected to the action of electric fields with a minimum potential of 2-4 kV, an average of 12-16 kV, and a maximum of 20-26 kV. With a good connection of the person to ground, the currents passing through the body at these voltages are, respectively, 15-35 microamperes, 100-130 microamperes, and 180-230 microamperes.

Attending personnel of open switchyards consist of maintenance and operating crews. Workers from both groups carry out light work with elements of intellectual and physical stress. Auxiliary and relaying people from the operating crews work in closed quarters which are located on the switchyard site in places with a minimal electric field. Attendants make rounds of the switchyard and are in places with minimal, average, and maximal fields.

Maintenance personnel may work in any place in the switchyard. Repair of air breakers, disconnects, current transformers, etc. is carried out under partial shutdown of equipment. With such work, personnel are subjected to a weak electric field, but the current of 15-35 microamperes flows through these people for long periods of time. Maintenance personnel sometimes work close to connective machines and devices of the switchyard located under high voltage (for example, repairs to disconnects carried out without shutting down the device). In these cases, the intensity of the electric field at the work site reaches the maximum values.

Two groups were formed for the physiological studies. Persons working under electric field exposure of not more than two hours daily were in Group I (operating personnel) while those who were exposed not less than five hours daily were in Group II (maintenance personnel). In all, 54 people were studied: 29 people from the operating crews and 25 people from the maintenance crews. The breakdown of work experience in electric fields is as follows: up to 1 year—12

people, from 1 to 3 years—22 people, from 3 to 5 years—15 people, and over 5 years—5 people. The ages of the subjects fell into three groups: under 30 years—17, from ages 30 to 40 years—33, and older than 40 years—4.

The following indices were determined in order to evaluate the functional state; temperature, pulse, arterial pressure in the humeral artery, latency and quantitative error of the speech-motor reaction, critical flicker frequency, and the strength-duration curve and optimal stimulation frequency of the adductor muscle (adductor pollicis) of the thumb of the right hand. The rate of movement of the thumb was determined by the tetanizing curve which may be directly characterized by the tangent of the angle of inclination of the ascending portion of the tetanizing curve to the initial horizontal line. All other conditions being equal, the lower the rate of movement, the greater the tangent of the angle of inclination of the tetanizing curve to the initial line.

The temperature of the body, pulse, and blood pressure reflect the status of autonomic function. Critical flicker frequency characterizes the functional mobility of the eye, while the strength-duration curve and the optimum-pessimum frequency of stimulation of the adductor pollicis characterizes the excitability and functional mobility of motor systems. Higher nervous activity was studied by the Ivanova-Smolenskii method.

The results of these studies were worked up statistically, according to the degree of probability P of the difference between means of compared values. A result was considered justified for P of 0.05. With such a value of P , the assurance of a difference between two compared series is 95%.

A comparison of the average arithmetic data for the six days of the week was made; it consisted of Group I before and after work, Group II before and after work, Groups I and II before work and Groups I and II after work. Analysis of the results permitted the following observations: 1.) what functional changes arose in the course of the working day in persons for various durations of work under the influence of the electric field, 2.) the intensification, if any, of functional changes over the period of one work week, and 3.) any differences in functional changes in persons of the two groups for various work durations under the influence of the electric field.

Indices of Autonomic Functions

Every day of the work week exhibited a well-defined pattern of functional changes. Therefore, the results of the studies of just one day (a Wednesday) are given.

Body temperature, pulse, and diastolic and systolic arterial blood pressure of persons in Groups I and II are given in Table 1. Body temperature in persons of both groups at the beginning of the work day was in the normal range — Group I, 36.6 ± 0.05 C — Group II, 36.8 ± 0.08 C. By the end of the work day it was still in the normal range for persons of Group I (36.9 ± 0.06 C), but those in Group II, were higher (37.1 ± 0.06 C).

¹ Drs. T. P. Asanova and A. M. Rogov of the Institute of Hygiene and Industrial Medicine (Leningrad) together with physicians of the local polyclinics carried out medical examinations on (attending) personnel of these stations.

TABLE I
Indices of Autonomic Function

| Index | Time Measured | Group I | | | Group II | | | $M_1 - M'_1$ | P | $M_2 - M'_2$ | P | $M_3 - M'_3$ | P |
|----------------------------------|---------------|-----------------|---------------|---------------|-----------------|-----------------|-----------------|--------------|-------|--------------|-------|--------------|-------|
| | | $M_1 \pm m_1$ | $M_2 \pm m_2$ | $M_3 \pm m_3$ | $M'_1 \pm m'_1$ | $M'_2 \pm m'_2$ | $M'_3 \pm m'_3$ | | | | | | |
| Body Temperature | before work | 36.6 ± 0.05 | - | - | 36.8 ± 0.08 | - | - | -0.2 | 0.061 | - | - | - | - |
| | after work | 36.9 ± 0.06 | - | - | 37.1 ± 0.06 | - | - | -0.2 | 0.093 | - | - | - | - |
| Pulse Beats/Min | before work | 68 ± 2.4 | 117 ± 2.4 | 67 ± 1.5 | 69 ± 2.7 | 107 ± 5.5 | 70 ± 2.6 | -1 | 0.383 | +10 | 0.055 | -3 | 0.159 |
| | after work | 73 ± 2.0 | 115 ± 2.6 | 75 ± 2.1 | 67 ± 2.0 | 98 ± 5.0 | 69 ± 2.4 | +6 | 0.002 | +17 | 0.002 | +6 | 0.036 |
| Systolic Arterial Pressure mm Hg | before work | 121 ± 2.0 | 140 ± 2.8 | 119 ± 2.9 | 107 ± 3.4 | 126 ± 4.4 | 101 ± 3.6 | +14 | 0.001 | +14 | 0.004 | +18 | 0.001 |
| | after work | 120 ± 2.5 | 142 ± 2.9 | 118 ± 2.8 | 108 ± 2.0 | 130 ± 4.7 | 97 ± 2.6 | +17 | 0.001 | +12 | 0.014 | +21 | 0.001 |
| Diastolic Pressure mm Hg | before work | 60 ± 1.9 | 69 ± 1.8 | 75 ± 1.9 | 51 ± 3.5 | 53 ± 4.1 | 61 ± 3.9 | +6 | 0.067 | +16 | 0.001 | +14 | 0.001 |
| | after work | 60 ± 1.7 | 61 ± 1.9 | 72 ± 1.7 | 52 ± 2.9 | 50 ± 4.2 | 55 ± 2.7 | +8 | 0.009 | +11 | 0.009 | +17 | 0.001 |

M_1, M'_1 : Average value before squatting.
 M_2, M'_2 : Average value after squatting.
 M_3, M'_3 : After 5 minutes of rest.
 $m_1, m_2, m_3, m'_1, m'_2, m'_3$: Average error
 (the functional state of the cardiovascular system was evaluated by means of a functional test - 30 squats)

Pulse and arterial pressure of both groups did not substantially change in the course of the working day. The comparison between groups showed that after work the pulse and arterial pressure in the workers of Group II was lower than those in Group I. With this, the pulse in Groups I and II and the arterial pressure in Group I oscillated in normal limits but the arterial pressure in Group II was lower than normal. For example (see Table 1), at the beginning of the work day in tests (before squatting) the systolic pressure was 117 ± 3.4 mm Hg, diastolic pressure 54 ± 3.5 mm Hg; correspondingly at the end of the working day 103 ± 2.0 mm Hg and 52 ± 2.9 mm Hg.

The excitability and speed of reaction of the neuromuscular organs of the hand in response to stimulation with an electric current of the adductor pollicis muscle were indicators of the functional state of the central nervous system and higher nervous activity. Excitability of the neuromuscular apparatus of the hand was evaluated by the strength-duration curve; the functional mobility by the tetanizing curve.

The curves characterizing excitability are given in Figure 1; Figure 2 is the functional mobility of the neuromuscular apparatus of the hand of persons of Group II. Analogous curves for operating personnel are not given because they coincide with the corresponding dotted lines given in Figures 1 and 2. To achieve the threshold effect (a hardly noticeable movement of the thumb) in maintenance personnel measured after work, less amplitude of the stimulating current was required than before work. The difference was expressed more strongly with the longer stimulating impulses exceeding 0.11 milliseconds and weaker with durations from 0.02 to 0.11 milliseconds. This gives evidence to the fact that the excitability of the neuromuscular apparatus by the indicator of long duration threshold (Nasonov's terminology (2)) changed more strongly than the index of short duration threshold. It is known that short duration threshold characterizes the excitability of tissue while the prolonged duration threshold characterizes their resistance. Consequently the excitability of the neuromuscular apparatus at the end of the working day in comparison with the beginning was elevated, but the resistance

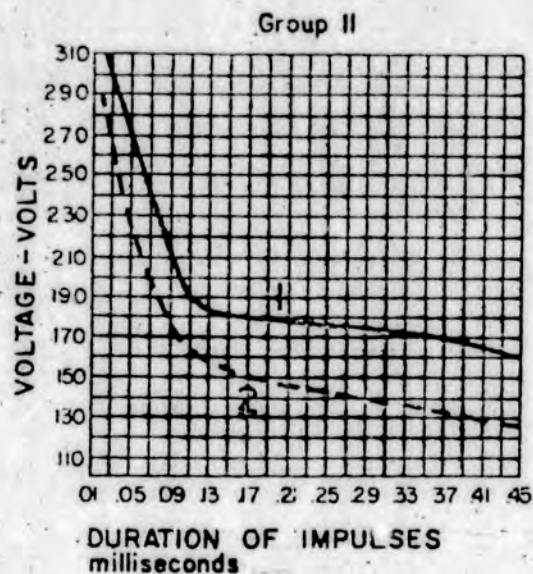


Figure 1. Excitability of neuromuscular apparatus of the hand. 1 - Before work. 2 - After work.

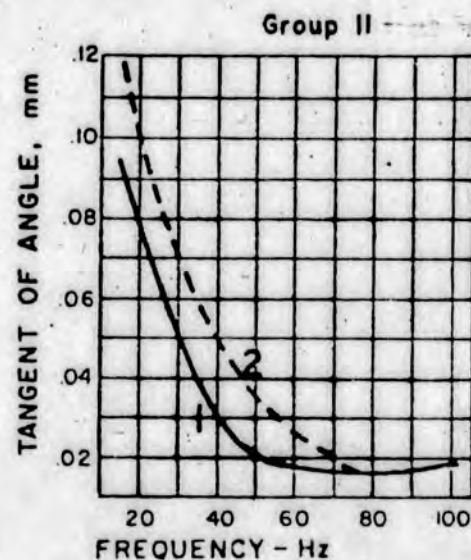


Figure 2. Dependence of tangent of angle of inclination of tetanus curve to initial line on frequency of stimulating current. 1 - Before work. 2 - After work.

TABLE 2
Indices of Speech-Motor Reactions

| Conditional Stimulus | Group | Latent Period of Reaction (seconds) | | | | Errors (percent) | | | |
|----------------------|-------|-------------------------------------|-----------------|--------|-------|------------------|----------------|--------|-------|
| | | $M \pm m$ | $M' \pm m'$ | $M-M'$ | P | $M \pm m$ | $M' \pm m'$ | $M-M'$ | P |
| Bell | I | 0.51 ± 0.08 | 0.52 ± 0.15 | -0.01 | 0.461 | 0 | 0 | 0 | 0 |
| | II | 0.49 ± 0.06 | 0.53 ± 0.09 | -0.05 | 0.309 | 0 | 0 | 0 | 0 |
| Red Light | I | 0.52 ± 0.16 | 0.56 ± 0.11 | -0.04 | 0.421 | 0 | 0 | 0 | 0 |
| | II | 0.52 ± 0.19 | 0.82 ± 0.11 | -0.30 | 0.081 | 0 | 0 | 0 | 0 |
| Green Light | I | 0.78 ± 0.19 | 1.09 ± 0.14 | -0.31 | 0.097 | 9.1 ± 1.6 | 12.4 ± 1.1 | -3.3 | 0.135 |
| | II | 0.76 ± 0.20 | 1.31 ± 0.12 | -0.55 | 0.009 | 12.6 ± 2.6 | 27.4 ± 3.2 | -14.8 | 0.001 |
| Blue-Green Light | I | 0 | 0 | 0 | 0 | 8.3 ± 1.0 | 10.7 ± 2.1 | -2.4 | 0.159 |
| | II | 0 | 0 | 0 | 0 | 14.1 ± 2.3 | 32.4 ± 2.8 | -18.3 | 0.001 |

M : Average value before work.
 M' : Average value after work.
 m, m' : Average error.

to the action electrical current was diminished.

Even the indices of functional mobility of the neuromuscular apparatus changed (see Figure 2). The speed of movement of the thumb for frequencies of excitation from 20 to 70 Hz at the end of the working day in comparison with the beginning was lowered while at the higher frequencies it remained unchanged. In operating personnel the functional state of the neuromuscular apparatus of the hand during the course of the working day did not change.

The functional state of visual receptors judged by the index of critical flicker frequency essentially did not vary with various duration of work under conditions of the action of electric fields. Critical flicker frequency in persons of Group I at the beginning of the work day varied from 34.4 ± 1.2 to 37.1 ± 0.8 Hz, at the end of the working day from 32.1 ± 1.1 to 34.7 ± 1.1 Hz, correspondingly in persons of Group II at the beginning of the working day from 33.0 ± 1.4 to 39.1 ± 0.7 Hz and at the end of the working day from 31.6 ± 1.5 to 40.2 ± 1.3 Hz.

Higher nervous activity was characterized by the latent period of the speech-motor reaction and equal quantitative error in response to positive signals (bell, red light, green light) and to negative (differentiating) signal (blue-green light). The latent time of reaction and the quantitative error of persons of Groups I and II are given in Table 2. The latent time of reaction of workers in both groups at the end of the working day increased: in Group II this was expressed more markedly than in Group I. For example, the latent time of reaction to green light in persons of Group I at the end of the working day in comparison with the beginning increased from 0.78 ± 0.19 to 1.09 ± 0.14 seconds, but in Group II the increase was from 0.76 ± 0.20 to 1.31 ± 0.12 seconds.

The quantitative error in both groups increased by the end of the working day just as the latent time of reaction did. It was more noticeable in Group II than in Group I. The increase of the latent time of reaction gives evidence of a developing inhibition in the cortex of the brain but an increase in the quantitative error gives evidence of a weakening of the concentration of the processes of excitation and inhibition. These changes of neurodynamics in persons of Group II were significantly stronger than in Group I.

If we taken into account that fatigue is connected with the development of inhibition in the higher sections of the central nervous system then we may draw the conclusion that prolonged action of the electric field evoking inhibitions in the cortex of the brain favors the development of fatigue.

As a result of medical studies in attending personnel a definite direction for changes in the central nervous system was established. These changes appeared in the form of autonomic disfunction (greater variability of pulse and arterial blood pressure, predominantly toward bradycardia and hypotonia) and neurasthenic syndrome. Symptoms of organic disfunction as a result of the action of electric fields while working on 400-500 kV switchyards was not established.

The results of physiologic studies agrees with and supplements the data of medical observations. The physiological studies showed vagotonic changes of the cardiovascular system, weakening of the processes of thermal regulation, lowering the resistance to the action of electric currents and functional mobility of the neuromuscular apparatus of the hand, and a weakening of neurodynamic processes in the cortex of brain. The functional changes recounted above were evident in maintenance personnel (prolonged work in the electric field no less than five hours per shift) and they did not appear or appeared weakly in operating personnel (prolonged work in milliseconds. This gives evidence to the fact that the excite the electric field of not more than two hours per shift). This permits us to say that the extent of functional changes in the organism are in direct dependence upon the duration of work under conditions of the action of electric fields, i.e., changes evoked by the field proceed in a cumulative fashion. Earlier such a dependence was expressed in experiments on animals with the study of the action of the electric fields of a frequency of 50 Hz on the efficiency of motor organs(3).

Considering that the work experience in 400-500 kV switchyards in a majority of the individuals observed was relatively short—up to five years, the appearance of functional changes necessarily must be viewed as the beginning of an unfavorable action of the electric fields. In connection with this it is necessary at first to carry out possible measures for protection of attending personnel in 400-500 kV switchyards from the prolonged action of electric fields and secondly to

continue the studies for establishing limits of permissible intensity of electric fields of commercial frequency.

REFERENCES

[1] S. A. Lebedev, "Recommendations for development of a suit for protection from the action of an electric field in open 400-500 kV

switchyards," *Compendium Scientific Work of the Institute of Labor Protection VTzSPS*, vol. 4 (24) Moscow Profizdat, 1963.

[2] D. N. Nasonov and D. L. Rozental, "Time factors in the evaluation of the excitability of tissue," I.M. Schnov, *Physiologic Journal of the USSR*, vol. 39, no. 4, 1953.

[3] T. E. Sazonova, "Functional changes while working in a high intensity electric field of commercial frequency," Abstract of Candidate's Dissertation, Leningrad, 1965.

DEVICE FOR THE MEASUREMENT OF INDUSTRIAL FREQUENCY ELECTRIC FIELD INTENSITY

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Ultra high voltage transmission lines of 500 kV and higher have found wide application for transmission of electrical energy at great distances in the Soviet Union. Studies showed that in the work regions of these transmission lines a strong electric field with intensities to kV/meter arise. It is known that prolonged exposure of a person to an electric field of high intensity is not without effect upon his health (1).

Special devices are required for studying work conditions of attending personnel of these transmission lines which permit measurement of the intensity of the electric field close to high voltage apparatus. Until recent time there were no such instruments. The existing instrument INEP-2 (2) has a 1.5 meter long remote pickup connected with ground and therefore its use on high voltage transmission lines is prohibited by the electrical safety rules.

Other methods of evaluation of the electric field at the work site on transmission lines by means of measurement of the potential field relative to ground by an electrostatic voltmeter or the determination of the magnitude of displacement current through a person by a microammeter (3) does not give sufficient information for complete characterization of the action of the field on a person. Besides this, these methods are quite time consuming inasmuch as they require good electrical isolation of the man from ground which is very difficult to accomplish in practice, especially in measurements on transmission line towers.

One of the basic requirements set down for an instrument for direct measurement of the intensity of the field on transmission lines at close range is that its circuit antenna and case not be electrically connected to ground. In the INEP-50 instrument developed at the All Union Scientific Research Institute for Labor Protection in Leningrad this requirement is guaranteed by the use of a handle of insulating material 250 mm in length.

The operator holds the instrument by the handle and inserts it into the measured area (Fig. 1). In the process of making the measurement the instrument is oriented to give the greatest deflection of the needle which corresponds to the maximum intensity of the field in the region in which the instrument is located. The instrument has the dimensions 150 mm X 90 mm X 50 mm and weighs 600 grams. Power is

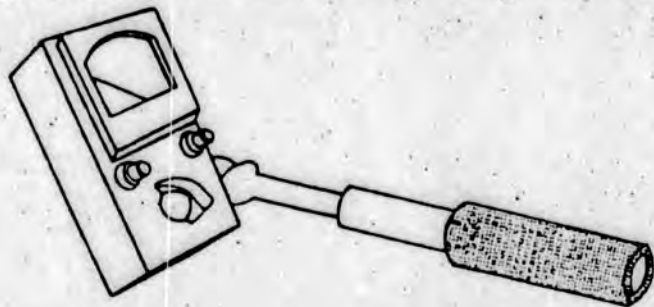
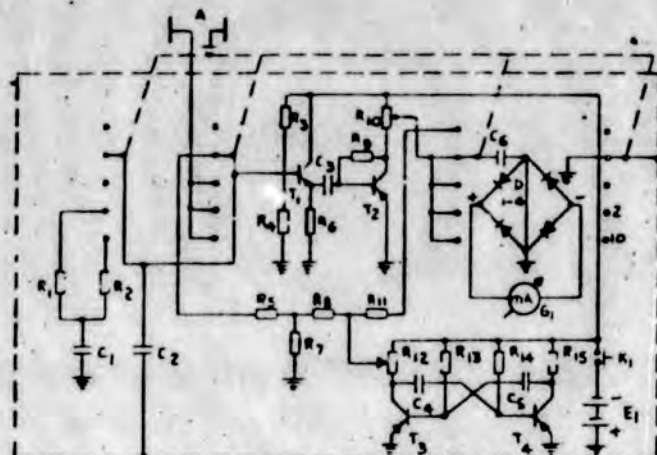


Figure 1. An instrument for the measurement of the intensity of electric fields of 50 Hz.



$R_1, R_7, R_9 = 100K; R_2 = 6.2K; R_3, R_4 = 300K; R_6 = 10K; R_5, R_{10} = 4.7K;$
 $R_8, R_{13}, R_{14} = 51K; R_{11} = 20K; R_{12} = 1K; R_{15} = 2.2K; C_2 = 30pF;$
 $C_1, C_3, C_6 = 20mfd; C_4, C_5 = 0.25mfd; \text{Transistors } T_1 \text{ thru } T_4 = \text{Type}$
 $MP-41A \text{ (Soviet NPN transistors); Diodes } D_{1-4} = \text{Type D-11 (Bridge);}$
 $\text{Battery } E = 4.5V, \text{ Meter} = \text{Type M-4204 - 10 Duo}$

Figure 2. A schematic of the instrument.

supplied from one 4.5 volt battery. Fields from 1-1000 kV/m are the limits of measurement of electric field intensity. Error of measurement does not exceed 20% of the actual value of the measured magnitude.

Description and Principles of Operation of the Instrument

The schematic of the instrument (Fig. 2) consist of four basic sections:

1) The input network is an antenna A in the form of a dipole made of two metal plates of dimensions 25 mm X 40 mm located on the top and bottom of the body of the instrument, two resistors R_1 and R_2 with which the input of the instrument is shunted for expanding the limits of measurements, and a capacitance C_1 for symmetrizing the capacitance between antenna plates and the body of the instrument.

2) A two-stage ac amplifier consists of transistors T_1 and T_2 . The first stage is an emitter-follower for increasing the input resistance; the second is a common-emitter with gain control R_{10} in the collector circuit of transistor T_2 . The gain of the amplifier is 40.

3) A full-wave rectifier is accomplished with a bridge of semi-conductor diodes D_{1-4} . One diagonal of the bridge is connected to the output of the amplifier through a decoupling capacitor C_3 , and the other diagonal is connected to a microammeter G_1 .

4) A generator of sustained oscillations (50 Hz) is accomplished by a multi-vibrator, utilizing transistors T_3 and T_4 . The generator is used for automatic calibration of the instrument before measurements.

The principle of the instrument is based on the action of an ac electric field in the antenna dipole which induces an electromotive force as a consequence of which a signal is produced at the input of the amplifier. In accordance with the equivalent

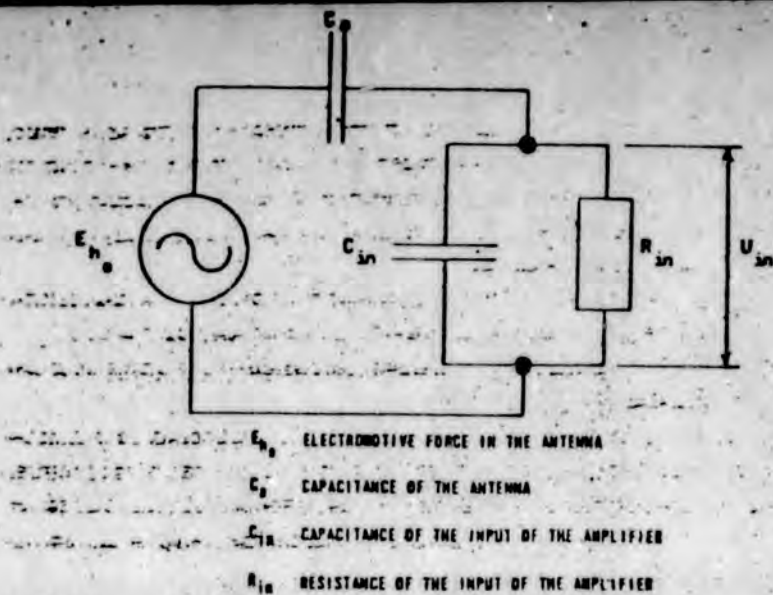


Figure 3. Equivalent diagram of the input circuit of the instrument.

diagram of the input circuit of the instrument (Fig. 3) the voltage of the signal at the input of the amplifier U_{in} is proportional to the effective value of the intensity of the electric field E

$$U_{in} = \frac{E h_e C_a}{(C_{in} + C_a) \sqrt{1 + \frac{1}{W^2 (C_{in} + C_a)^2 R_{in}^2}}}$$

where

h_e is the effective length of the antenna

C_a is the capacitance of the antenna

C_{in} is the input capacitance of the instrument

W is the angular frequency

R_{in} is the input resistance of the instrument.

The signal amplified by transistors T_1 and T_2 (see Fig. 2) is applied through potentiometer R_{10} and blocking capacitor C_6 to the measurement bridge D_{1-4} . The scale of an indicating microammeter is graduated from one to ten kilovolts per meter. The upper limit of measurement may be multiplied by a factor of two or ten by switching resistances R_1 or R_2 in parallel to the input.

Calibration of the Instrument

In the instrument there is a special calibrating generator of transistors T_3 and T_4 for accomplishing calibration of the instrument which establishes the coefficient of amplification before measurement. Resistances R_{12} through R_{15} and capacitances C_4 and C_5 are chosen such that the signal frequency is 50 Hz.

Calibration of the instrument consists of initially applying the signal from the generator to the measurement bridge through resistance R_{11} . The magnitude of this resistance is at least an order of magnitude greater than the sum of the resistances of the diode bridge and the coil of the indicating ammeter. This eliminates the error in establishing the calibrating potential of the generator because of temperature changes

of the resistance of the semi-conductor diodes of the bridge. The necessary voltage at the output of the generator is set according to a mark on the scale of the instrument by means of potentiometer R_{12} .

Then the output of the generator with fixed voltage is connected to the amplifier through resistance R_3 , the magnitude of which by many times exceeds the input resistance of the amplifier. This insures a constant current in the circuit during possible temperature changes of the input resistance of the semi-conductor amplifier. With the aid of the mark on the scale of the instrument the required coefficient of amplification is established by adjustment R_{10} . By such a calibration, the indication of the instrument will correspond to its initial calibration in a uniform electric field of known intensity.

Initial calibration is carried out with adjustment of the instrument and consists of the device being placed on an insulating stand in the uniform electric field of a plane capacitor consisting of two metal plates 2.5 X 2.5 meters separated by a distance of one meter.

A source of regulated high voltage up to 20 kV is applied to the plates. For a given case the intensity of the electric field between the plates is $E = U/L$ kV/m where U is the voltage on the plates in kilovolts and L is the distance between the plates in meters.

Calibration under the stated conditions simultaneously takes into account the distortion of the uniform electric field because of insertion of the instrument into it. It is necessary to note that uniformity of the electric field in the zone in which the instrument is placed is a necessary condition for correct measurement of the intensity. Conditions of uniform electric field at the point of measurement on high voltage transmission lines is practically always fulfilled with the physically small instrument INEP-50. Actually, data from calculations and measurements of the distribution of the electric field on high voltage lines (4) shows that field intensity is proportional* to the square of the distance from the source of the field (conductor, connecting bus, etc.). The relative magnitude of the changes of intensity of the field for increases of the distance from the source S to the magnitude of the linear dimensions of the instrument ΔS is equal to $\Delta S(d/ds)(1/S^2)S^2 = -2\Delta S/S$.

At the present time an experimental group of INEP-50 instruments is being prepared at the SKB Institute. Preliminary tests of the instrument field conditions were carried out on transmission lines of the distribution centers of the Leningrad power system and the Moscow power system. Results of the test showed that the instrument is simple and convenient to use. No more than five minutes were spent making the necessary measurements at one work site (ten measurements). Calibration of the instrument does not need to be carried out before each measurement but after ten to fifteen minutes of use.

REFERENCES

- [1] T. E. Sazanova, "Physico-hygienic evaluation of labor conditions on open switchyards of 400 to 500 kV," *Compendium Scientific Work of the Institute of Labor Protection of the VTSsPS*, number

*Translators Note: Though not specifically stated "inverse" proportionality would seem to be indicated by reason of physical principles.

46. Moscow, Profizdat, 1967.

- [2] A. M. Konia and Votloe Foanke, "An instrument for measurement of the intensity of electric and magnetic component fields in the zone of induction," *Compendium Scientific Work of the Institute of Labor Protection of the VTSSPS*, number 6, Moscow, Profizdat, 1963.
- [3] S. A. Lebedev, "Measurement of the Magnitude of the Potentials of an Electric Field in Open Switchyards of 400 to 500 kV and the

Currents Flowing Through Man to Ground," *Compendium Scientific Work of the Institute of Labor Protection VTSSPS*, number 3, Moscow, Profizdat, 1963.

- [4] S. A. Lebedev, and Yu. A. Morozov, "Reduction of the intensity of electric fields in the work zone of high voltage transmission lines of commercial frequency," *Compendium All Union Scientific Research Institute of Labor Protection VTSSPS in Leningrad*, Leningrad, 1967.

ELECTRICAL DISCHARGE INFLUENCE UPON A MAN

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While working in intense electric fields, in addition to the direct action of fields on man there is the action of electric discharges occurring at the moment a person carrying an electric charge contacts grounded construction or at the moment when a man well-connected to ground, contacts a charged object. In both cases the person may experience a painful pricking sensation.

The object of this present work was the study under laboratory conditions of the action of electric discharges on man arising during work in strong electric fields. The potential on the person working in such fields reaches 10 kV, and the capacitance of a man is 70 to 100 picofarads. The energy of the electric discharge with a potential of 10 kV and a distributed capacitance of 100 picofarads is equal to 5×10^{-3} joules; the duration of the impulse 8×10^{-8} seconds.

Electrical discharges were obtained by means of a special high voltage device. The influence of electrical discharges was studied on four subjects (40 experiments). Two series of experiments were carried out. In the experiments of both series electrical discharges with equal energies were applied but the sequence of application of impulse discharges was varied.

It was observed at the beginning of the action of the electrical discharges that there was a marked increase in excitability in the cortex of the brain, depression of alpha rhythm in the lobar regions of the brain. Simultaneously in other regions on closing the eyes the latent period reaction increased and then decreased upon opening the eyes. For this the ratio of the latent period of the first reaction to the second reaction increased by $1\frac{1}{2}$ to 2 times. Besides this the action of the discharge caused an observable shift of the bilateral focus of activity in the cortex: the right hemisphere rather than the left became dominant.

In experiments of the first series (discharge of impulses applied with an interval of 20 seconds) at the time of action of

the discharges the bilateral focus of the activity of the brain changed in one or two regions. In the second series (discharge of impulses applied with an interval from 1-30 seconds) the activity changed in all regions of the brain. In control experiments the bilateral focus of activity of the brain did not change.

Electrical discharges evoke changes even in autonomic function. In experiments of the first series the rate of pulse and respiration did not change, but in the second series the pulse became slower and respiration became more rapid. Variability of pulse and respiration increased. The marked increase in variability of the rate of pulse and respiration (by $1\frac{1}{2}$ to 2 times) is evidence of the lowering of functional stability of the organism. Consequently the action of electrical discharges is not without effect upon a person. With the action of discharges the excitability in the cortex of the brain increased in particular in regions "responsible" (according to the neurologic conception of E. K. Sepp (Luria, A. G., Tsvetkovals, L. S.)) for motor logic function as the interchangeability of the hemispheres was intensified. This gives evidence of the intense work of the brain similar to that which takes place at the time of fatigue in overcoming the "dead point" in the process of exercise (Pavlova, L. P., Tochipaw, K. S.). Variability of pulse and respiration was markedly increased.

It must be supposed that with increased voltage on active transmission lines, the intensity of the electric field in the working region will increase and consequently the frequency of occurrence of electrical discharges and the discharge energy will increase. Evidently, for work in such fields, frequent sudden electrical discharges evoking painful sensations may lead to the occurrence of stagnant foci of excitability in the cortex and disruption of the equilibrium of processes of excitation and inhibition. Therefore, when performing work in electric fields the action of strong discharges on persons must necessarily be avoided.

**RULES AND REGULATIONS ON LABOR PROTECTION AT 400, 500, AND 750 kV AC
SUBSTATIONS AND OVERHEAD LINES OF INDUSTRIAL FREQUENCY
(IN THE USSR)**

1. Extent and Order of Application of Rules and Regulations for Labor Protection for Work at Substations and on Open Transmission Lines With Voltages of 400, 500, and 750 kV ac of Commercial Frequency.¹

1. These rules and regulations are disseminated to personnel: A) serving active 400, 500, and 750 kV substations and transmission lines; B) serving working electric systems of any voltage (open and cable transmission lines and also lines of communication and so forth), located within the zone of influence in 400, 500, and 750 kV open transmission lines; C) carrying out construction, maintenance, and repair work on active 400, 500, and 750 kV substations and in the zone of influence of open transmission lines of the same potential (including consulting personnel).

2. These rules and regulations are required for the personnel for whom they are promulgated. Deviations from them are not permitted. Every worker if he cannot take measures to avoid infraction of standards and rules must immediately report directly to the director and in those cases of his absence to a superior, all infractions of standards and rules noted by him and also of any improper protective measures.

The administrative technical manager of an installation for personnel for which these rules and regulations are set forth may, depending upon local conditions, set forth additional measures increasing work safety. These measures must not contradict demands of these standards and rules.

3. Changes and additions in the rules in conformity with safety practice must be introduced in accordance with the requirements of these rules and regulations.

4. Responsibility for observation of these rules and regulations lies with the manager of the installation carrying out work on active substations and transmission lines of 400, 500, and 750 kV and in the zone of influence of open transmission lines of the indicated voltage.

II. Hygienic Standards

5. The electric field of 400, 500, and 750 kV substations and open transmission lines has an unfavorable effect on the human organism. Besides this at the moment a person touches metallic parts of equipment, construction machines, vehicles, and so forth, electrical discharges occur. The unfavorable influence of electrical fields and discharges on the human organism appears only in the zone of influence—the space in which the intensity of the electrical field exceeds 5 kV/m.

The degree of effect of the electric field on the human organism depends both on the intensity of the field and the length of time in it. The influence of electrical discharges on the human arising in the zone of influence is not permissible regardless of the time of its action.

6. The permissible duration that a person may be in an electric field of various intensities in the course of a day without protective means is given in the table. (See Table 6)

¹For further simplicity "substations and open transmission lines with a voltage of 400, 500, and 750 kV ac of commercial frequency" will be called 400, 500, and 750 kV substations and transmission lines.

TABLE 6

| Numbers | Electric Field Intensity kV/m | Permissible Duration of Personnel Stay in Electric Field During 24 Hours (minutes) | Notes |
|---------|-------------------------------|--|---|
| 1 | 5 | unlimited | Points 2, 3, 4, and 5 of the regulations are valid if: 1) all the remaining time a man is in areas where electric field intensity is less than or equal to 5 kV/m 2) a possibility of electrical discharge influence is eliminated. |
| 2 | 10 | 180 | |
| 3 | 15 | 90 | |
| 4 | 20 | 10 | |
| 5 | 25 | 5 | |

7. If the intensity of the electric field at the working site is not equal to the standard values, the permissible duration that a person may be in the electric field must be determined according to the next greater value of intensity according to the table of paragraph 6 of these rules and regulations. Interpolations in the table are not permitted.

8. Any work may be carried out in places in which the intensity of the electric field is equal to or less than 5 kV/m without restrictions of it by character or duration. If the intensity of the electric field at the work site exceeds 24 kV/m and also if duration of work safety conditions do not correspond to the demands of paragraph 6 of the present standards and rules the work must be carried out with the use of protective means.

9. In substations and open air lines the boundary of the zone of the influence of the electric field is located at the following distances from the nearest current carrying parts (in air): in 400 and 500 kV substations and open air transmission lines—20 meters; in 750 kV substations and open transmission lines—30 meters.

10. The boundary and the zone of influence on the magnitude of the intensity of the electric field at the work site may be made more precise when established as a result of measurements of the actual value of the intensity of the electric field. The intensity of the electric field is measured: A) at a height of 1.8 meters if the person is located on the ground; B) over the whole height of the man if the person is located on a device or on construction. The greatest measured value of intensity is the determining value.

III. Protective Measures and Their Basic Requirements

11. Protective measures must be applied in the zone of influence of electric fields while carrying out all forms of work if the duration is longer or the safety conditions for accomplishing the work do not correspond to the requirements laid down in the table of paragraph 6.

12. The following screening measures may be applied for the protection of personnel from the influence of electric fields: A) stationary shielding of the structure, B) portable shielding structures, and C) individual shielding outfits (shielded clothes).

13. Stationary and portable screening structures must be grounded and must insure reduction of the intensity of the electric field at the work site to a magnitude of 5 kV/m or less.

14. Stationary shields may be made in the form of baffles, curtains, or partitions. Baffles are made of metallic mesh. They are placed over work sites at unit cabinets and air breaker control compartments, at terminal blocks and conductors of disconnect (if these leads jut out from behind the structures from which the disconnect stands), at 380V units, power distribution bays, and at filters of connections and other devices and equipment requiring periodic service.

Curtains are made of steel cable conductors, reinforcement, and so forth. They are set up over walkways and over other sites of distribution equipment from which inspection of equipment may be carried out.

Partitions are made of metal conductors. They are set up vertically between two neighboring bays. Grounding of stationary shielding devices must be accomplished by connecting them to the network ground or to a grounded object (by welding or by bolting).

15. Portable shields may be made in the form of stock curtains, tents, dividers, panel, and so forth. They are placed over work sites and also between live cubicles and dead cubicles or cubicles under construction. Portable panels are expedient to use as removable lateral screens in scaffolding used when working on circuit breakers, in bucket lifts, and so forth. Grounding of portable screens must be carried out by connecting them to the network ground or to a grounded object for which they must have special ground leads and clamps.

16. Personnel or individual shielding devices are used in the absence of stationary and portable shields. The use of personnel devices are prohibited in those cases where contact with current carrying energized parts is possible, in particular when working on panels, electric leads, installations, and circuits up to 1000 volts, during preventative inspection of equipment (for those persons directly carrying out the task) and while arc-welding. Protection of personnel in these cases must be carried out with stationary or portable shielding.

17. The protective properties of the personnel shields are insured by construction and observation of the rules of their use. Individual shielding devices consist of the following elements: A) protective suit—jacket and pants (or coveralls), B) shielded head covering—metallic or metallized plastic helmet for warm seasons or a fur cap with ear pieces covered with a covering of metallized cloth for the cold seasons, C) special shoes having conductive rubber soles or made wholly of conductive rubber (shoes, boots, galoshes with felt linings).

Special shoes are the principle means of grounding of individual shielding assemblies. All elements of a personnel shielding device for protection from the action of electric fields must be used together and must be reliably electrically connected with each other with conductive jumpers.

18. For tasks connected with contact to ground objects, personnel shielding devices must be further grounded in the following cases: A) when the person is on ground with low conductivity (concrete, gravel, wooden flooring, etc.), B) when the person is located on grounded construction but the as-

sembly is isolated from "ground".

Platforms of fluted metallic sheets or screen on which the person must be doing the work may be used for additional grounding. Platforms must be grounded. They must be provided with special clamps and cables for grounding. Additional grounding of the assembly may be accomplished also by way of grounding of special leads and joining it to any of the conductors connected with the assembly.

In all other work, in particular in work not connected with a person's touching grounded objects or if he is located directly on metallic grounded construction on damp sand, earth, or grass, additional grounding of the personnel shielding device is not required.

19. When working in the zone of influence of the electric field vehicles and mechanized devices on rubber tracks or tires must be grounded. Grounding must be accomplished by conductors. Bodies or frames of machines and devices must be equipped with special clamps for grounding. Besides this, these machines and devices must have metallic chains which must be connected with the frame or the body. Before entering a substation or the zone of influence of a transmission line the chain must be let down and be in contact with the ground.

20. Vehicles and mechanized devices (mobile laboratories and workshops, cranes, tractors, etc.) the roofs and bodies of which are metallic and reliably grounded are comparable to a shielding structure.

21. Devices and equipment which during work in the zone of influence of an electric field may be isolated from ground (blocks on an insulated rope, unrolled conductors, etc.), must be grounded.

IV. Special Work Procedures in 400, 500, and 750 kV Substations

22. All work in the zone of influence of an electric field without being up on a device or construction (that is on the ground), must be carried out with the use of shielding if the standards given in Table 6 cannot be insured.

Work carried out up on devices and construction must be carried out with the application of shielding independent of its duration. Exceptions include operational servicing of transformers and shunt reactors not requiring elevation to the input (oil sampling from it or from the input, servicing the cooling system, control and measurement devices, light repair, etc.). This work may be carried out without shielding independent of duration in view of the adequate shielding provided by the cases of the transformers and shunt reactors.

23. Work in production in ancillary compartments, at control desks, in transformer vaults, in compressor, shop, and other facilities made of reinforced concrete may be carried out without protective measures independent of the distance between the compartment and the current carrying parts under voltage.

24. Partitions (stationary and temporary) eliminate the influence of an electric field only of neighboring connections. The influence of an electric field of a given connection or bus located overhead for work without removal of voltage is eliminated by other means of shielding.

25. Before carrying out work, however short, it is necessary to ground all current carrying parts isolated from

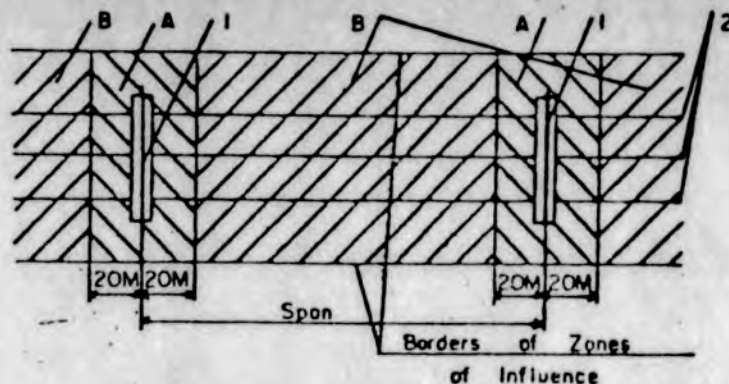


Figure 1. Diagram of 400 and 500 kV transmission lines with zones of influence.

- 1 Tower (intermediary, anchor, or corner).
- 2 Transmission line conductors.
- A Zones in which work is permissible without the use of protective measures and without time limitation (distances are given in the diagram).
- B Zones in which work is permissible without protective measures for durations of no more than 90 minutes.

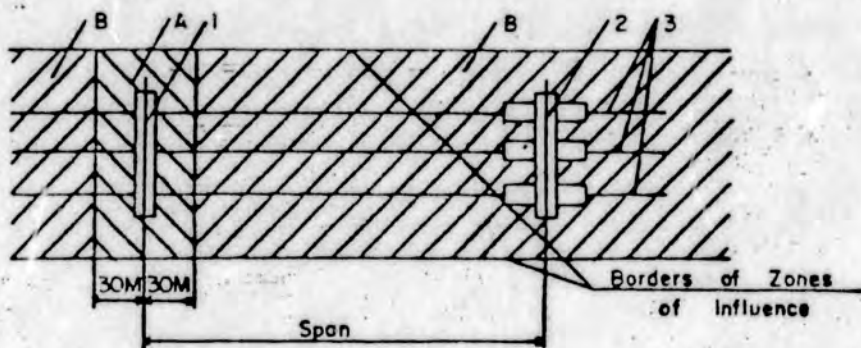


Figure 2. Diagram of 750 kV transmission lines with zones of influence.

- 1 Intermediary tower.
- 2 Anchor or corner tower.
- 3 Conductors.
- A Zones in which work is permissible without protective measures for duration of no more than 180 minutes (distances given in the diagram).
- B Zones in which work is permissible without protective measures for durations of no more than 10 minutes.

ground and to disconnect portions of the bus which it is possible for the worker to touch. Disconnected current carrying parts of nearby devices must also be grounded even in those cases where work on them is not anticipated. Grounding must be accomplished with a grounding blade or portable grounding.

V. Special Work Procedures in the Zone of Influence of 400, 500, and 750 kV Transmission Lines.

26. Work carried out on the ground in the zone of influence of 400 and 500 kV transmission lines without protective measures is permitted (see Figure 1): 1.) at a distance up to 20 meters (along the ground) from the axis of the tower independent of the type of tower, without limitation of time; 2.) in the span of the transmission line for no more than 90 minutes. Measures must be taken to exclude the possibility of the action of electric discharges to the person.

27. Work carried out on the ground in the zone of influence of a 750 kV transmission line without the use of protective measures is permitted (see Figure 2): 1.) at a dis-

tance of up to 30 meters (along the ground) from the axis of intermediary towers for no more than 180 minutes; 2.) in the span of the transmission line and close to anchor and corner towers for no more than 10 minutes. While working both close to towers (intermediary, anchor, or corner) and on other portions of transmission lines measures excluding the possibility of electrical discharges to the person must be taken.

28. If the duration of work on the ground in the zone of influence of 400, 500 and 750 kV transmission lines exceeds the time given in paragraph 26 and 27, or if the work is off the ground at height (up on the tower or in a bucket lift or other lifting device) it must be carried out using protective measures.

VI. Medical Examinations and Contra-Indications

29. Personnel subject to these rules and regulations (see para. 1) must pass preemployment and periodic medical examinations in correspondence with the order of the Minister of Health (USSR) of May 30, 1969, #400, "Preemployment and Periodic Medical Examination of Laborers".

APPENDIX I

Discussion of Paper 23.06 at CIGRE 1972

CIGRE Proceedings, Vol. 1, Group 23, pp. 24-29

Mr. V. V. BOURGSDORF (U.S.S.R.)—The problem of the effect of very high voltage electric fields on staff has become very important since the first 500 kV substations have been made live. The gradients are fairly high, about 10, 15 and even more than 20 kV/m.

This problem is also topical in the case of a number of test installations.

Research which has been carried out has been published in the Paper and it is possible to provide special solutions with a fairly high degree of safety.

Measures for protecting staff in substations have been successful and we have no longer complaints and no longer undesirable cases.

These recommendations have been introduced into the official safety regulations for service staff and have been drawn up and published in the specifications for the 500 and 700 kV substation projects.

Mr. L. CAHILL (Canada)—Staff who carry out maintenance work in the 735 kV substations of Hydro-Quebec do not appear to have been subjected to any serious trouble caused by the electric field.

In 735 kV substations the lower busbars are 10.7 m from the ground and the upper busbars about 13.7 m higher. The adjacent phases of the various bays are different colours.

Originally the staff complained of annoying discharges when they carried out maintenance work on the equipment. This problem has been solved by attaching metal working platform rigidly to the equipment and by checking the resistance of the soles of the shoes.

Furthermore, the staff has not complained of any physical or chronic mental suffering which seems to have been caused by the effect of the electric field. There is no screen above the pathways or the control cubicles in the 735 kV substations.

Experience concerning the effect of the electric field under 735 kV transmission lines is excellent. The conductors are a minimum of 14 m above the ground. The enclosures of metal grids supported by wood poles along the line have been earthed. The linemen working at live line maintenance of 735 kV lines by the bare hand method wear over-garments which form a Faraday cage and shoes with conductive soles. They have made no complaints concerning their health.

Paper 23-06 gives rise to certain misgivings and we have the intention of carrying out additional tests so that we can make sure that our staff work in complete safety.

We will be happy to exchange information with our Russian and Japanese colleagues who have also worked on this problem.

Study Committee 23 should form a Working Group in order to define and standardise the terms, methods of measurement and methods of analysing the results. This work should be carried out with a certain amount of discretion so that the population does not fear more than it ought the

pollution of the environment by electric fields.

Before concluding, I would like to ask the authors of Paper 23-06 if the physiological effects observed on staff in 500 kV substations are irreversible? Are these effects caused solely by the presence of the electric field without any sudden discharge by contact between the staff and the equipment under maintenance?

The CHAIRMAN—Thank you very much, Mr. Cahill, for that contribution and especially the proposal for further studies in this field before any panic occurs. This is very important, and I am sure my colleagues in the Study Committee will agree to take up this problem.

Mr. H. SINGER (Germany)—I should like to make a few remarks on Question 2.1: What observations have been made in other countries?

It might be of interest for the audience to hear, that at the Institut für Hochspannungs und Anlagentechnik, Technical University Munich, in cooperation with the Forschungsstelle für Elektropathologie, Freiburg, investigations were started about one year ago with a view to get information on the influence of 50 cycle electric fields on the human body. In this endeavour the calculated electric field underneath overhead transmission lines up to 1100 kV of the order of around 10 kV/m has been simulated in a climate laboratory, where the test persons had to undergo a cycle of 45 min at zero field, 45 min at 15 kV/m and finally 45 min at zero field.

In the course of a first series of tests the electrocardiogram, the electroencephalogram, the blood pressure and the pulse have been measured and in a second series the reaction time was investigated. In the first test row no significant influence could be found up to now by the presently used method of evaluation. However, as can be seen from Figure 30, a significant influence at the reaction time tests, carried out with ten test persons, could be derived: after a zero field period the reaction time increased during the 15 kV/m field period and decreased again during the following zero field period. Additionally, it may be pointed out, that even in a 1 kV/m electric field an increase of the reaction time could be stated.

These preliminary tests are evidently demonstrating the necessity of further tests with a greater number of persons with the main aim to find the threshold value of the electric field strength, where no influence on the human body can be expected.

The CHAIRMAN—Thank you, Dr. Singer. It would be very interesting for us to hear in the future of the very detailed studies in this field. I am very glad to hear that they are continuing.

Mr. A. C. FAGERLUND (United States)—We were quite interested to read of the difficulties the authors have en-

countered with electric fields in EHV substations at 500 kV and above. There are many 500 kV substations in service in the U. S. which have been energised for a number of years. No special shielding equipment for personnel is utilised at this level, yet, no complaints by substation personnel have been made.

Since the distances between buses and equipment are important, we wonder whether substations in which problems have been experienced are substantially more compact than most U. S. designs. These designs inherently provide for greater distances between buses and equipment or other buses. The closest energised bus parallel to a substation crew providing circuit-breaker maintenance is approximately 23 m from the nearest phase of the bus to the circuit-breaker center. This is in excess of the 20 m recommended in the paper and hence may clarify the difference between our experience and that of the authors.

We understand that shielding similar to the type described in the paper is provided in some U. S. 765 kV substations to shield personnel while operating disconnection switches. However, to our knowledge, no shielding is provided during maintenance operations.

We strongly feel that the study of the detrimental effects of electrical fields on personnel working in EHV and UHV environments, should be pursued further, and they are being pursued vigorously in the U. S. A. We regret that the references which the authors have mentioned are not more easily obtained, as we would like to review these in detail.

Mr. T. FUKUNISHI (Japan)—I should like to comment on Question 2.1, because this problem is very important for us.

As regards the first part of the question, we can state that in the 500 kV substations now under construction in Japan the electric field strength at the height of 1 m above the ground is designed to be equal to, or below, the strength at the 275 kV substations in which we have had experience over 10 years and which have not caused any big trouble.

I turn to the second part of the question. Especially at seaside districts, the protection design against salt pollution is considered to be the insulation of equipment. Therefore, the height of the live part of equipment is so great that we do not study marginal conditions.

On the third part, we have no example to be expressed, but, due to the report above mentioned it is recognised that the conductive shoes and overalls are effective to protect the personnel against electrical fields.

Fourthly, we consider that a metal-clad installation sufficiently protects personnel against electrical fields.

Mr. J. BUTER (Germany)—In the conclusions of Paper 23.06, the authors pointed out that for an electrical field on the ground equal to 5 kV/m or lower there is no influence on man. Because of our long-term experience in Germany, I think it is very important to underline this result.

Practically, this limit of 5 kV/m means that no influence on man occurs in switchyards or on lines operating with a voltage of 300 kV or lower. In our 380 and 220 kV switchyards, field

strengths of this value or only a little higher have been found. The values under lines are even lower.

We have been operating 220 kV networks for 43 years and 380 kV networks for 15 years. In all this time, no event with an unfavourable effect on the human organism has been known. However, at higher voltages it is advisable to carry out accurate studies of the problem. To make the result of such studies comparable, it would be interesting to get more details from the authors of Paper 23-06 about the measuring procedure and devices concerning both the field strengths and the effects on human beings.

Mr. V. CALECA (United States)—I am presenting this discussion also in the names of Messrs. Kolcio and Shih, of the American Electric Power Service Corporation, colleagues of mine.

We are happy to take this opportunity to discuss the paper presented by Madame Korobkova and her associates, and in particular to reply to the question posed by the Special Reporter: What observations have been made in other countries regarding the electric field effect on the human body?

The American Electric Power Company has conducted a study oriented towards the influence of the electric field on men involved in maintenance work on energised EHV lines. In addition to medical investigations, an experimental study has been conducted by exposing mice to strong electric fields. These investigations were conducted by the medical group of the Johns Hopkins University under the guidance of D. W. B. Kouwenhoven. In 1966 five IEEE papers were written on the evaluation of physical and medical effects of AC electric fields encountered in energised line work. One paper gave a four-year medical evaluation of men working in electric fields, and this is covered in [1]. A second paper [2] covered the exposure of mice to an electric field of up to 160 kV/m and concluded that there was no detrimental effect.

Our linemen working on lines energised at 345 kV use two distinct methods, the "barehand" method and the "hot-stick" method. Most of the "barehand" work is performed from a basket supported by the insulating arm of an aerial lift truck. In such cases the basket is provided with a conductive shield on all four sides which is only waist high and on the bottom, and this shield is bonded to the energised conductor. Other "barehand" techniques used included working from insulating platforms or ladders. In the latter cases the linemen wore conductive clothing consisting of a suit with a hood, gloves and footwear. Where "hot-stick" work was performed no shielding was used but the linemen were separated from the energised conductors by the length of the stick, which is 3 m for 345 kV.

Under all of these circumstances it is reasonable to assume that the linemen were immersed in an otherwise uniform field, whose magnitude depended upon the average distance between the lineman's body and the energised lines. At 345 kV, for instance, these background field strengths vary typically from 15 kV/m to 100 kV/m at 3 m and 0.5 m from the conductors respectively. In all cases the electric field is intensified by the presence of the lineman's body, which can be considered

essentially as a perfectly conductive medium. The intensification factor, according to an analytic calculation [3] can be as high as 50 times at the body extremities closest to the conductors.

Test results [1 and 4] at 345 kV obtained during barehand work using a basket in which the man was shielded up to the waist gave a maximum body current of 660 μ A at a maximum intensified fieldstrength of 470 kV/m at the top of his head. During hot-stick work the maximum body current was about 400 μ A while the maximum intensified fieldstrength was in the neighbourhood of 200 kV/m at the knee exposed to the conductors.

At 765 kV, electric field effects such as hair-nerve stimulation, tingling between body and clothes and discomfort due to arc discharges naturally could be more intense than those observed at 345 kV. To provide comfort for linemen doing barehand work, more complete shielding is used. It is our experience that conductive clothing effectively shields the linemen from the electric field. At 765 kV the body current is reduced to an insignificant level. For example, for a lineman wearing conductive clothing, and bonded to a 765 kV conductor, with his face exposed to the electric field, the measured body current was only about 40 μ A.

We have received no complaints of deleterious health effects from electric fields while operating 345 kV lines and stations for 20 years and 765 kV lines and stations for over three years.

Finally, the following comments pertain to the use of screens and conductive clothing. We find no protection is necessary for personnel doing maintenance, inspection or any other routine work at ground level. Therefore no screens are installed in our stations. Contrary to the authors' report, the type of the conductive clothing used by our linemen is comfortable for use in both hot and cold weather.

REFERENCES

- [1] W. B. Kouwenhoven, O. R. Langworthy, M. L. Singewald, and G. G. Knickerbocker—Medical evaluation of men working in AC fields. (IEEE Transaction of Power Apparatus and Systems, 1967).
- [2] G. G. Knickerbocker, W. B. Kouwenhoven and H. C. Barnes—Exposure of mice to a strong AC electric field—an experimental study. (ibid)
- [3] H. C. Barnes, A. J. McElroy, and J. H. Charkow—Rational analysis of electric fields in live line working. (ibid)
- [4] C. J. Miller—The measurement of electric fields in live line working. (ibid)

The CHAIRMAN—I have pleasure in welcoming to the rostrum Mr. Barnes, the Chairman of Group 31.

Mr. H. C. BARNES (United States)—This supplements the comments of Mr. Caleca.

The authors of Paper 23-06 indicate that men working in high voltage substations are disturbed by the fields in these stations. This is contrary to the findings of the American Electric Power Corporation. Men working on the ground

experience no discomfort even though no shielding is provided. This is the result of design which keeps voltage gradients within proper limits. Even a station of lower voltage can have discomforting levels if not properly designed.

For 765 kV our minimum bus clearance to earth is about 13 m and about 7 m is maintained from the bottom of insulating supports and bushings. Shielding is provided when working near energised buses, as described by Mr. Caleca.

The authors' indication of medical and psychological disturbances is contrary to the findings of extensive pathological and neurological research carried out for us by the staff of Johns Hopkins Hospital. The comments of Dr. Ing, W. B. Kouwenhoven and Dr. Martin L. Singewald, medical doctor of Johns Hopkins, from which I will quote later, are appended to this discussion.

Dr. Kouwenhoven is America's foremost authority on electrical safety; although an electrical engineer, he has long been a lecturer in heart surgery and is the inventor of the defibrillator: included in his many honours is an honorary degree of doctor of medicine. Dr. Singewald is a noted medical doctor who also holds a degree in electrical engineering taken under Dr. Kouwenhoven.

They and several members of the Johns Hopkins staff have carried out a nine-year programme of research which included measurements and medical observations of the men while they themselves, as well as the men, were energised at full line voltage of up to 780 kV using the barehand maintenance technique.

I now quote their statements:

"The authors have presented an excellent paper on the results of their investigation on the effect of 500 and 750 kV electrical fields in switchyards. The paper states that switchyard or substation workers are affected by these electrical fields. Most of these effects which are reported are subjective. The authors also state that medical and physiological studies were made. However, we found no supporting evidence for these results.

In the United States we have been conducting research for nine years on 10 linemen working on energised high voltage lines. Half of the men worked from screened insulated box baskets while connected directly to the line and the other half worked with hot sticks while standing on the steel towers. Each man spent about 100 hours a year on high voltage lines with potentials of 345 to 765 kV. Average field strengths were 11-12 kV per inch, as contrasted to the 5 kV/m mentioned as a limit in Paper 23-06.

During the nine years, each man was subjected to seven complete medical histories and physical examinations. Each examination required a stay at the Johns Hopkins Hospital of three and a half days. The history and physical examinations were performed by members of the hospital staff and included a complete laboratory survey of each man. The medical survey consisted of consultations with an ophthalmologist, an otolaryngologist, a urologist and a neuro-psychiatrist. The laboratory survey consisted of complete hematological studies and blood chemical studies, which included serum urea nitrogen, blood sugar and serum cholesterol, uric acid, urine

analysis and stool examination. In addition, thyroid, kidney and liver functions were evaluated. Electrocardiograms and electroencephalograms were recorded, and hearing was tested. X-rays of the chest and hands were obtained at each of the examinations as well.

It can be reported that the health of each one of these 10 men has not changed in any way from their exposure to the high voltage lines within the limit of these studies. There was one child born during the nine years of the survey.

No abnormalities were found which could be ascribed to the exposure to electrical fields. All of the men were in first

class physical and mental condition when examined in January and February of 1972. No X-ray radiation was found, nor the effects of working barehanded on energised line conductors. There were no complaints of nuisance discharges, headaches or other subjective ills.

Therefore, we cannot agree with the statement in Paper 23-06 that 5 kV/m is the maximum voltage a normal man can stand.

The results of this completed study will be presented at the 1973 Winter meeting in New York of the IEEE Power Engineering Society."

G. G. Knickerbocker

Three other articles published in the Soviet literature and dealing with the exposure of man and experimental animals to commercial power frequency electric fields have been translated. However, the quality of illustrations in the originals does not make it possible to satisfactorily reproduce these papers at this time. They are abstracted below.

THE PHYSIOLOGICAL INVESTIGATION OF THE EFFECTS OF A HIGH TENSION, INDUSTRIAL FREQUENCY ELECTRICAL FIELD ON LIVING ORGANISMS

T. I. Belyaeva and K. V. Stroikova

Based on observations reported by Stroikova (1952) people complained of various sensations while working near or on high voltage transmission lines—up to 220 kV—laboratory investigations of the exposure of both experimental animals and human beings to high intensity electric fields were carried out and reported in this paper.

In the animal studies 345 mice and 12 rabbits were used, of which some of each served as unexposed controls. The animals were exposed either to 65 or to 130 kV repeatedly with single exposures as long as three hours. No values of electric field intensity were cited. Electric field effects upon mortality and weight change were studied in the mice; temperature, thermoregulation and blood pressure in rabbits.

No direct effect upon mortality of mice was noted though the authors report metabolic disorders, lowered resistance to infection, paralysis, necrosis and late deaths from secondary causes which did not occur in control animals. In rabbits, the authors believe that compensatory mechanisms of thermoregulation are affected by exposure. Blood pressure in rabbits tended to be higher during exposure but was within normal limits.

Human subjects underwent testing to determine the effects of exposure to a conductor, two meters distant and energized with 65,000 volts. Fifteen to twenty exposures each lasted from 0.5 to 3 hours. Three groups of three people each were studied. Thermoregulation as determined from rectal temperature, cardiovascular reflexes measured by a plethysmographic technique and performance tasks (manual and verbal) were tested.

The authors contend that their studies show demonstrable changes in the human subjects as a result of the series of exposures. Among them are: slight lowering of body temperature modification of thermoregulator mechanisms, altered vascular regulatory mechanisms and lowered work efficiency.

THE INFLUENCE OF AN ELECTRIC FIELD OF COMMERCIAL FREQUENCY AND DISCHARGES ON THE HUMAN ORGANISM

T. I. Krivova, V. V. Lukovkin, T. E. Sazanova

This article first describes briefly the findings of examina-

tions carried out on 319 men during and after work on 220, 330 and 500 kV switchyards. The authors report that the electric field evoked an unfavorable influence causing non-specific disturbances of the functional state of the central nervous system (CNS) and cardiovascular system, and hematologic changes. Specifically, they cite autonomic system dysfunction, variability in arterial pressure and pulse rate, reticulocytosis and qualitative changes of neutrophils.

A number of different experimental studies were briefly described and the results summarized. Twenty three young men participated in various experiments which included (a) exposure to field strengths ranging from 10 to 32 kV per meter, (b) being subjected to a body current equivalent to the displacement current resulting from an electric field, (c) the occurrence of capacitive discharges from the body while in the field.

No results are reported pertaining to study (a). The authors claim that the results of (b) suggests that displacement current alone is not sufficient to explain all the phenomena attributed to exposure to an electric field.

Most of the discussion of results pertain to the third experimental study—capacitive discharges. Changes in pulse and respiratory rate and electrocardiographic R-S wave amplitude were studied. An effect of sub-pain threshold stimuli upon autonomic function was notable among their reported findings. Adaptation to pain was observed and was, as might be expected, more marked with regularly occurring discharges than with random.

STANDARDIZATION OF THE INTENSITY OF AN ELECTRIC FIELD OF COMMERCIAL FREQUENCY BY THE THRESHOLD OF PAINFUL STIMULATION OF ELECTRICAL DISCHARGES.

T. I. Krivova, S. A. Lebedev, Yu. A. Morozov,
M. D. Stolyarov, V. I. Filippov

Assuming typical values for the capacitive coupling of a person both to an overhead transmission line and to ground, the authors calculate the discharge currents which can occur when a person touches a grounded object while in the field of an energized transmission line. Drawing upon well known published data they show that the calculated energy released in such discharges (1.6×10^{-2} watt-seconds for a 300 kV system) is well below that normally considered life-threatening.

They then describe an experimental study to determine the electric field strength necessary to cause discharges to an ungrounded object at the pain threshold of human subjects. The subject stands on a 3 mm thick sheet which insulates him from a grounded plate 1.5 X 1.5 meters. A similar plate 4 meters above the surface on which the subject stands is energized and the voltage adjusted until the discharges evoked between the subject index finger and a grounded object are on

the verge of producing pain. The subject then steps out of the test array and the electric field at the level of his head is measured. The authors present a statistical analysis of the

threshold determination in 30 subjects which shows that at 5.18 kV per meter, 80% of people will not experience painful sensation upon discharge.

APPENDIX III
BIBLIOGRAPHY OF RELATED LITERATURE

- M. L. Singewald, O. R. Langworthy, W. B. Kouwenhoven, "Medical follow-up study of HV linemen working in A.C. electrical fields." IEEE Trans. PAS 92-4 pp. 1307-1309, 1973.
- G. G. Knickerbocker, W. B. Kouwenhoven, H. C. Barnes, "Exposure of mice to a strong A.C. electric field—An experimental study." IEEE Trans. PAS 86-4 pp. 498-505, 1967.
- W. B. Kouwenhoven, C. J. Miller, Jr., H. C. Barnes, J. W. Simpson, H. L. Rorden, T. J. Burgess, "Body currents in live line working." IEEE Trans. PAS 85-4 pp. 403-411, 1966.
- W. B. Kouwenhoven, O. R. Langworthy, M. L. Singewald, G. G. Knickerbocker, "Medical evaluation of man working in A.C. electric fields." IEEE Trans. PAS 86-4 pp. 506-511, 1967.
- H. C. Barnes, A. J. McElroy, J. H. Charkow, "Rational analysis of electric fields in live line working." IEEE Trans. PAS 86-4 pp. 482-492, 1967.
- C. J. Miller, Jr., "The measurement of electric fields in live line working." IEEE Trans. PAS 86-4 pp. 493-498, 1967.
- J. E. Brown, H. Z. Hill, P. E. Renner, A. L. Kinyon, "Developing safe working procedures for EHV DC hotline maintenance." IEEE Trans. PAS 87-4 pp. 1044-1048, 1968.
- E. Meda, V. Carrescia, S. Cappa, "Experimental results from exposure of animals to A.C. electric fields." presented 2nd Int. Colloquium on the Prevention of Occupational Risk due to Electricity, Koln, Germany, Nov. 30, 1972.
- G. Jakob, H. Steinligler, J. Wiesinger, "Das elektrische feld unter hoemspannungs freileitungen." Bull. ASE 24, pp. 1428-1432, Nov. 25, 1972.
- IEEE Committee Report, "Recommendation for safety in live-line maintenance." IEEE Trans. PAS 87-2 pp. 345-352, Feb. 1968.
- H. L. Rorden, H. Hubard, D. C. Hubbard, "500-kV live-line maintenance." IEEE Trans. PAS 85-6, pp. 571-573, June 1966.
- G. Anderson, "Safe, efficient EHV hot-line maintenance begins with design." Electric Light and Power, pp. 70-73, April 1969.
- H. Westman, K. Charest, T. W. Amyot, "735-kV line designed for barehand maintenance." Electric Light and Power, pp. 89-91, April 1969.
- J. A. Marks, "Experience boosts acceptance of EHV barehand maintenance." Electric Light and Power, T/D Edition, pp. 52-51, March 1971.
- M. Wendt, "Where barehand technique pays off: working EHV hot." Electric Light and Power, T/D Edition, pp. 88-90, Sept. 1971.
- Don. W. Deno, "Calculating electromagnetic effects of overhead transmission lines." IEEE Trans. PAS 93-5, pp. 1458-1471, Sept. 1974.
- IEEE Working Group on Electrostatic Effects, "Electrostatic effects of overhead transmission lines, Part 1, Effects and safeguards." IEEE Trans. PAS 91-2, pp. 422-426, March 1972.
- IEEE Working Group on Electrostatic Effects, "Electrostatic effects of overhead transmission lines, Part 2, Methods of calculations." IEEE Trans. PAS 91-2 pp. 426-433, March 1972.
- IEEE Working Group on Electromagnetic and Electrostatic Effects of Transmission Lines, "Electromagnetic effects of overhead transmission lines—Practical problems, safeguards, and methods of calculations." IEEE Trans. PAS 93-3, pp. 892-904, May 1974.
- H. C. Barnes, B. Thoren, "AEP-ASEA UHV project results to 1973 and planning of a system test station and line." CIGRE Proceedings Report 31-10, 1974.
- R. Johansson, S. Lundquist, V. Scuka, "Is there a connection between electricity in the atmosphere and the function of man?" Institute of Research Armed Forces, Sweden.
- R. Haut, "Effets biologiques des champs electriques et electromagnetiques." GE Congpos International de Biometcorologie, Sept. 3-9, 1972, Noordwijk, Hollande, Informations Medicales, p. 85, Dec. 1972.
- T. Tarogi, T. Muto, "Influences upon human bodies and animals of electrostatic induction caused by 500-kV transmission lines." (Source unknown), Feb. 1971.
- M. V. Strumza, "Influence sur la sante humaine de la proximate des conducteurs d'electricite a haute tension." Archives des Malades Professionnelles, 31-6 pp. 269-275, June 1970.
- K. Berger, Research Leader, FKH., Seefeldstrasse 301, Zurich 8., "Basic considerations in revising the regulations for grounding HV installations." Bull. SEV 52, pp. 337-365, 1961.

APPENDIX IV
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#2

EPRI'S RESEARCH PROGRAM ON BIOLOGICAL EFFECTS OF ELECTRIC FIELDS

HARRY A. KORNBERG

EPRI'S RESEARCH PROGRAM ON
BIOLOGICAL EFFECTS OF ELECTRIC FIELDS^{1/}

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Abstract.--Since available technology and capital make necessary overhead transmission lines at least to the year 2000, Electric Power Research Institute is sponsoring environmental research on effects of mechanical, chemical, and physical factors associated with the transmission of electricity. Only EPRI's research on biological effects of the physical factor is reviewed here. Human exposure to natural and man-made magnetic and electric fields are common and are associated with electric storms and ordinary electric equipment, such as hairdryers and soldering irons. Nonetheless, reports of illness among some Russian switchyard workers, and conflicting reports of biological effects under controlled laboratory conditions, stimulated expansion of research projects in this area supported by EPRI. These are summarized in this paper.

INTRODUCTION

The nation's electric utilities currently operate approximately 500,000 circuit miles of overhead electric line rated 22 kV and above. This includes 90,000 circuit miles of transmission line rated 230 kV and higher. Transmission voltage over the years has gradually increased to its present nominal operating maximum of 765 kV. The reason for the increase is that, as line loading (current) increases, line losses also increase. Increasing the voltage permits the transfer of larger amounts of power, minimizes losses and allows more efficient use of scarce rights-of-way. The Federal Power Commission (1971) has estimated that there will be 118,500 miles of 230 kV and above transmission lines in service by 1980, and 159,200 miles by 1990. However, the largest percent increase was forecast to occur at 500 kV and higher. The 14,000 (approximate) circuit miles now in service was predicted to increase to 24,000 circuit miles by 1980 and to 42,000 circuit miles by 1990. Without the use of HV

overhead transmission, the nation's utilities would be unable to serve the large and concentrated urban loads from power stations located far from the load centers at a reasonable cost for electricity.

High capacity underground transmission via superconducting cables may be a reality in the late 1980s; but, as of now, this technology is still in its infancy, and much additional research is required to improve both conducting and insulating materials. The remaining alternative to HV overhead transmission is underground cable, using technology that is already available. However, the cost of equivalent underground transmission is estimated to be 12 to 16 times higher than overhead construction (Salvage 1975). If all future transmission lines were to be underground, costs of electricity would increase 30 to 50%. If, additionally, existing lines were also to go underground, costs of electricity would at least double (Schulte 1975).

Assuming that overhead transmission lines will be with us to the end of the century, it is necessary that their environmental impact be understood and minimized whenever possible. The three agents responsible for environmental impact are: mechanical--clearance, construction, and maintenance of ROWs; chemical--principally herbicides; and physical--electric fields.

^{1/}Paper presented at the Environmental Concerns in Right-of-Way Management Symposium, Mississippi State, Miss. January 6-8, 1976.

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For more than a year, Electric Power Research Institute had been expanding its research in these areas.

EPRI began to function in September of 1973 with a staff of 12 people. By June 1974 the staff totalled about 200, and a significant increase in numbers of EPRI-sponsored research projects was initiated. One area that appeared unusually clouded with opposing issues, was that of the biological effects of electric fields. Our response was to select a research contractor experienced in electric field effects, and request a comprehensive state-of-the-art review to identify what is known and what is not known in order to formulate a research plan for the future. The contractor, IIT Research Institute, completed its task in December 1975 when the final report to RP381 became available (EPRI 1975). From this nearly-exhaustive review, several interesting conclusions were drawn.

The maximum vertical field under a typical 765 kV line at four feet above the ground is about 9 kV/m. (The corresponding magnetic field generated by 2000 A current flow is 0.31 Gauss.)

Gradients from powerlines may be compared with natural and other man-made electrical fields. Beneath thunderclouds, 3 kV/m and more have been measured. Dust storms in northern West Africa can reverse the earth's 0.13 kV/m field (caused by the ionosphere) and produce fields up to 1.5 kV/m. The earth's natural magnetic field is about 0.5 Gauss.

Examples of man-made ac electric fields appear in Table 1. Some sources of man-made magnetic fields are soldering guns and hair-driers which can generate 10-24 Gauss in their vicinity, and a can-opener, kitchen range, and electric shaver which can generate 5-10 Gauss (EPRI 1975). Thus, exposure of mankind to natural electric and magnetic fields occurred before electricity was harnessed, and to man-made fields before high voltage transmission lines were constructed.

Reports from the U.S.S.R. (Korobkova et al, 1972; Lyskov et al, 1975; Krivora et al, 1975) stated that occupationally-exposed linemen experienced nausea, lassitude, loss of appetite, and reduced sexual drive. Subsequently, the U.S.S.R. promulgated time limits for exposure to electric fields greater than 5 kV/m. A report from Spain described a similar syndrome among switchyard workers transferred to a new 500 kV station. These reports stimulated an intensified interest as to whether higher voltage gradients under some transmission lines and in switchyards can cause biological effects.

Table 1.--60 Hz Electric Fields in the Vicinity of Electrical Appliances (measurements were made 30 cm from appliances).

| Appliance | Electric Field (volt/meter) |
|-------------------------|--------------------------------|
| Electric Blanket | 250 |
| Broiler | 130 |
| Stereo | 90 |
| Iron | 60 |
| Refrigerator | 60 |
| Hand Mixer | 50 |
| Toaster | 40 |
| Vaporizer | 40 |
| Phonograph | 40 |
| Color TV | 30 |
| Coffee Pot | 30 |
| Vacuum Cleaner | 16 |
| Clock | 15 |
| Electric Range | 4 |
| Incandescent Light Bulb | 2 |

Investigations in other Western European countries and in the U.S. have produced different findings. Table 2 summarizes tests using human subjects (EPRI 1975). Inability to confirm the Russian and Spanish observations suggests that the effects noted may have been caused at least partly by factors other than the electric field which are not common to all working conditions.

A similar situation exists for experimental work using laboratory and agricultural animals. Such research is summarized in Table 3. Male progeny of mice exposed to 160 kV/m for 1500 hours in the experiment reported by Knickerbocker, et al. (1967) showed a slightly decreased growth rate compared to controls. However, the authors pointed out that the controls had free access to water which was denied the exposed group when the field was on. They also added that the exposed group was located nearer a window than were the controls, which could have allowed greater body heat loss among the exposed group.

It seems that wherever positive results are noted, they can be ascribed to factors other than the electric field. That offspring of exposed animals showed decreased growth rate could have been due to differences in water availability and temperature. That research on human subjects in Western Europe and the U. S. cannot reproduce the syndrome reported by the U.S.S.R. suggests that factors other than the electric field may be responsible. Candidates include noise (100 Hz transformer

Table 2.--Summary of American and Western European Tests Using Human Subjects.

| Subject (Investigator) | Frequency | Stress | Indicator | Results |
|---|-----------|---|---|---|
| Humans (Koeppen) | 50 Hz | 7.5/2.5/27 kV 30 minutes | EKG | No effects |
| 525 Humans and controls (Strumza) | 50 Hz | Long duration fields within 25 m of 200/400 kV line vs fields beyond 125 m for controls | Visits to and by physicians use of medicine, medical histories | No significant difference observed in subject and control groups |
| 10 Males 10 Females | 50 Hz | 100 kV/m | Psychological test subjective responses | No statistical difference was observed in test performance, some discomfort reported by a few subjects also influenced by weather |
| Farm workers and livestock 18 farms (Busby) | 60 Hz | Fields from 765 kV line | Questionnaire response | No significant effect attributed to fields from lines |
| Human 11 American Linemen (Kouwenhoven) | 60 Hz | Fields encountered in normal line and bare-hand work | Physical examination CV, ECG, kidney, visual, auditory, emotional status | No effects |
| 10 Humans (R. Hauf) | 50 Hz | 1, 15 kV/m intermittent 45 minute exposure | EKG, EEG, pulse, blood pressure reaction time | No significant changes except for small decreases in reaction time |
| 6 Humans (3 Male) (G. Hauf) | 50 Hz | 1/15/20 kV/m Alternating 45 minute exposure | EKG, EEG, Blood pressure reaction time | No Pathological changes |

noise), noxious vapor from paint, chemicals or switchyard equipment, and diseases possibly endemic to the region.

More precise resolution should come from a systematic search among the candidate fact-

ors and from additional field and laboratory research. In order to identify a set of priorities for such further research, on the biological effects of electric fields, a workshop comprised of qualified consultants was organized by IITRI while under contract

Table 3.--American and Western Europe Tests Using Agricultural and Laboratory Animals

| Subject (Investigator) | Frequency | Stress | Indicator | Results |
|--------------------------------------|-----------|---------------------------|---|--|
| 22 Male mice (Knickerbocker, et al.) | 60 Hz | 160 kV/m 1500 hours | Weight gain physiological parameters, necropsy | No differences between subjects and controls |
| Male guinea pigs, mice, rats (Meda) | 50 Hz | 100 kV/m 18 hrs/day | EEG, ECG, blood analysis | No chronic changes of significance/transitory changes EEG & ECG, some suggestion of infection-like responses |
| Rats (Strumza) | 50 Hz | 17 kV/m 4 to 23 months | Clinical and biological | No differences between subjects and controls |
| Mice (Moos) | 60 Hz | 1 kV/m | Lifetime of mice given lethal 900 rad x-ray | No significant effect attributed to electric field |
| Chickens (Krueger & Gariola) | 60 Hz | 3600 V/m | Weight gain | No statistically significant difference between subjects and controls |
| Rats (Spittka) | 50 Hz | 50 to 70 kV/m | Trained rats in Skinner Box reaction time | Inconclusive--reaction time altered, short and long-term effects suggested |
| Livestock (Ware) | 60 Hz | Fields from 765 kV line | Survey 166 Farms 106 responses questionnaire | 104 responses, no effect was noted, 1 suggested grazing pattern altered; 1 concerned loss of cow |

to EPRI. The following recommendations were developed at this workshop. Of the 23 separate topics, 11 are or soon will be among EPRI's research projects.

RESEARCH PRIORITIES
BIOLOGICAL EFFECTS OF ELECTRIC FIELDS

Existing Environments

Influences on Humans

Medical record comparison
Perception of fields and arc discharges

Effects on Animals

Agricultural animals
Insects
Birds

Plants and Ecosystem Considerations

Crops
Ecosystems

CONTROLLED SIMULATED ENVIRONMENTS

Psycho-Physiological Functions

Rodent
Pig
Nonhuman primate

Special Objective Tests

Small arc discharge effects -- pig
Seizure latency -- rodent/primate
Behavioral/physiological as appropriate-- human

Vegetation

Acute damage -- large plants and trees

MEDICAL DEVICES

Pacemakers
Long-term compatibility with existing and future devices
Metallic implants

DOSIMETRY AND SUPPORT

Peer review and environment verification
Data bank and information exchange
Relating other biological data
Collateral environments
Exposure profiles
Laboratory instrumentation

To aid in the continuing process of developing research plans and priorities, and to review research progress, EPRI recently formed an Advisory Committee on Biological Effects of Electric Fields. It is comprised of about a dozen distinguished engineers and scientists, as well as representatives of government and industry.

The following list summarizes EPRI's eight research projects on biological effects of electric fields in progress at the time this paper was presented:

EPRI's RESEARCH PROJECTS ON BIOLOGICAL EFFECTS OF ELECTRIC FIELDS - JANUARY 1976

| Number/ Contractor | Principal Experimental Observations |
|---|---|
| RP98 Johns Hopkins U. | Cardiovascular and other stress related response in individual nonhuman primates and dogs. |
| RP129 Westinghouse and Penn State U. | Leaf tip effects, egg hatchability, vole behavior and reproduction in simulated ecosystems. |
| RP381(a) ITT Research Institute | State-of-the-art review of biological effects of electric fields. |
| RP381(b) ITT Research Institute | Performance of special tasks on request: Aid other contractors in electrical engineering problems - electrode design, dosimetry, analysis of other research projects. |
| RP581 Battelle-Northwest | Behavioral, biochemical, hematological, and physiological response in Hanford Miniature Swine to be exposed in groups for prolonged periods. (See Text.) |
| RP679 ITT Research Institute | Effects on cardiac pacemakers implanted in non-human primates |

TPS76
U. of Illinois

Effects on honeybee behavior and production under natural conditions.

TPS76
Equitable Environmental Health

Epidemiological study of health of linemen and switchyard workers. (Not on-going as of January, 1976, but feasibility study being planned.)

EPRI anticipates expenditures for research in this area between one to one and one-half million dollars annually. The project numbered RP581 is especially noteworthy, since guidance on parameters to be measured in the large animals will come, for the most part, from observations to be made on experimental mice and rats. The small animal portion of the experiment will be performed in parallel by the team of investigators and will be supported by ERDA, the Energy Research and Development Administration.

This is a major effort to seek a very subtle and elusive biological effect, assuming there is one caused by electric fields. Further, it is not the only effort being made in this direction. In the U.S., ERDA is supporting research on electric field effects on materials and genetic material. Elsewhere, Canada, France, Germany, Italy, Sweden, and the United Kingdom all have research programs on effects of electric fields. EPRI is in the process of establishing an informal international information exchange to avoid needless duplication and to encourage validation of results in different locales when deemed desirable.

LITERATURE CITATIONS

- Electric Power Research Institute.
1975. EPRI RP381-1, Final report, November.
- Federal Power Commission.
1971. The 1970 National Power Survey, Part 1, 13-14, U.S. Government Printing Office.
- Knickerbocker, G. G., W. B. Kouwenhoven, and Barnes.
1967. Exposure of mice to strong AC electric field - an experimental study, IEEE Transactions on Power Apparatus and Systems, Vol. Pas-86, No. 4, pp.26-33, April, 1967.

Korobkova, V. P., U. A. Morozov, M. D. Stolarov, and Y. A. Yakub.

1972. Influence of the electric field in 500 and 750 kV switchyards on maintenance staff and means for its protection. CIGRE Paper, 23-06. (Russian) International Conference on Large High Tension Electric Systems.

Krivova, T. I., V. V. Kukovkim, and T. I. Sazanova.

1975. The influence of an electric field of commercial frequency and discharges on the human organism. (Russian)

Lyskov, Y. I., Y. S. Emma, and M. D. Stolarov.

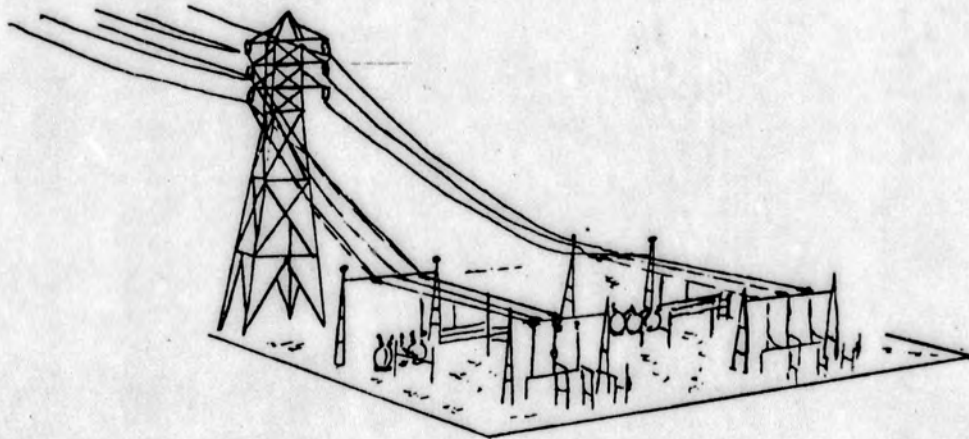
1975. Electric field as a parameter considered in designing electric power transmission of 750-1150 kV; the measuring methods, the design practices, and the direction of further research. (Russian)

Salvage, B.

1975. Overhead lines or underground cables: the problem of electric power transmission. Endeavor, 34:3-8.

Schulte, R. J.

1975. Personal communication.



ELECTROMAGNETIC FIELDS AND LIFE

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"Only a few of the invisible radiations are known to us at present. We have hardly begun to realize their diversity and the scrappy nature and inadequacy of our knowledge of the radiations which surround us and pass through us in the biosphere, and to understand their basic role in the processes going on around us, a role which is difficult to comprehend by minds accustomed to other conceptions of the universe. . . ." "We are surrounded and penetrated, at all times and in all places, by eternally changing, combining and opposing radiations of different wavelengths — from ten millionths of a millimeter to several kilometers."

V. I. Vernadskii, 1926

INTRODUCTION

Since the above lines were written science has learned much more about the electromagnetic radiations which have been present in the biosphere — the region which living organisms inhabit — throughout the whole epoch of evolution. Scientists have discovered more and more new natural electromagnetic radiations in various ranges of the electromagnetic spectrum. To the long-investigated range of solar radiations — infrared to ultraviolet — we have now added ionizing radiations (x rays and γ rays) of cosmic and terrestrial origin. In the remaining lower-frequency region of the electromagnetic spectrum, the discovery of the slow periodic variations (seasonal, monthly, diurnal) of the earth's magnetic and electric fields was followed by the discovery of the short-period fluctuations of the earth's magnetic field with frequencies extending to hundreds of hertz. The investigation of atmospheric discharges has shown that the electromagnetic radiations produced in this case cover a wide range of wavelengths — from superlong to ultrashort. Finally, radio emission in the range of meter to millimeter waves from the sun and the galaxies has been discovered.

Thus, it has now been established that periodic electromagnetic processes with frequencies distributed throughout the known

electromagnetic spectrum are a permanent feature of the biosphere. Hence, it can be postulated *a priori* that any region of this natural electromagnetic spectrum might have played some role in the evolution of living organisms and that this will be reflected in some way or other in their vital processes. We can say that any region of the spectrum is biologically active in some degree. In the general case three kinds of activity are probable:

1. The effect of electromagnetic processes taking place in the environment on the functioning of living organisms.
2. The role of electromagnetic processes taking place within organisms in the vital activity of organisms.
3. Electromagnetic interconnections between organisms.

For the spectral region where $h\nu > kT$ (at temperatures characteristic of living organisms), i.e., from the infrared range to gamma rays, these kinds of biological activity have already been discovered to some extent. It is known that photobiology is concerned not only with the reaction of living organisms to infrared, visible light, and ultraviolet rays, but also with the role of radiations of these ranges in processes occurring with organisms and "light-mediated interaction" between organisms. Radiobiology is concerned at present only with the biological action of x rays and gamma rays,* but "internal radiation" has also been discovered, although its role in biological processes has not yet been elucidated. Some recent investigations indicate the possibility of "radiation-mediated interactions" between organisms.

The situation is different with the remaining vast region of the electromagnetic spectrum, where $h\nu < kT$; this region includes the ranges from super-high to ultralow frequencies, right down to "zero frequency" (constant electric and magnetic fields). For convenience of exposition we will henceforth call this whole region of the spectrum "electromagnetic fields"[†] or EmFs. The problem of the biological activity of EmFs as a whole has only begun to take shape in recent years, although investigations of individual aspects of this problem has been carried out some time ago.

* We exclude here the corpuscular kinds of radiation (α - and β -rays, neutron fluxes), since we are dealing only with electromagnetic radiations.

† This term is arbitrary, of course, since all the rest of the spectrum also consists of electromagnetic fields.

Galvani's experiments in the 18th century initiated the development of electrophysiology (electrobiology), which deals with the reactions of living organisms to electric stimuli and with electric phenomena in organisms themselves. Using the terminology which we have adopted we can say that electrophysiology is the study of the first and second kinds of biological activity of EmFs, mainly in the low-frequency range and mainly in the case of contact application (or withdrawal) of electric energy. Galvani, however, was also first to discover a long-distance electric effect when he observed the contraction of the muscle in a frog nerve—muscle preparation situated at some distance from the spark of an electrostatic machine. Such experiments on electric stimulation of nerve at a distance were not taken up again until the end of the 19th century. At this time there also appeared the first reports of the biological effects of a magnetic field and high-frequency fields. In 1900-1901 there appeared V. Ya. Danilevskii's two-volume monograph dealing with the main experimental and theoretical principles of the biological action of EmFs on biological objects — from cells to entire organisms.

In the thirties and forties research on the effect of high- and ultrahigh-frequency EmFs on the human and animal organism was greatly extended (Libezin, 1936). Frenkel and Tatarinov, 1939; Proceedings of the Conference on the Application of UHF in Medicine, 1940; Shcherbak, 1936). The researchers encountered two kinds of biological effects from EmFs. There was a clear demonstration of the thermal effect — heating of the tissues of the organism or the biological substance in vitro due to EmFs of fairly high intensities; there were less definite effects which could not be attributed entirely to heating and also effects due to low-intensity EmFs, where no heating of the tissues was detected. Such "non-thermal" effects (which were often unwisely called "specific" effects) were observed mainly in the reactions of entire organisms, more rarely in isolated organs, and hardly ever in experiments with macromolecular solutions in vitro.

A possible role of natural EmFs in living nature has been categorically rejected on the basis of the following theoretical considerations.

Any possible effect of EmFs on biological objects, as on non-living objects similar to them in electrophysical properties, must

be due to particular energetic interactions of the EmF with the substance, i.e., conversion of the electromagnetic energy to other forms such that the resultant effect depends on the effective energy of the EmF. But the conversion of the EmF energy into other forms of energy in living tissues can involve only the same processes as in electrolyte solutions of corresponding composition. As regards the effect of a constant magnetic field, living tissues must be regarded as a weakly magnetic substance. Moreover, the energies of quanta in the EmF region are sufficient only to cause vibrations of charged particles as a whole — ions, dipole molecules, and colloidal micelles — in biological media. Such processes represent the only possible interaction of EmFs with biological media and result in the conversion of the electromagnetic energy to heat energy. However, for the induction of any biologically significant thermal effect the strengths of the acting EmFs must be several orders greater than those of natural environment EmFs of corresponding frequency. The biological effects of a constant magnetic field can be due to the orientation of paramagnetic and diamagnetic molecules. Such effects are possible only if the energy of the magnetic field, calculated per molecule, exceeds kT . For this the intensity of the field must be at least ten thousand times greater than that of the geomagnetic field.

The experimental data indicating changes in physiological processes in entire organisms due to exposure to much weaker EmFs were regarded as unconvincing for the following reasons. Firstly, organisms can respond with similar changes to diverse external factors and, hence, there are no grounds for postulating a "specific" biological effect of EmFs; secondly, if there was an effect it would certainly be detected in experiments with physicochemically homogeneous media or, at least, in experiments with very simple biological systems, but such attempts were unsuccessful. Thus, physicists concluded that weak EmFs were incapable of producing biological effects.

In spite of these categorical conclusions biologists continued with experimental attempts to detect biological effects due to EmFs and constant magnetic fields with strengths much lower than the theoretically predicted effective values. Within the last ten years these attempts have produced successful results, which give grounds for believing that natural EmFs have probably been implicated in

the evolution of life and play a significant role in the vital activity of organisms. One cannot help recalling in this connection the words of Szent-Gyorgyi (1960) that "the biologist depends on the judgement of the physicist, but must be rather cautious when told that this or that is improbable."

Biological investigations have shown that organisms of the most diverse kinds — from unicellular organisms to man — are sensitive to a constant magnetic field and EmFs of different frequencies with an effective energy tens of orders (1) less than the theoretically estimated effective level. Hence, such estimates, based on the concept of the energetic interaction of EmFs with the biological substance, obviously lack a sound basis. This concept is also contradicted by the fact that instead of the predicted proportional relationship between the biological effects and the intensity of the acting EmFs quite different relationships have been experimentally established. It has been found that in some cases the reactions of living organisms to EmFs occur only at certain "optimum" intensities, in other cases the effects increase when the intensity of acting EmF is reduced, and in other cases the reactions to low and high intensities are of opposite nature. "Cumulative" biological effects produced by repeated exposure to EmFs well below the effective threshold for a single exposure have also been observed. Finally, the concept of energetic interaction is contradicted by the fact that for the same average EmF energy absorbed in the tissues of organisms the nature of the reactions depends considerably on the modulation of the EmF, on the directions of the electric and magnetic vectors of the EmF relative to the animal's body axis, on the localization of the exposure, and so on.

This has given rise to the need for a fundamentally new theoretical approach to the problem of the biological activity of EmFs — a theory which will not only be consistent with the experimental data but will provide a basis for their interpretation and an elucidation of the particular mechanisms involved. Such an approach can be based on information theory.

The application of this theory to biology has shown that, in addition to energetic interactions, informational interactions play a significant (if not the main) role in biological processes. Such interactions entail the conversion of information, its

transmission, coding, and storage. The biological effects due to these interactions do not depend on the amount of energy introduced into the particular system, but on the amount of information introduced into it. The information-carrying signal merely causes the redistribution of the energy in the system itself and regulates the processes occurring in it. If the sensitivity of the receiving systems is sufficiently high very little energy is required for information transfer. The information can be built up in the system by the repetition of weak signals.

The informational aspect of the interaction of EmFs with biological objects must be taken into account even in the consideration of such obviously energetic effects as thermal effects. These effects are due not only to an increase in the kinetic energy of chaotic motion of the molecules, as in normal heating (convection, infrared radiation), but also to coherent vibrations of the molecules and ions with the same frequency as the acting EmF. In biological systems with oriented molecular layers and ordered motions of the microparticles such an imposed rhythm can be regarded in general as the introduction of "harmful" information into the system.

The information approach to the biological action of EmFs is even more essential in the case of very low intensities, where any energetic effects are theoretically impossible. Informational interactions of EmFs with biological systems can account for the high sensitivity of living organisms to EmFs, the specific relationship between the biological effects of EmFs and their intensity and modulation, and the cumulative effect of EmFs.

It is a valid assumption that all these special features of the reactions of living organisms to EmFs are associated with certain biological systems formed in the process of evolution for the reception of information from the environment. This hypothesis has already received experimental verification. It has been found that the periodic variations of natural environmental EmFs have a regulating effect on vital functions — on the rhythms of the main physiological processes, on the ability of animals to orient themselves in space, on multiplication in populations, and so on. In the living organism the systems for receiving information transmitted by EmFs are reliably shielded from natural electromagnetic interference, but in pathological states spontaneous variations of EmFs

(solar flares, lightning discharges) upset the regulation of physiological processes.

It appears that in the process of evolution living nature has used EmFs to obtain information about the changes in the environment. The EmF, of course, is the most reliable information-carrier among geophysical factors. By means of EmFs information can be transmitted (in the appropriate frequency ranges) through any medium inhabited by living organisms and in any meteorological conditions — during the polar day or night, in river and sea water, within the earth's crust and, finally, in the tissues of organisms themselves.

Thus, the first kind of biological activity of EmFs — the effect of environmental EmFs on the functioning of living organisms — acquires reality in the light of the results of biological investigations and their interpretation on the basis of the concept of the informational interactions of EmFs with biological systems formed in the process of evolution.

Experimental data which indicate the existence of the second kind of biological activity of EmFs — their implication in informational interconnections within the organism — have now been obtained. There is not only the already known transmission of information along the nerves by bioelectric pulses with a frequency spectrum extending to thousands of hertz, but also the long-range interactions effected by EmFs of very different frequencies — from infrared to superhigh frequency (we will henceforth call these EmF-interactions or EmF-connections). They are manifested in the electromagnetic interrelationships between macromolecules, in the synchronization of the electromagnetic vibrations in assemblies of macromolecules and groups of cells, and so on. It is hoped that the concept of EmF-connections may clarify the hitherto baffling nature of some long-established selective interactions between cells and macromolecules.

Finally, there are data which suggest the existence of the third kind of biological activity of EmFs — informational interconnections between organisms. On one hand, animals are particularly sensitive to EmFs with parameters (frequency, intensity, pulse modulation) in a fairly narrow range. On the other hand, it has been found that living organisms are sources of EmFs of various

ranges — from infralow to superhigh frequency. Finally, exposure of human beings to EmFs gives rise to definite sensations — visual, auditory, and tactile. The concept of informational EmF-connections in the animal world may prove fruitful in several cases where there is clearly an exchange of signals between animals, but the physical nature of the signaling process has not yet been determined.

An analysis of the experimental data which indicate the appearance of these kinds of biological activity of EmFs leads to the conclusion that it is useless to attempt to seek the causes of such properties of life only at the molecular level or to proceed from a consideration of the processes arising at this level due to EmFs. This is most obvious from investigations of the effect of external EmFs on biological objects.

It has been found, for instance, that entire organisms are most sensitive to EmFs, isolated organs and cells are less sensitive, and solutions of macromolecules are even less sensitive. Significant differences are observed in the reaction of one biological system (molecular, cellular, organic, or systemic) to EmFs in relation to the conditions in which the action takes place — whether it is in the entire organism or in the isolated state. In these two cases there is also a difference in the nature of the relationship between the reaction of the system and the parameters of the EmF.

All this indicates that the systems which are particularly sensitive to EmFs have presumably been formed in the process of evolution only at the macroscopic level, beginning, at the lowest, from ordered macromolecular assemblies. In other words, the property of receiving weak natural EmFs appears only at the level of fairly complexly organized biological systems and this property is probably manifested to the full extent only in the entire organism.

The appearance of enhanced sensitivity to EmFs only in fairly complexly organized biological systems, can be regarded as one of the manifestations of the specific nature of life — its "organization." We cite some current views on this subject.

Shmal'gauzen (1964) says ". . . the functions of a higher system are not a summation of the activity of lower systems, but their integration. Each higher system reveals its own qualitative

specificity, which is created only by the organization of this higher system."

Szent-Gyorgyi (1960) says "One of the basic principles of life is "organization" by which we mean that if two things are put together something new is born, the qualities of which are not additive and cannot be expressed in terms of the qualities of the constituents."

Schmitt (1959) speaks of "hierarchies of organization and with the properties that are characteristic of systems . . . at each particular level of organizational complexity, viz., molecular, macromolecular, subcellular, cellular, supercellular, organismic, and superorganismic." Further, ". . . there is a formidable "black box" between the molecular effectors, as studied in the model system, and the final behavior of the cells or organism under study."

It has been pointed out on occasion that such integration occurs also in nonliving nature — in the systems of elementary particles forming atoms and in the combination of atoms to form molecules. At these levels, however, there is no difference between nonliving and living matter: The atoms and molecules are organized in the same way in each case. The difference appears only at the "supermolecular" level — in the specific nature of the organization of the macromolecules and their assemblies, and in the hierarchy of the systems comprising the living organism. Here we encounter the integration of properties which has no analogy in nonliving nature.

We have made this excursion into the problem of the specificity of life, since up till now the common approach to the investigation of the biological effect of EmFs has been one in which effects at the molecular level in physicochemically homogeneous systems are first investigated and only after this are the more complexly organized structures examined. There is still a sceptical (and usually negative) attitude to any results of experiments on entire organisms and even on isolated organs. Such views are the result of excessive enthusiasm over the undoubtedly significant successes of "molecular biophysics" and the neglect of the historical fact that the investigation of the interaction of living organisms with any external factor began with observation of the reactions of

the entire organism and only after this were the systems involved in these reactions revealed.

Yet the reverse procedure is the practical one: To investigate first the reactions of the entire organism to EmFs, and then to go on from there to determine the simplest level of organization at which it is still possible to detect the changes which are ultimately responsible for the particular reaction of the organism. The prime cause of the reaction need not necessarily be due to processes at the molecular level — it may be a feature of some macroscopic level of organization. There is nothing paradoxical in this — we encounter such a situation in the examination of "organized" machine systems, which are also characterized by the presence of a hierarchy of order and the appearance of new properties with increase in complexity.*

This can be illustrated even by the example of such a relatively simple system as the oscillatory circuit. The specific feature of this circuit is its particularly high sensitivity to an EmF of a particular (resonant) frequency. Of course, the electromagnetic oscillations induced in the circuit are due to microprocesses — motion of electrons in the wires and the polarization of the molecules in the dielectric of the capacitor. But attempts to discover the mechanism of resonance at this level will be in vain — it is not there. Nor can we detect this property by considering the processes in separate macroscopic elements of the circuit — the capacitor and the induction coil. The property of resonance is a feature only of the whole organized system — the circuit as a whole.

Thus, the phenomenological approach to the investigation of the systems and processes involved in the reactions of biological objects to EmFs is the practical one at present. We can determine only the regular relationships between the "input" and "output" characteristics of the system, i.e., between the operating factors and the reactions. It is quite in order to simulate such systems and processes by means of equivalent electromagnetic "organized systems", exhibiting corresponding input and output charac-

*This may be the result of a historically manifested law which McCulloch (1962) expounds in the following way: "But aside from sources of power, and from the wheel, most of what we have done has been an imitation (of animals)."

teristics, the relationship between which is described within the framework of the macroscopic parameters. In this way we can, for instance, approach an explanation of the high sensitivity of biological systems to EmFs, i.e., their ability to receive the information carried by EmFs of very low intensity (even below the noise level).

Information theory indicates the possibility of "spatial summation" of electromagnetic informational signals received simultaneously by n elements and of "temporal summation" of signals repeated n times. In either case the total signal-to-noise ratio is increased by a factor \sqrt{n} . Hence, if n is sufficiently large the reception of information with a signal intensity below the noise level is possible. Reception has been effected in technical systems of such kind. The two types of summation are also found in living organisms — in the visual organs for electromagnetic light waves (Glezer and Tsukerman, 1961) and in nerve cells for low-frequency electromagnetic signals. Hence, the existence of such biological systems for the reception of EmFs of other frequency ranges is probable.

The main information on the input and output characteristics of biological systems sensitive to EmFs has been obtained mainly from investigations of the reactions of entire organisms to EmFs. However, to seek certain specific reactions is "to pursue a will-o-the-wisp": to adequate informational action of EmFs and to electromagnetic noise the reactions are nonspecific — the same reactions can be produced by other external factors.

For instance, regulation of the daily rhythm of physiological processes is effected by various geophysical factors, probably equally. The role of periodic environmental EmFs in this regulation can be determined only by a correlation analysis, either by artificially maintaining other geophysical factors constant, or by investigating changes in the rhythm of physiological processes when the environmental EmFs are artificially attenuated.

The disturbances of physiological processes — changes in intensity, direction, etc. — due to electromagnetic interference must also be nonspecific. The same kind of disturbances can be produced by the action of other factors — mechanical, chemical, biological, etc. The disturbance of the function of any organized

system is nonspecific in the sense that its nature is often independent of the type of interference. For instance, the same noise can be produced at the output of a radio receiver by radio interference (natural or artificial) or by faulty contacts — mechanical or chemical.

These remarks on the approach to the investigation of the biological action of EmFs apply also to the EmF-interconnections within the organism. Interactions between macromolecules and between cells and, even more so, between more complex biological systems cannot be understood at present without regard to the role of "organization" at all these levels and without regard to the differences in the course of the corresponding processes in the organism and in systems isolated from it.

As regards the investigation of the problem of EmF-interconnections between animals, even investigations of entire organisms may be inadequate. Since associations in groups, communities, populations, and biocenoses exhibit their own specific features due to "coalition" (von Foerster, 1962) — "an aggregate of elements which jointly can do things which all of them separately could never achieve". Hence, the investigation of the EmF-interconnections in animal associations will require an analysis of a vast amount of material collected by zoologists, ecologists, and ethologists. In this respect the method of empirical generalization, proposed by Vernadskii (1926), may prove to be very effective. This method, which is based on inductively obtained facts, does not go beyond the limits of these facts and is not concerned with the consistency or inconsistency of the obtained conclusion with other existing ideas on nature. In this respect empirical generalization does not differ from scientifically established fact: Their agreement with our scientific ideas on nature does not interest us, their contradiction of them is a scientific discovery.

Such briefly are the general arguments and experimental evidence which have led us to pose the problem of the role of EmFs in life. In fact, in addition to previously developed fields of biology — photobiology and radiobiology, which are concerned with the biological activity of electromagnetic radiations from infrared to gamma rays, there is now developing a new branch of biology dealing with the biological activity of the remaining region of the elec-

tromagnetic spectrum — from superhigh to "zero" frequency (constant fields). We suggested earlier (Presman, 1965a) that this branch, which brings together a wide circle of problems relating to various manifestations of the biological activity of EmFs, should be called electromagnetic biology (for lack of a more suitable term).

The basic tenets in the formulation of the problem are: 1) the concept of the informational functions of EmFs in life at all levels of its hierarchical organization and 2) the conviction that the investigation of these functions of EmFs must proceed from complex biological systems and processes to more and more simple systems and processes.

The aim of this book is to substantiate this concept and methodology from the abundant experimental material on the diverse biological effects of EmFs. I have tried to carry out this analysis as objectively as possible, but I admit that, being the author of this concept, I have found it difficult to avoid partiality in the assessment of the experimental data which I have examined and the derivation of conclusions from them.

In such a case it is particularly valuable to have the opinion of impartial scientists as to how far the author has managed to retain sufficient objectivity in the exposition and substantiation of his views. For such a critical evaluation of the manuscript of this book, and for valuable advice and comments I am deeply grateful to Academician V. V. Parin and Professors L. A. Blyumenfel'd, P. I. Gulyaev, and S. É. Shnol'.

Return to W. Bradley
St. Peter, MN

Phys-B
27

1 BEFORE THE STATE OF NEW YORK

2 PUBLIC SERVICE COMMISSION

3

4 CASES 26529 and 26559 - Common Record :
5 Hearings on Health and Safety of :
6 765 kV Transmission Lines. :
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7

8

Prepared Testimony of
Robert O. Becker
Veterans Administration Hospital
Irving Avenue
Syracuse, New York

9

10

11 Q. Would you state your name and business address?

12 A. Dr. Robert Becker, Veterans Administration Hospital,
13 Syracuse, New York.

14 Q. Would you summarize your educational and professional
15 background?

16 A. I am a doctor of medicine, having received my MD degree
17 from New York College of Medicine in 1948. In 1959 I
18 became a Diplomate of the American Board of Orthopaedic
19 Surgery, having completed the necessary advanced training
20 at Downstate Medical Center, SUNY. I have been Chief
21 of Orthopedic Surgery at the VA Hospital, Syracuse, since

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1 1956, and have been Professor of Orthopedic Surgery,
2 SUNY, Upstate Medical Center since 1963. I have been
3 engaged in medical research since 1958 with particular
4 interest in electronic biological control systems. I
5 have published more than 70 scientific papers and given
6 more than 75 presentations at national and international
7 scientific meetings. In 1964 I was awarded the William
8 S. Middleton Award of the Veterans Administration for
9 research in biological solid state physics and biological
10 control systems. I was presented with the Distinguished
11 Alumnus Award from NYU, College of Medicine in 1966. I
12 became a Medical Investigator with the VA in 1972, a
13 position enabling me to devote full time to research.

14 Q. Are you the director of a research laboratory?

15 A. Yes. I am the director of the Orthopedic-Biophysics
16 Laboratory at the Syracuse VA Hospital-Upstate Medical
17 Center. The staff varies between 10 and 16 people
18 depending upon such things as the number of students on
19 elective, the number of visiting scientists spending
20 their sabattical year with us, etc. The present staff
21 includes three Ph.D bicphysicists, one Ph.D anatomist,

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1 two M.D.s (orthopedic surgeons) and a variety of
2 technical personnel.

3 Q.. Would you briefly describe the nature of your research?

4 A. In brief, our research is aimed at elucidating the
5 details of the control systems that living organisms
6 utilize to direct certain basic life functions such as
7 growth and healing, biological cycles, etc. We have
8 determined that living organisms possess certain electric
9 control systems characterized by the use of very small
10 electrical currents and voltages as control signals.
11 These are derived from certain solid state properties
12 of cells and tissues such as semiconductivity, piezo-
13 electricity, etc. At this time our discoveries are being
14 used to stimulate the healing of non-united fractures and
15 to treat certain types of infectious processes in the
16 human by the application of small electrical currents which
17 stimulate those which naturally occur. This work is going
18 on at several medical centers including Syracuse. Other
19 research groups are also using small electrical currents
20 to relieve pain, produce surgical anesthesia or sleep
21 and as additive treatment to acupuncture.

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1 Because of the physical nature of the biological
2 electronic control system, we predicted that external
3 electromagnetic fields should produce physiological
4 and functional changes in living organisms. We have
5 been conducting research using a variety of such fields
6 and a variety of experimental animals for the past 15
7 years. The results of these experiments have conclusively
8 indicated that such fields do have an effect upon living
9 organisms.

10 Q. What is the purpose of your testimony?

11 A. I will discuss the medical and biological significance
12 of exposure to low frequency electric and magnetic fields.
13 My testimony will encompass both the published reports and
14 the latest results of our own research. I will testify
15 that an electric field at 60 Hz is a biological stressor.
16 I will discuss the question of medical ethics involved
17 in exposing human beings to electric fields. My testimony
18 will conclude that the transmission line should not be
19 built as proposed.

20 Q. Would you comment on the medical significance of the reports
21 described by Dr. Marino dealing with ELF effects?

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1 A. Before answering this specifically, I would like
2 to point out that the majority of these reports came
3 from the refereed scientific literature. That means
4 before they were published, they were reviewed by
5 scientific experts in the specific area concerned, and the
6 experimental set-up and techniques used were judged to be
7 both appropriate and rigorous enough to have yielded
8 valid data. Such reports cannot be lightly dismissed.

9 The first and most obvious conclusion to draw
10 is that ELF electric fields do have biological ef-
11 fects, some at extremely low field strengths. In
12 general, the reports fall into two main categories,
13 and one minor category. The first main category is
14 growth effects. These include tumor growths, accelerated
15 healing rates, both increased and decreased mitotic
16 rates and abnormalities in development. There are
17 some apparent inconsistencies in the reports; how
18 can the same physical modality produce at one time,
19 bone tumors, an undesirable effect, and at another
20 time, accelerated rate of healing of bone fractures,
21 an obviously desirable effect? The answer lies in

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1 the fact that the biological response to such a
2 parameter is determined much by the state of the
3 living specimen when it is exposed. Normal unbroken
4 bones exposed to 3 or 30 Hz fields developed tumor
5 growth. Bones with fractures, in which
6 a healing response of increased cellular growth
7 has been switched on, when exposed to 65 Hz fields,
8 showed an increase over the normal rate of healing.
9 Obviously, the two experiments involved two dis-
10 tinctly different biological states and there is no
11 contradiction between the reports at the basic level.
12 It would appear valid to postulate upon the basis
13 of these reports that growth disturbances could
14 result from exposure to ELF fields strengths or
15 frequencies outside of the norm. It may be wise
16 to comment upon the fact that only one report
17 presents the occurrence of tumors following such
18 exposure. Why are there no confirmatory reports
19 from other workers who similarly exposed animals?
20 The answer lies in the nature of scientific research.
21 The investigator operates on a limited budget and

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1 within a specific frame of reference. If he is
2 interested in the use of such fields to obviate
3 the osteoporosis of the bone that accompanies im-
4 mobilization, you will carefully examine the bones
5 following exposure. He will however, have neither
6 the funds nor cooperating scientific personnel to
7 examine all other organs and tissues of the animals
8 for the occurrence of tumors therein. For example,
9 in our own series of experiments described by Dr.
10 Marino, we were fully aware of McElhaney's report
11 and we are familiar with bone physiology, yet we
12 structured our experiment around another thesis,
13 that of the stressor effect. We could accomplish
14 that with our limited funds and it would be more sub-
15 stantive to our overall scientific objective than
16 would a repeat of McElhaney's experiments. While
17 we would have liked to autopsy our experimental
18 animals for tumor growths, we lacked both funds and
19 personnel to do so.

20 The second main category of effects can be
21 classified as functional. In this type of response,

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1 the exposure to the field produced a change in
2 the way the organism worked. Such changes can be
3 produced without any noticeable change in the appearance
4 either of the total animal or of its tissues when
5 studied under a microscope. Functional responses
6 have included strictly behavioural effects, such as
7 the avoidance of a field irradiated area, orientational
8 effects within a field, and alterations in response
9 times. Two reports dealt with alterations in the
10 electrocardiogram and the electroencephalogram.
11 Both the heart and brain utilize electrical energy
12 in their operation and such interferences may be
13 predicted. A basic aspect of function is the
14 phenomenon of biological cycles and two extremely
15 precise sets of experiments have indicated a sensitivity
16 of this function to such applied fields. The medical
17 significance of functional changes such as these have
18 been well described in the Russian literature relating
19 the complaints of occupationally exposed
20 workers. These complaints all fall within the functional
21 frame of reference and appear related to effects upon

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1 the central nervous system and the cardiovascular
2 system. Such complaints are also concomitant with
3 stress and indeed the stress response may be integral
4 with other central nervous system symptoms.

5 The minor category includes two reports, one
6 Russian, one American, both presenting data on
7 the death of cells or total organisms accompanying
8 exposure to very high strength fields. The state of
9 knowledge in this area at present does not permit us
10 to speculate upon the pathophysiology that might have
11 been involved.

12 To sum up, from the viewpoint of possible medical
13 significance, the literature reports represent a solid
14 body of data indicating that living organisms are in-
15 fluenced by ELF fields, and that such effects are likely
16 to occur in the areas of growth, both cellular and of
17 the total organism, and in the function of the central
18 nervous system and cardiovascular system. Obviously,
19 to answer specific questions, such as the effects of
20 various field strengths at 60 Hz upon the variable
21 human population, will require specific laboratory

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1 ~~1~~ experimentation. These answers are not available
2 ~~2~~ at this time.

3 Q. Do the results of your research on electric field
4 exposure at 60 Hz as described by Dr. Marino indicate
5 that the rats were subject to biological stress?

6 A. The condition of the rats at the end of 30 days exposure
7 was consistent with chronic exposure to an environmental
8 stressor. Chronic stress has been linked to cardiac
9 (hypertension), renal (nephritis), gastro-intestinal
10 (ulcers) and nervous (psychoses) diseases. There is
11 some evidence that arthritis, particularly rheumatoid
12 type and certain vascular diseases such as periarteritis
13 nodosa may also be related. In addition, chronic stress
14 results in exacerbation of any pre-existing pathological
15 processes. There is extensive literature in this field
16 and since there are several phases of response to stress,
17 depending upon the length of exposure, I have limited
18 my response to chronic stress situations.

19 Q. Would you explain the distinction between the terms
20 "acute" and "chronic" as they are used medically?

21 A. Acute refers to a short term exposure, generally less
22 than one day and chronic refers to long term exposure,

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1 more than a day.

2 Q. What is meant by the term "stress" or "stressor"?

3 A. A non-specific biological stressor is any environmental
4 stimulus which causes systemic stress in an organism.

5 Systemic stress denotes a condition in which, due to
6 function or damage, extensive regions of the body
7 deviate from their normal resting state.

8 The stress response in the organism is basically
9 produced by alterations in the function of the pituitary
10 and adrenal glands. Presumably the initial response is
11 in the central nervous system - most probably the brain -
12 with information being transmitted to the pituitary gland
13 which is directly connected to the brain.

14 The actual physiological changes resulting from
15 exposure to a stressor are determined not only by the
16 nature of the stressor itself, but also by factors within
17 the stressed organism, such as the level of nutrition,
18 concurrent stressful conditions, the presence of pre-
19 existing disease states, heredity and previous conditioning
20 experiences.

21 The actual total stress response produced by chronic

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1 exposure to a stressor is called the General
2 Adaptation Syndrome and is divided into three
3 stages. The first is called the Alarm Reaction,
4 in which the adrenal glands enlarge, lymph nodes
5 and thymus gland decrease in size and gastric ulcers
6 appear. The levels of hormones secreted by the active
7 glands are increased. In the second stage, that of
8 Adaptation, the hormone levels return to normal and
9 the animal does not appear to be responding to the
10 stress. In the final phase, that of Exhaustion, the
11 level of the active hormones decrease below normal,
12 and the organism is less capable of responding to the
13 stress. Dr. Hans Selye, who first described the stress
14 adaptation syndrome, has been able to correlate chronic
15 stress with certain disease states including collagen
16 diseases, periarteritis nodosa, renal arteriosclerosis,
17 hypertension and gastric ulcers.

18 Q. It is occasionally said that stress is "good for you".
19 Do you agree?

20 A. If stress is "good for you", then it is the biological
21 response to stress that is "good for you", since stress

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1 that does not elicit a response from the stressed
2 organism has no effect on its own.

3 There are two conditions under which the stress
4 response may be considered "good for you". It is
5 in fact, vital for the survival of life, having been
6 evolved from the earliest living organisms. When an
7 organism is stressed naturally, i.e., being pursued by
8 a predator, the stress response enables the animal to
9 use its body maximally to escape. The action of the
10 muscles and nerves is enhanced and the animal becomes
11 functionally capable of extra activity. Humans
12 experience a similar response when subjected to bacterial.
13 infections and in this case the increase in the activity
14 of the immune system is advantageous. Initially, the
15 physiology associated with such acute stress was termed
16 the "fight or flight" condition which is an apt
17 description. Therefore, under the conditions of acute
18 stress, the organism's functional ability is heightened.
19 We experience this occasionally in "being able to work
20 best under stress". The problem however, is two-fold.
21 First, there are indications from Dr. Selye's work that

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1 stresses are additive and that two stresses, neither
2 of which would be particularly harmful, when acting
3 in concert, will produce a pathological state.
4 Secondly, all of the good effects of the stress
5 response are limited to the alarm reaction phase of
6 the stress response. If the stressful condition con-
7 tinues, the alterations in body chemistry and function
8 that were advantageous in a "fight or flight" situation
9 begin to change and ultimately, in the stage of
10 exhaustion, the changes are reversed and the organism
11 is less able to function in an optimal fashion.

12 The "stress is good for you" concept is limited
13 to single short duration episodes of mild to moderate
14 stress and cannot be applied to the situation of multiple
15 stresses or long-term chronic stress.

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1 Q. Could people sustain the same effects as the rats, if
2 comparably exposed?

3 A. Yes. I know of no significant difference between rats
4 and men in terms of their reaction to stress.

5 Q. Assuming that the electric field distribution due to the
6 proposed transmission line is as Dr. Deno has calculated,
7 does it present a danger, from a health viewpoint, to
8 either maintenance personnel or persons living near the
9 edge of the right-of-way?

10 A. Utilizing the safety factor of 100 in connection with our
11 research, the field strength within the proposed right-of-
12 way and for a distance out on either side would exceed
13 the safe level (1.5 volts/cm). Maintenance personnel would
14 probably be exposed to levels in excess of 1.5 volts/
15 cm for relatively short periods of time. Since our experi-
16 ments involve long term (30 days) exposure, we cannot say
17 whether or not such short exposures would produce any
18 biological effect. By the same token, we cannot say
19 whether or not any effects from such short time exposures
20 (if they did occur) would be cumulative and eventually
21 become clinically significant.

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1 In regard to persons residing near the right-of-
2 way and within the zone of field strength of 1.5
3 volts/cm or higher, they would run the risk of having
4 some biological effect induced as a result of this
5 exposure. Since the effects we noted experimentally
6 indicated that the field acted as a stressor, I would
7 have to assume that the effects would be harmful.
8 Again in regard to cumulative effects (dose related in
9 this case, i.e., lower field strengths at greater dis-
10 tances with long term exposures) we cannot make any
11 statements at this time.

12 Q. Would you recommend against the public periodically
13 using the right-of-way for less than a day for such
14 activities as farming, logging, hiking, camping,
15 hunting, etc.?

16 A. In general, I would be opposed to the multiple use
17 concept until the extent of the biological hazards was
18 ascertained. In specific, it certainly seems prudent to
19 discontinue recreational use. In the case of economic
20 use, farming, etc. involving short term exposures, it
21 may be possible to continue such usage provided the

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1 potential risks are made evident. In regards to
2 the question of short term exposure to maintenance
3 personnel, perhaps the present Russian regulations
4 might be applied.

5 Q. Would it be unsafe to permit people to occupy
6 residences within 329 feet of the centerline of the
7 proposed lines if the electric field within the
8 residence is less than 1.5 volts/cm?

9 A. We cannot answer this question at this time, not
10 knowing the effects of chronic exposure to fields
11 lower than we have employed in our experiments to date.

12 Q. Is it likely that different individuals will react
13 differently to the same degree of exposure to the
14 electric fields from these lines?

15 A. Yes.

16 Q. Would a person subject to long term exposure to electric
17 fields from these lines be likely to discern effects
18 from such exposure?

19 A. I believe that the weight of the evidence indicates that
20 biological effects would occur. Such effects would be
21 within the framework of the stress Adaptation Syndrome

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1 and may be evidenced in a variety of fashions, from
2 such functional changes as increased irritability
3 and fatigue, to such actual pathological states as
4 hypertension and stomach ulcers.

5 Q. Could a medical doctor diagnose the electric field
6 from 765 kV lines as the causative agent for certain
7 stress related-illnesses?

8 A. Given the present level of knowledge and the absence
9 of any other causative factors, I believe that such a
10 diagnosis could be made with a reasonable medical
11 certainty.

12 Q. In your research, do you use human beings as subjects?

13 A. Yes, humans are presently used in our studies on
14 stimulating bone growth and retarding infectious
15 processes.

16 Q. Would you briefly describe the precautions taken
17 when humans are involved as subjects?

18 A. In the case of human experimentation, the present
19 regulations require that any proposed study be
20 reviewed in detail by a committee of experts including
21 medical and scientific personnel (it is further

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1 recommended that representatives of the clergy,
2 psychological sciences, and laymen be included on
3 the committee). It is the responsibility of the
4 committee to balance risks against gains of any
5 given experiment. In regard to risk, the nature
6 of experimental medicine is such that the possibility
7 that all risks may not be predicted in advance must
8 be entertained. In regard to gain, consideration
9 must be given to gain that may be experienced by the
10 experimental subject (i.e., possible healing of a
11 non-united fracture) and to general human gains in
12 terms of the collection of knowledge that may be of
13 value to others or to general biological understanding.
14 After consideration of these factors, the committee
15 must approve the proposed study. An investigator
16 cannot proceed without such approval. It is most
17 important to note that the key provision of present
18 human experimentation is informed consent. If the
19 committee approves the project, each subject must still
20 be fully apprised of all known possible risks, the
21 possibility of unknown risks and the possible gains

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1 (if any) he or she will accrue. Only under these
2 circumstances is human experimentation medically
3 proper.

4 Q. Would it be considered medically unethical to apply
5 small electric currents to humans for research
6 purposes without securing their permission?

7 A. Yes, it would be considered unethical in my opinion.

8 Q. Would it be considered medically unethical to apply
9 60 Hz electric fields to humans without securing their
10 permission?

11 A. Yes, it would be considered unethical in my opinion,
12 if the field strengths exceeded that to which we are
13 exposed in the normal course of everyday living (i.e.,
14 ~~normal household ambient levels~~). In that case human
15 experimentation committee approval and informed consent
16 would be required.

17 Q. Dr. Marino has discussed piezoelectric effects as a
18 possible mechanism of action of 60 Hz electric fields
19 on animals; are there any other biological mechanisms
20 that would enable 60 Hz electric fields to have an
21 effect on living organisms?

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1 A. As I indicated previously, we have, over the past 15
2 years, obtained evidence for the existence of electronic
3 biological control systems based upon solid state
4 properties of living materials. We know, for example,
5 that injuries result in specific electrical phenomena
6 at the site of injury and that these (very minute in
7 amount) electrical parameters in turn cause the cells
8 at the injured site to multiply and heal the injury.
9 This function is controlled by an overall biological
10 control system which is associated with, but separable
11 from, the central nervous system. Our evidence indicates
12 that this control system is based upon specific cells
13 (the perineural cells) and that it transmits information
14 by means of the actual flow of small direct electrical
15 currents, generated by solid state properties of these
16 cells. It may be likened to an analog computer system,
17 while the nervous system itself is similar to a digital
18 computer. This direct current system controls growth
19 and healing, as previously noted, and in addition, we
20 believe it may be related to the perception of pain.
21 There is evidence that biological cycles of behavior

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1 in all organs are linked to the same cyclic pattern
2 in the normal environmental electrical and magnetic
3 fields. The properties of this direct current system
4 are such that it would be influenced by such cyclic
5 changes in these environmental fields. It is believed
6 that this system may provide the necessary linkage
7 mechanism between the normal variations in these
8 geophysical parameters and the normal biological cyclic
9 rhythms. One of the primary characteristics of the
10 normal atmospheric electromagnetic field is its
11 associated extra low frequency (ELF) component.
12 These ELF fluctuations are in the region of from
13 1 to 20 cps with maximum power centered in the 10 cps
14 range. It is perhaps significant that the electro-
15 encephalogram contains the same frequencies and that
16 electroencephalograms of a wide variety of organisms
17 are basically similar. Electromagnetic waves in
18 this frequency range can be transmitted for great
19 distances with little loss in strength. It has been
20 proposed that, since all organisms arose and developed
21 within an environment that included these electromagnetic
22 fields and frequencies, they were a primary factor

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1 in providing the energy input for the origin of life
2 and that the coupling between living organisms and
3 them is a basic life function (Cole, F. and Graf, E.,
4 in Biologic and Clinical Effects of Low-Frequency
5 Magnetic and Electric Fields, Charles C. Thomas,
6 Springfield 1974). Some substantiation for this is
7 the fact that profound disturbances in the electro-
8 magnetic field such as magnetic field reversals,
9 occurring in the geologic past, were associated with
10 the death of many animals and the actual extinction
11 of some species (Hays and Updyke, Science 158,
12 1001 (1967)).

13 If the natural electromagnetic field is directly
14 linked to the organism via the electronic control
15 system we have described, then changes in the natural
16 field, including increased field strength and
17 frequencies not normally present would result in stress
18 in exposed organisms. Such stress responses would
19 come about by disturbances in the normal biological
20 cycles caused by the abnormal field exposure. Many
21 of the scientific reports quoted by Dr. Marino in

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1 his testimony are interpretable in this light.

2 Therefore exposure to electric fields differing
3 in frequency and/or in magnitude from the normal
4 earth's field may produce biological effects by
5 (1) inducing small electrical fields within the
6 tissues that could interfere with normal healing and
7 growth processes by presenting abnormal signals to
8 the cells (under certain circumstances such induced
9 currents may be beneficial, i.e., in stimulating the
10 healing of non-united fractures) and (2) by interferring
11 with the normal biological cyclic rhythm through
12 interaction with the electric system linking organisms
13 to the geophysical environment. This latter effect
14 would be evidenced as a response to stress and with
15 prolonged exposure as the stress adaptation syndrome.

16 Q. Does your research involve magnetic fields?

17 A. Yes. I have used magnetic fields primarily as a tool
18 to probe the workings of the direct current control
19 system.

20 Q. Have you published in this area?

21 A. I have reported effects of external magnetic fields

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1 upon the peripheral nerve electrical potentials
2 (Becker, Science, 134, 101 (1961)) and upon the
3 electroencephalogram from the brain in animals
4 (Becker, Proc XI Int. Cong. Tsfiol., 1753 (1966)).
5 In conjunction with Dr. Howard Friedman, I have
6 investigated and reported on interactions between
7 changes in the earth's natural magnetic field
8 (magnetic storms) and human behavior (Becker, Nature,
9 200, 626 (1963) and Becker, Nature, 205, 1050 (1965)).
10 We have also reported on the effects of low strength
11 magnetic fields modulated at 0.1 and 0.2 on reaction
12 times in human volunteers (Becker, Nature, 213, 949
13 (1967)). I was asked to review the literature on the
14 biological effects of magnetic fields in 1963 for
15 publication (Becker, Med. Elect. Biol. Eng., 1, 293
16 (1963)). This was done to provide a base line for
17 the experimental interest in this area that was on
18 the increase at that time. Most recently, I have
19 been consulted by the AEC on possible hazards associated
20 with the ultra-high strength fields necessary for
21 fusion reactors.

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1 Q. What is the current state of research in the area of
2 biological effects of magnetic fields?

3 A. There has been increasing interest in this area over
4 the past 10 years. Two books have been published in
5 the United States (Barnothy, M.F., ed., Biological
6 Effects of Magnetic Field, Vol. I. Plenum Press,
7 New York 1964 and Vol. II, Plenum Press, New York 1969
8 and several volumes in the Soviet Union.) Of particular
9 pertinence to the present hearing are several reports
10 of effects produced by very low strength magnetic
11 fields (i.e., from 1 to 10 gauss). The most recent
12 was by Dr. William Keeton (Proc. Nat. Acad. Sci. U.S.A.
13 68, 102, 1971) who was able to show that the homing
14 pigeon utilized the earth's magnetic field for
15 navigation with a sensitivity and precision that
16 our best instruments cannot attain. His observations
17 have recently been corroborated by Wolcott and Green
18 (Science 184, 180, 1974) and extended to several other
19 species of birds (Southern, W.E., Bioscience 22, 476,
20 1972 and Wiltschko, W. in Animal Orientation and
21 Navigation, p. 569, Government Printing Office, Washington,

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1 D.C. 1972). I believe that this is an instance of
2 these particular animals developing the same system
3 that is present in all animals into a specific sensing
4 mechanism of survival value. Dr. James Hays has shown
5 that naturally occurring reversals in the earth's
6 magnetic fields in the geological past were accompanied
7 by the extinction of animal species. During reversal
8 periods, the magnetic north and south poles exchange
9 their position. We know only that this is not associated
10 with a drop in the field strength below half normal nor
11 is it associated with any major increases in field
12 strength. Since no reversals have occurred in the
13 documented past, we cannot speculate on such factors as
14 the appearance of specific frequencies or alterations
15 in the earth's electrostatic field. The point is that
16 such seemingly minor variations in the magnetic
17 field are quite apparently events of major biological
18 magnitude. (Hays and Updyke, Science 158, 1001, 1967).
19 Dr. Frank Brown, who is primarily interested in the
20 phenomenon of biological cyclic behavior has shown
21 that it can be influenced by applied magnetic fields

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1 as low as 1 gauss. Since the biological cycles have
2 periodicities the same as the natural geomagnetic
3 field cycles, the suspicion is that the biological
4 cycles are driven by the earth's naturally fluctuating
5 geomagnetic cycles (Brown, F. Nature 209, 533, 1966,
6 Encyclopedia Britannica 292, 1966).

7 The work of Friedman and his colleagues may be
8 relevant to Brown's observations in that he has been
9 able to demonstrate that magnetic fields of 200 gauss
10 strength are definite stressors for the exposed organisms
11 (Friedman, H. and Carey, R. Physiol. & Behavior 9,
12 171, 1972 and Physiol. & Behavior 4, 539, 1969). Most
13 recently Dr. Dietrich Beischer of the Navy's Aerospace
14 Medical Research Laboratory has shown effects upon
15 human volunteers of exposure to very low strength (1 gauss)
16 45 Hz magnetic fields. The primary findings were an
17 increase in serum triglycerides observed in two
18 experimental runs (Beischer, D., Navy Aerospace Med.
19 Res. Lab. report # 1180, 1973). The Sanguine Biological
20 Study Committee to which these findings were reported
21 was also advised by the responsible Navy personnel

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1 that following Dr. Beischer's report, the personnel
2 at the Wisconsin Test Facility (a test antenna similar
3 to the proposed Sanguine Antenna located at the proposed
4 Wisconsin site) were examined and all were found to
5 have elevated serum triglycerides. The mechanism
6 producing this effect is currently under study. The
7 significance of the elevated triglycerides is in the
8 fact that this material is one of the steps involved
9 in fat metabolism and such elevations beyond the normal
10 range are generally believed to indicate an increased
11 risk of arterioscleratic disease.

12 Q. Why haven't you determined safe levels for human exposure
13 to 60 Hz magnetic fields?

14 A. We do not have sufficient funding to conduct these, or
15 any other additional experiments on power frequency
16 fields.

17 Q. Would you recommend construction of the 765-kV line as
18 proposed by the applicants?

19 A. No, for the reasons that the strength of both the
20 electric field and magnetic field produced by the
21 line will be in the range possibly productive of

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1 biological effects. I believe that chronic exposure of
2 humans to such fields should be viewed as human
3 experimentation, and subjected to the rules previously
4 mentioned. I believe that the most prudent course to
5 follow would be to determine the complete spectrum of
6 biological effects produced by exposure to 60 hz fields.
7 It should then be possible to establish firm levels of
8 permitted exposure both as to field strength and to
9 exposure times.

10 Q. Do the conclusions you have proffered apply to
11 transmission lines whose voltage is less than 765 kV?

12 A. Yes, proportionally so.

13 Q. Would you state for the record whether the conclusions
14 you have reached apply equally to an underground 345 kV
15 line, a 400 kV d-c overhead line and an underground d-c
16 transmission line?

★ 17 A. Our conclusions do not apply to the d-c case. In the
18 case of the underground 345 kV line, it is my
19 understanding that these lines may be shielded to
20 reduce the ground level electrical and magnetic
21 fields to the ambient level.

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1 Q. Does this conclude your testimony?

2 A. Yes.

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ENVIRONMENTAL PROBLEMS IN EXTRA HIGH VOLTAGE TRANSMISSION^{1/}

Louise B. Young^{2/}

Abstract.--This paper discusses health hazards caused by EHV transmission line corona and electrostatic fields. Comparative measurements of electric field gradients under EHV lines taken according to methods used in the U.S. and the Soviet Union show that, according to the Soviet standards, the electric fields under some U.S. lines are strong enough to represent a danger to people who are exposed to them for appreciable lengths of time.

INTRODUCTION

During the last two years several new questions about environmental effects of extra-high-voltage overhead transmission lines have surfaced as significant issues. As a result, a series of studies investigating these problems recently was commissioned by the Electric Power Research Institute, but these questions also deserve consideration by other agencies and research funded by sources other than the electric power industry.

A well-known fact that is acknowledged by the electric industry is that EHV transmission lines have an adverse impact on any environment in the immediate vicinity of these lines. They create audible noise, radio and television interference, and some hazard from transient electric shocks. These effects have been under scrutiny by the scientific community for at least a decade, and research studies are continuing in an attempt to understand and control these problems.

There are, however, two possible health hazards that the United States has only just begun to take seriously: (1) air pollution resulting from chemical reactions in corona discharge; and (2) electromagnetic effects, particularly the strong electric field that exists in the vicinity of EHV lines. Research into the biological effects of electric fields has been conducted in Russia since 1962. Scientists conducting these studies have con-

cluded that there is significant biological effect resulting from frequent exposure to electric fields in EHV substations and under EHV transmission lines.

In 1962, shortly after the first 500 kilovolt (kV) lines had been operating in the Soviet Union for several months, men working at the substations began to complain of headaches and a general feeling of malaise. Abnormal fatigue and sleepiness were mentioned by a majority of the workers. They associated these symptoms with exposure to the electric fields.

In view of these reactions, a long-term study was instituted, with systematic medical examinations of approximately 250 men working at 500 and 750 kV substations. These results were compared with medical examinations of men working at lower-voltage substations. The studies showed that long-time work at 500 kV substations without protective measures resulted in "shattering the dynamic state of the central nervous system, heart and blood-vessel system, and in changing blood structure. Young men complained of reduced sexual potency" (Korobkova, et al 1972). The severity of these effects depended directly on the length of stay in the field.

Unfortunately, there has been a tendency in the United States to brush off the results of these studies as unscientific and exaggerated, while at the same time, there has been no serious attempt to replicate the experiments in a manner which would be completely acceptable to the international scientific community. Some of the differences of opinion about the significance of these experiments concern the strength of the fields that exist under the Russian lines as compared to those in the United States and

^{1/}Paper presented at Symposium on Environmental Concerns in Rights-of Way Management, Mississippi State University, January 6-8, 1976.

^{2/}Author of Power Over People, Winnetka, Ill.

the validity of Soviet measuring techniques. Of course, no scientific research can even get off the ground without standardization and complete agreement on the methods of quantifying the various parameters. During the past year I have researched these problems, and this paper summarizes the results of my findings.

ELECTRIC FIELD GRADIENT MEASUREMENTS

Although the vertical electrostatic field to which people are exposed under a transmission line can be computed theoretically, it also is advantageous to make actual field measurements in order to confirm these calculations. We should bear in mind, however, that the measurement of a truly unperturbed field is impossible since the combined presence of any measuring device plus the observer must of necessity perturb the field. The size and position of both the meter and the observer are significant factors in determining the degree to which the field is perturbed. When measurements are made at a height above ground, the degree of perturbation caused by the meter and the observer is greater than measurements at ground level.

Up until about a year ago, electrical engineers in the United States reported the electrical field gradients under transmission lines at ground level. In this case, the instrument in contact with the ground does not appreciably distort the field. However, it was found that results did not always correspond to theoretical ground level gradients, because the presence of vegetation and irregularities in the ground surface caused significant variations in the electric field intensity.

More recently, measurements in the United States have been made at one meter above ground level with an instrument held on a hot-stick or a similar long, insulating handle. Measurements made in this way generally confirm the theoretical calculations of the unperturbed field. It must be remembered, however, that these unperturbed values are useful only for comparing different transmission lines. From a biological standpoint, it is important to consider the fields that actually impinge on the body of a person exposed to the electric field. For example, the intensity of the field impinging on the top of a man's head may be as much as fifteen times as strong as the unperturbed field at that position (Schneider 1974). The taller the person (or other perturbing object) the greater the

field intensity at head height.

Results of the Russian studies of health effects from exposure to alternating electrostatic fields first were reported at the international symposium in Paris in 1972 (Korobkova, et al. 1972). Four other reports on this work subsequently have become available in translation. Because the Russian scientists concluded that long-term exposure to fields that exist under their 500 kV and 750 kV lines did cause significant and important biological changes, safety regulations were designed to protect workers from the influence of these fields (Knickerbocker 1975). Accordingly, new regulations provided that no one should be exposed for any time to fields over 25 kV per meter (kV/m) without special protective screens or Faraday cages. In a field of 25 kV/m, for example, maximum exposure time was determined to be no more than 5 minutes in a 24-hour period. The number of minutes allowed increases as the field strength diminishes. At 10 kV per meter, 180 minutes is allowed; 5 kV/m or less is considered the only safe levels for unlimited exposure (Table 1).

Table 1.--Safety Regulations - U.S.S.R.

| Electric field intensity kV/m | Permissible duration of personnel stay in electric field during 24 hours minutes |
|-------------------------------|--|
| 5 | unlimited |
| 10 | 180 |
| 15 | 90 |
| 20 | 10 |
| 25 | 5 |

(From "Rules and Regulations on Labor Protection at 400, 500, and 750 kV AC Substations and Overhead Lines of Industrial Frequency [In the U.S.S.R.]," translated by G. G. Knickerbocker.)

In trying to interpret the significance of the Russian results in relation to our own lines, a number of difficulties have been encountered. There appears to be an important difference, for example, between electric

field gradient levels measured under their lines and those reported by our electrical engineers for lines carrying similar voltages.

In the CIGRE paper by Korobkova et al (1972), maximum field intensity figures of 22 kV/m are reported for roads under 750 kV lines. Korobkova also states that "at 750 kV switchyards, there is practically no area with an intensity lower than 10 kV/m." A graph of field intensity versus distance to the conductor of a 500 kV line shows a maximum intensity reading beneath the outer conductor of 22 or 23 kV/m and this occurs when the conductor is approximately 10 meters away. I understand this to mean that the line in this case is at least about 33 feet above ground level. Citing from "Rules and Regulations on Labor Protection," (Knickerbocker 1975) work carried out on the ground in the zone of influence of a 750 kV transmission line without the use of protective measures is permitted in the span of the transmission line and close to anchor and corner towers for no more than 10 minutes. If the work is off the ground protective measures must be used. Since the field that the Soviets allow their workers to be exposed to for a maximum of 10 minutes is 20 kV/m, we can reasonably assume that they believe fields of this intensity occur within the span as designated (fig. 1).

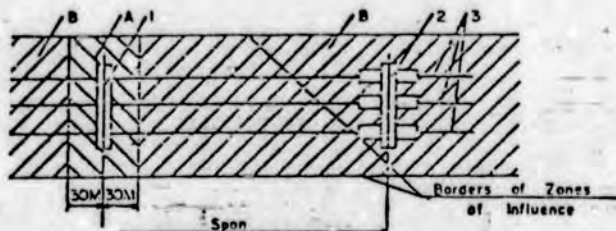


Figure 1.--DIAGRAM OF 750 kV TRANSMISSION LINES WITH ZONES OF INFLUENCE

1--intermediary tower

2--anchor or corner tower

3--conductors

A--zones in which work is permissible without protective measures for durations of no more than 180 minutes (distances given in the diagram)

B--zones in which work is permissible without protective measures for durations of no more than 10 minutes

From "Rules and Regulations on Labor Protection," in (Knickerbocker, 1975).

The above statements quite clearly reveal that the Russians were measuring field gradient intensities as high as 22 kV/m under both 750 kV and 500 kV lines. Maximum levels actually measured by electrical engineers in the

United States, however, are 10 kV/m under 765 kV lines and 8 kV/m under 500 kV lines. There appears to be a difference, therefore, of a factor of more than two between U.S.S.R. and U.S. readings.

Some of this discrepancy may be accounted for by differences in line design. For example, Russian lines are somewhat lower than lines in the United States. It is difficult to quantify this factor precisely because not enough specific information is available on the height of Russian lines that were in operation at the time these first health studies were being conducted. The only indication we have of line height is the one previously mentioned - a 500 kV line which appears to have a minimum height of about 33 feet above ground level. Our 500 kV lines theoretically have minimum heights of 35-37 feet under maximum load and temperature conditions. However, even when lower clearances of this order of magnitude are taken into consideration, there still remains a significant discrepancy, a factor of somewhere between 1.5 and 2. It is important that this difference be resolved before the significance of the Russian studies can be applied to our own lines.

During the past year, I made several field gradient measurements under 765 kV lines, duplicating as closely as possible with the instruments available to me the Russian measuring techniques, as well as those of our own engineers. I now believe that the discrepancy between the two sets of figures can be simply explained on the basis of the different methods used in measuring fields in the two countries.

Russian reports state that the strength of fields in their substations and under their lines was determined by measurements with a specially-designed field gradient meter. The meter itself and the manner in which the readings were taken is described in detail. However, theoretical calculations do not appear to have played any part in the determination of the field gradient by Russian scientists. Only one reference in the five reports relates to theoretical field strengths, and this single reference indicates that their theoretical understanding of the spatial distribution of the electric field differs significantly from ours: Morozov and Gromov (1975) "...data from calculations and measurements of the distribution of the electric field on high voltage lines show that field intensity is proportional to the square of the distance from the source of the field (conductor, connecting bus, etc.)" Even assuming that the authors mean "inversely proportional", this statement does not correspond with a theoretical formula for field gradient. It also indicates that their

field gradient measurements increased in intensity fairly rapidly as height above ground increased - much more rapidly than occurs in our field gradient readings, which do not alter significantly until more than half the distance between the ground and the conductor has been traversed.

To measure their fields, the Russians used a small ungrounded meter held by an observer on a short handle at 1.8 meters above ground. This meter is described in the report by Morozov and Gromov. (fig. 2). The authors specify that the handle of insulating material be 250mm long, and they say that "the operator holds the instrument by the handle and inserts it into the measured area." The height at which the instrument is held is described as 1.8 meters above ground (see "Rules and Regulations on Labor Protection," in Knickerbocker 1975).

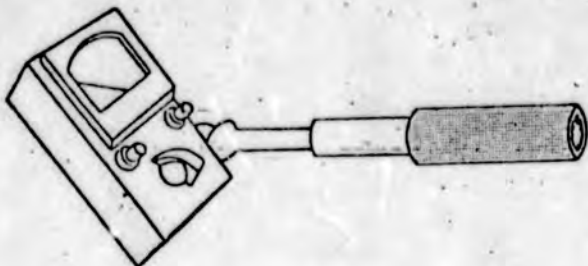


Figure 2.--An instrument for the measurement of electric fields of 50 HZ. From Morozov and Gromov, (1975).

A handle of 250mm (about 10 inches) is so short that the observer holding the instrument cannot avoid causing considerable concentration of the field by the presence of his body. I found that a Monroe meter (Model 238A-1 Portable Differential AC Electric Field-meter) held close to the meter (thus simulating a 10-inch handle) and raised to a height of 1.8 meters above ground gave readings that ranged from 1.5 to 2 times higher than the same meter held out on a 4-foot-long handle at approximately one meter above ground. Figure 3 shows a field profile under a 765 kV line with readings taken according to the standard U.S. method (on a 4-foot-long handle at one meter above ground); and according to the Russian method (using a 10-inch handle with the instrument held at 1.8 meters above ground). In the short handle configuration, the position of the hand is extremely important. The hand itself, of course, must occupy part of the 10-inch handle. If the hand is moved several inches nearer the body of the instrument, readings increase by as much as 50%.

For the measurements in figure 4, the hand was placed as far from the meter as possible on the 10-inch handle. The readings taken by the Russian method average 1.6 times the readings taken by the U.S. method.

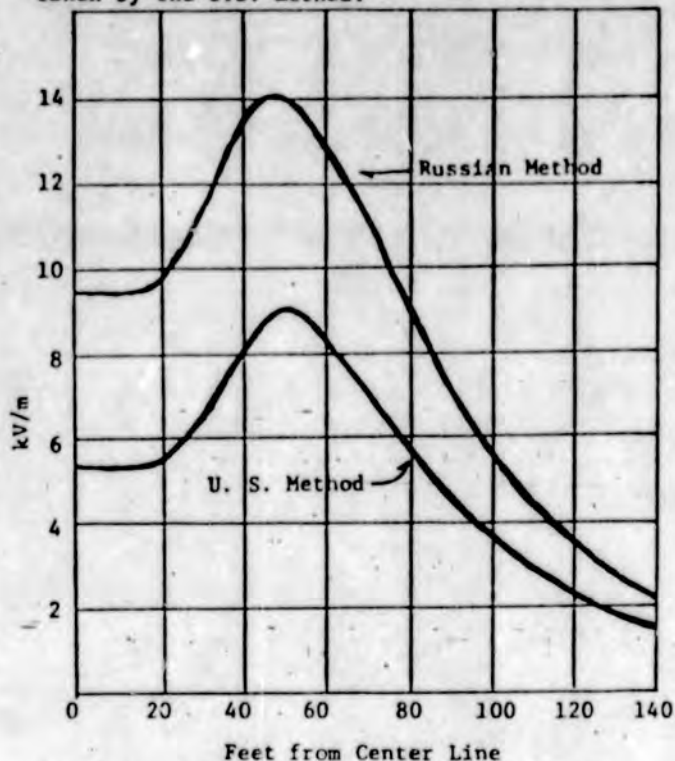


Figure 3.--Field gradient readings under 765 kV line, Peotone, Ill., June 21, 1975

It is also interesting to note that the height at which the Russian measurements are made tends to magnify the discrepancy between the two ways of measuring electric field gradient. If the observer crouches down and holds the instrument in the short handle position at one meter above ground, the readings for field gradient are 1.26 times higher than those taken when the full handle is used. In other words, the presence of the observer has a more perturbing effect on the field at 1.8 meters than it does at one meter (an observation that could also be predicted by theory).

It seems apparent that the Russians were measuring a more perturbed field than the U.S. engineers measured, which may account for a large part of the discrepancy in the two sets of readings. The Russian method of measuring electric fields was valid within their own frame of reference as long as all their results were based on this same technique. A paper given in February, 1975, at a US/USSR exchange meeting in Washington indicates that Soviet scientists are now revising both their measuring techniques and their theoretical calculations in order to bring them more in line with

accepted international procedure. For example, they have increased the length of the insulating handle used on their meter from 250mm to about 500mm, in addition, when discussing the variation of the theoretical electric field with height above ground, they now speak of an inverse proportionality relationship of 1.35 or 1.45 instead of 2 (Lyskov et al, 1975). However, these recent changes do not alter the fact that field measurements which were used as their basis for health studies during the decade from 1962 to 1972 were made in the manner I have described above. Therefore, in order to relate the conditions of these studies to fields created by our lines, a correcting factor of approximately 1.6 must be applied. For example, Russian safety regulations state that 25 kV/m is the maximum field to which people should be exposed at all. If we multiply this maximum figure by 1/1.6 or .6, we would obtain a limiting field gradient of 15 kV/m.

There is an additional factor which must be taken into account in studying the Russian research findings. The frequency of the AC current in Russia is 50Hz, while 60Hz is used in the United States. For a given field intensity, the higher frequency causes a 20 percent larger charging current to run in the bodies of people exposed to these fields. Since electrical current is thought to be the principal cause of biological influence, we must apply a factor of .8 to the U.S.S.R.'s fields in order to arrive at the biologically equivalent field for 60Hz. Russian standards with these two correcting factors applied are summarized in table 2.

It should be remembered, of course, that the actual size and characteristics of the Russian meter are slightly different from the Monroe meter which we used, and this may affect

the degree to which the field is perturbed. In order to determine the exact factor between the fields measured by the U.S. and the U.S.S.R. techniques, the Russian instrument should be used according to their method and compared directly with ours over a range of field strengths. However, the above charts and graphs provide at least a rough estimate of the way our field gradients would compare with the fields to which the Russian workers were exposed and which were used as the basis for their Rules and Regulations on Labor Protection. It is apparent from the figures that the fields experienced under our 765 kV lines fall well within the range of intensities which were found to cause biological effects in the Soviet Union. A graph of theoretical ground level gradients under such a line (see figure 4) shows maximum intensities of 13 kV/m

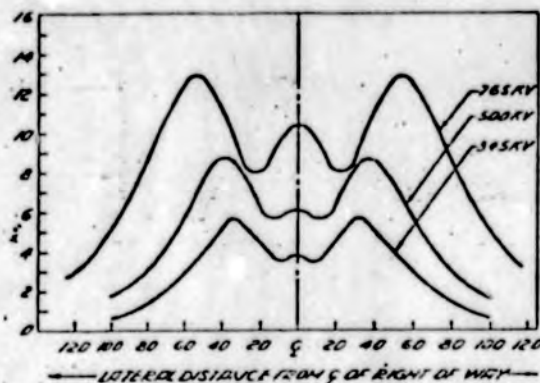


Figure 4.--Typical Electrostatic Ground Gradient Profiles of Various EHV Lines. From E. S. Zobel and F. J. Dormady, Charles T. Main, Inc. Report of Tests with Fluorescent Tubes to Indicate Electric Field Strength Under 500-kV Transmission Lines, Colstrip Project - 500 kV Transmission Lines, March, 1975.

Table 2.

| Russian field intensity in kV/m | same fields measured by U.S. method | biologically equivalent fields kV/m | maximum permissible time in field in 24 hours |
|---------------------------------|-------------------------------------|-------------------------------------|---|
| 5 | 3 | 2.4 | unlimited |
| 10 | 6 | 4.8 | 180 minutes |
| 15 | 9 | 7.2 | 90 minutes |
| 20 | 12 | 9.6 | 10 minutes |
| 25 | 15 | 12 | 5 minutes |
| over | over 15 | over 12 | no exposure |

and gradients at 100 feet from the center line (the edge of a typical right-of-way) of approximately 5 kV/m. It is also significant that the Russians emphasize that people exposed to these fields for the maximum times must not also be subjected to transient shock currents. In our country people walking and working under transmission lines frequently complain of transient shocks from farm machinery, and even from leaves of corn or blades of grass.

Charging Currents

A more direct and precise method of estimating the biological significance of alternating electrostatic fields is by determining the amount of charging current that flows through the bodies of people exposed to EHV fields. I have measured currents as high as 200 microamps in the body of a 6-foot man standing with both arms raised at the strongest point of the field under a 765 kV line. With one arm raised the maximum current was 160 microamps. These measurements were made with the subject standing on an insulating pad and holding one electrode of an ammeter between the thumb and forefinger. The other electrode was grounded. At the edge of the right-of-way (100 feet from the center line) body currents of 90 microamps were measured.

The CIGRE report by Korobkova et al (1972) states that studies of the biological influence of charging currents were being carried out in the U.S.S.R., "Preliminary data show that a 80-120 microampere current flowing through a man for a long time unfavorably affects him." The current levels measured under a 765 kV line were within or considerably above this U.S.S.R. danger level. Again, these current measurements indicate that electric fields under U.S. lines would be considered by Russian scientists to be biologically significant.

A group of German scientists (Schneider et al 1974) reported current levels similar to the ones cited above. They found that a person standing on the ground with one hand raised would have a charging current of 18 microamps for each kV/m of unperturbed field gradient. Therefore, at the maximum point under the 765 kV line where we measured 9.1 kV/m, the total charging current flowing in his body would be 162 microamps. At the theoretical maximum of 13 kV/m, a current level of 230 microamps would be anticipated.

Measurements made by Bonneville Power Administration and reported by T. D. Bracken (1975) yielded an average value of 16 microamps per kV/m for a 1.75m man with arms held at his side. Bracken also noted that the charging current is directly proportional to the square

of the height of the person exposed to the field. Although the experiments on which this relationship was based did not consider heights above 2 meters or differently shaped objects, the implication is strong that a taller object in the field - e.g. a man on a horse or a piece of farm machinery - would sustain a higher body current (see fig. 5).

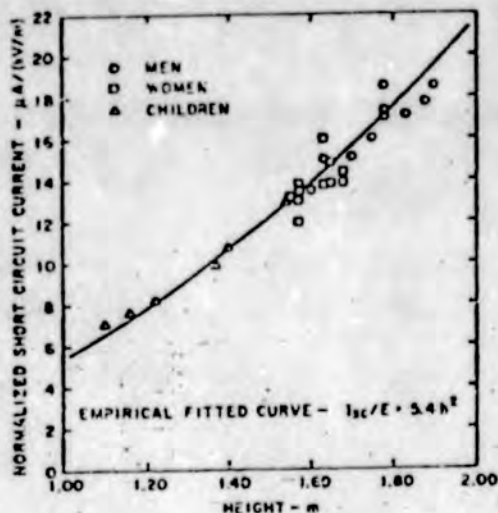


Figure 5.--Normalized short circuit current versus height for persons. From T.D. Bracken, (1975).

The above findings all lead to the conclusion that a person walking or working under the main span of the 765 kV lines now in operation in the United States, would have continuous displacement currents of 90 to 200 microamps in his body, and under special circumstances the levels could even be greater. These levels are significantly higher than the amounts considered safe by the Russians (Asanova and Rakov 1975). Since definitive research on this subject has not yet been conducted in this country, I believe that this health question should be answered before more such lines are constructed.

CHEMICAL PRODUCTS OF CORONA DISCHARGE

All EHV transmission lines create varying degrees of corona discharge, the amount depending upon design of the lines, voltage, surface of the conductors, and weather conditions. Electric breakdown of air causes a variety of chemical changes which lead to the production of reactive chemicals such as ozone, nitrogen oxides, hydroxyl radicals, and singlet oxygen. Of these, ozone is thought to be the most important product. Over the past few years, a number of field investigations of ozone levels

under 765 kV lines have been made which have shown no appreciable increase over ambient ozone levels. However, at the time these tests were conducted, the 765 kV lines were operated at levels 8 to 10 percent below the rated voltage, and since corona discharge with its associated formation of ozone are threshold phenomena, this relatively small difference in operating voltage makes an enormous difference in the amount of ozone production that could be expected. When these lines are run at 690 kV or 720 kV, corona loss would be negligible except under certain climatic conditions such as rain or snow. When there is considerable water vapor present in the air, less ozone also is formed per kilowatt hour of corona loss. Under these circumstances then, it would be surprising if monitoring for ozone near a "765 kV" line energized at about 700 kV, would show significant increases above ambient levels.

It is interesting to note, however, that at Oak Ridge National Laboratory, ozone measurements at the edge of a right-of-way for two 500 kV transmission lines recorded ozone concentrations of 210 and 230 parts per billion on April 6, 1972, at 9:30 and 9:40 A.M. (Oak Ridge National Laboratory 1973). Since these figures were ten times the ambient levels, the Oak Ridge report suggested they were caused by temperature inversion. Obviously, if a temperature inversion in the vicinity of a 500 kV line can cause a ten-fold increase in concentrations at ground level, then a very considerable amount of ozone must be generated by the line and normally must be carried off by surface winds. Such amounts, therefore, generated by thousands of miles of lines, would add significantly to ozone concentrations which already are dangerously high during much of the time. In the field measurement experiments, the monitoring equipment was not arranged in the most favorable manner for detecting ozone produced by EHV transmission lines.

It is apparent from purely theoretical considerations, that maximum levels are not likely to occur directly under the line but quite a distance down wind from the line. Since ozone is hot when formed, it rises and is blown by the wind, reaching ground level at some distance from the line. Even in the lightest of winds (about 2 miles per hour), the maximum concentration of ozone would occur about 300 feet from the line (Scherer et al, 1973). Only when the wind blows parallel to the line would it be reasonable to expect higher ozone levels under the line itself. When the wind is transverse to the line, the maximum concentration is inversely proportional to wind speed. Temperature in-

versions and very light winds provide the most favorable conditions for elevated ozone levels. In order to accurately report these periods, monitoring should be conducted continuously over a prolonged period of time.

The fact that ozone is formed in high electric fields can be simply demonstrated in the following manner: a grounded needle point or a fine wire is mounted in a teflon cylinder (to protect it from the wind) which is attached to the intake tube of a Mist ozone meter. This probe is then mounted in the electric field created by a power line. (We used a wooden tripod.) At a certain field intensity, the ozone meter readings suddenly begin to rise. In fact, one has to watch very carefully because the level recorded by the meter rises so quickly at times that it can go off the scale and saturate the meter. The field intensity at which this occurs has a definite threshold which varies with each type of needle or wire. By standardizing the type of probe, this method can provide a check on field gradient readings, a check which also has the advantage of being independent of any calibrating procedure. This experiment is effective in demonstrating threshold characteristics of ozone formation in high electric fields.

Although ozone is an important product of corona discharge, it certainly is not the only one, and it would be unfortunate if public interest in ozone formation obscures the need to consider the other deleterious results of electric discharge. Monitoring for NO and NO₂ near power lines has been given only token consideration, and to date only a few spot checks have been made. Furthermore, the question of what happens during actual rain or when humidity is high, still remains unanswered. It is an actual fact that during these conditions, ozone production per kilowatt hour of corona discharge drops very sharply, and it seems apparent that another chemical reaction is absorbing this energy. The most obvious candidate is the formation of hydroxyl radicals and atomic hydrogen from water molecules. Hydroxyl radicals are known to be biologically active and they probably serve a function similar to that of hydrocarbons in the formation of toxic smog.

Since all these questions have important implications for the health of people living near major transmission lines, they should be resolved before the onset of construction of thousands of miles of extremely high voltage lines that are planned for the next few years. In the long run, it will be to the financial advantage of the power companies themselves to consider these health questions before, rather than after, major investment is made

in this technology, especially since such potential health hazards can be minimized by a few small changes in design. Typical of some of the preventive steps which can be taken are:

(1) The electric field at ground level can be reduced by increasing the height of the conductors. (2) Corona loss, and the associated chemical reactions to it, can be reduced by proper choice of conductor diameter and by the number of conductors in each bundle. (3) Since direct current transmission lines do not cause continuous charging currents to run in the bodies of people and animals near the line, biologists believe that the electric fields created by DC lines are probably less damaging to living systems than are AC fields. DC lines have other advantages also. For example, the corona loss from DC lines does not increase as sharply in foul weather as does the corona loss on AC lines. Therefore, a changeover to DC technology for EHV transmission lines could reduce considerably the major sources of environmental concern. In addition, such changeover would not carry a financial penalty when large blocks of power are moved over several hundred miles.

Underground transmission undoubtedly is the technology of the future. New techniques have been developed and already are being used in a number of countries. Underground transmission also would be much more acceptable to the American public. It would minimize the visual pollution caused by the ever-increasing number of transmission lines built to handle the escalating demand. It would solve the electric field problem and would eliminate electrochemical and noise pollution. The sooner these technologies are perfected and put into mass production on a national scale, the sooner it will be possible to achieve a satisfactory long-term resolution of the environmental problems involved in transmitting electric power.

LITERATURE CITATIONS

Asanova, T.P. and A.I. Rakov.

1975. The state of health of persons working in the electric field of outdoor 400 and 500 kV switchyards. In Knickerbocker, G.G., Study in the U.S.S.R. of medical effects of electric fields on electric power systems.

Bracken, T.D.

1975. Field measurements and calculations of electrostatic effects of overhead transmission lines. The Institute of Electrical and Electronics Engineers, No. 75-573-6. New York.

Knickerbocker, G.G. (translator)

1975. Study in the U.S.S.R. of medical effects of electric fields on electric power systems. The Institute of Electrical and Electronics Engineers, Inc. N.Y.

Korobkova, V.P., Yu.A. Morozov, M.D. Stolarov, and Yu.A. Yukub.

1972. Influence of the electric field in 500 and 750 kV switchyards on maintenance staff and means for its protection. CIGRE: International Conference on Large High Tension Electric Systems. 28 August - 6 September, 1972, Paris.

Lyskov, Yu.I., Yu.S. Emma, and M.D. Stolarov.

1975. Electrical field as a parameter considered in designing electric power transmission of 750-1150 kV; the measuring methods, the design practices and the direction of further research. Proceedings of the Symposium on EHV Power Transmission. Joint American-Soviet Committee on Cooperation in the Field of Energy, February 17-27, 1975, Washington.

Morozov, Yu.A., and O.M. Gromov.

1975. Device for the measurement of industrial frequency electric field intensity. In Knickerbocker, G.G., Study in the fields on electric power systems. The Institute of Electrical and Electronics Engineers, Inc. New York.

Oak Ridge National Laboratory.

1973. Annual progress report ending September 30, 1972. In Draft Environmental Impact Statement, Colstrip Electric Generating Units 3 & 4. Montana State Department of Natural Resources and Conservation, Helena, Montana.

Scherer, Harold N., Brendan J. Ware, and C.H. Shih.

1973. Gaseous effluents due to the EHV transmission line corona. IEEE Transactions on Power Apparatus and Systems, PAS-92, No. 3, New York.

Schneider, K.H. et al.

1974. Displacement currents to the human body caused by dielectric field under overhead lines. CIGRE: International Conference on Large High Voltage Electric Systems, August, 1974, Paris.

Zorbel, E.S., and F.J. Dormady.

1975. Report of tests with fluorescent tubes to indicate electric field strength under 500 kV transmission lines. Charles T. Main, Inc. Colstrip Project.

POWERLINE PROTEST NEWSLETTER OF CENTRAL MINNESOTA

HEALTH/SAFE UPDATE

It looks like some progress is finally being made with this health-safety issue. The direction we are heading was ratified at the February 19 General Meeting of GASP. We have been working primarily with Art Sidner, Chairperson of the MEQB, and Representative Fjoslien...so far. We all went public with the evidence already accumulated, the progress that has been made, and the direction we are headed at a Press Conference held on February 26 in St. Cloud. What follows is the initial statement we made at that conference.

The procedure outlined below is the result of negotiations between representatives of the General Assembly to Stop the Powerline, and Art Sidner, Chairperson of the Minnesota Environmental Quality Board. The procedure points us in the direction which both parties would like to take. The exact course we will be following is not carved in stone because there are many pitfalls and dead-end paths in that direction. At this conference, each party will speak to their concerns in that regard. None-the-less, it is a direction which holds some promise of an acceptable resolution to a major issue in the Powerline Controversy, and the first steps are being taken with caution, but with hope.

1. GASP and the MEQB jointly conduct a survey of people along the line route to determine the effects people have experienced, and to identify "professional" people - nurses, doctors, veterinaries, A.I. technicians, and others who have had opportunity to notice professionally any changes in their clientele along the line route.
2. Professional people will be screened by a team consisting of consultants hired by the MEQB and representatives from GASP to determine which of them should testify before the MEQB and at subsequent proceedings.
3. Selected professional people will testify before the MEQB, thus establishing "probable cause" in the relationship between the effects people are experiencing along the line route, and the powerline.
4. On the basis of probable cause, Art Sidner will advocate that the MEQB proceed on one or more of several possible courses of action. Among the possibilities are:
 - A. The MEQB will call a Special Hearing before a Hearing Examiner for the purpose of revoking the permit needed to operate the facility.
 - B. The MEQB will file suit against the operation of the powerline on the grounds that it is in violation of the Environmental Rights Act. In this event, the MEQB shall precede that action with a motion for an injunction against further operation of the facility pending the outcome of the court proceedings.

There has been a bit of a misunderstanding already on that fourth point. At the conclusion of the last meeting we had with Sidner before the conference, Sidner categorically stated that the MEQB would take action on the basis of probable cause, and that the action would be likely to take one of those two courses. But in the meantime, he came to the conclusion that the best he could do would be to recommend to the MEQB that action be taken on the basis of probable cause. He says he will be an advocate of such

a course within the MEQB. So far, we will believe him. Sidner also (2) has problems with point 4-B of our statement, and at the Press Conference as far as he would go was to say, "The range of actions include modifying or if necessary, revoking the construction permit." None-the-less, the fact that he attended the Press Conference and spoke as strongly as he did for "action for resolving the health issue of the UFA/CPA 800 kV powerline," as his statement put it, indicates that it may be worth our while to maintain a working relationship with him.

Anyway, Sidner spoke to his concerns after the opening statement, and that was followed by a GASP position paper on the health/safety issue, and this is what it says:

On behalf of the General Assembly to Stop the Powerline, we are grateful that the Minnesota Environmental Quality Board is considering action on the powerline health/safety issue. We are particularly thankful that Art Sidner is providing the MEQB with the type of leadership needed to make progress, and we are hopeful that an acceptable resolution is possible.

However, as we proceed to address the powerline health/safety issue, it is entirely possible that the MEQB, the utilities, and the courts will take positions which are not acceptable to GASP. We are anxious that there be no misunderstandings on this matter.

It is essential that the MEQB, the utilities, the courts, and the general public understand that reduced line voltage would not solve the health/safety problem. Any move in that direction will be considered by GASP to be an attempt to divert attention away from the issue, and will be dealt with accordingly.

Likewise, courses such as widening and/or fencing the easement, converting the facility from Direct Current (DC) to Alternating Current (AC), or unsubstantial revisions of the Permit are diversionary, and therefore unacceptable.

We look forward to working with all parties concerned towards an acceptable resolution of the issue, and urge people along the line route to cooperate with the MEQB survey.

We would be glad to answer any questions about the reasons for our position.

There were plenty of questions, both for Sidner and the GASP representatives, so folks should have a pretty good understanding of where we're at, where we're trying to get to, and what's acceptable and what is not. In the course of the questioning, the matter of compiling evidence came up. That lead to the health/safety survey forms being circulated by the MEQB and by GASP people. (We urge people to cooperate with the survey, and it is particularly important that we identify the "professional" people! Also, if you haven't received a survey yet, either contact the office (612) 283-5439 or write the MEQB in care of Art Sidner at 101 Capitol Square Bldg., 550 Cedar Street, St. Paul 55101.) Anyway, that lead to a discussion of the powerline health/safety survey Representative Fjoslien has been working on for the past month. The report on that survey is still a preliminary one, seeing as how questionnaires are still being returned and there has been little work done yet to tabulate the results. But even so, the results thus far are startling. Of the 500+ questionnaires sent out, over 50% have been returned. Of those, some 60% report effects; primarily headaches, nosebleeds and respiratory problems. About 20% are unsure, and the remainder haven't noticed anything yet. But even a sizable portion of those reporting no effects did indicate that wildlife is gone from the area.

In his news release at the conference, Fjoslien stated, "My concern is that the peoples' government (of which I am an elected member) has a duty to attempt to find a solution to this health concern as long as anybody has

a legitimate complaint of adverse health effects which they believe (3)
are caused by this HVTL."

"Therefore, through my questionnaire, I am attempting to find out what the concerns are and what the adverse health symptoms of the people and the livestock are. Many of the concerns of people who live near the line are the same, although these people live hundreds of miles apart." Representative Fjoslien spoke well to his concerns at the Press Conference.

It is clear that the health/safety issue has become a legitimate one. Finally, we intend to gain an acceptable resolution to that issue, and that means SHUT IT OFF!!!

* * *
Tickets sales for the GASP Raffle are going well. We'd like to remind those of you who still have tickets out, that we'd appreciate getting them as soon as possible. If you know of anyone who would like to sell more tickets, just have them drop us a line or call the office. We have all been working towards making this fundraiser a success and want to thank all of you for your help.
* * *

LETTER FROM MARK

How is everything around there? I don't know if you guys are still kicking or not, I never hear from any of YA. Well I went to my Parole Board Hearing the 8th of February and they are going to make me do the WHOLE TIME, 10 months, they give me 2 months off for Good Time, that's if I'm good and don't get into any trouble around here.

I went before a Classification Board yesterday for the FARM, it is a Minimum Security Unit. Them Bigwheels won't even let me go out to the FARM, they say that they are going to make an example out of me, and they think that there is always VIOLENCE INVOLVED IN OUR PROTESTING ON THE POWERLINE, and I don't know where they get that from. "Accidents yes, Violence no." They must think, "Now we got one of those powerline protesters so we are going to really fix him." There are some guards who get pretty smart, they know who I am, they try to make it harder for me. But I just tell them, oh ya, I like it here and that I'm really having a good time here. That really gets to them boys, see they try to make it hardest for you in here. And believe me, it is not that easy. Oh well, I will just try to make the best of it. See ya all later. Say hi to everyone, ok?

Mark

(Mark's address is: Mark Hoiun, #111509, Box 55, Stillwater, Mn 55032)

WOUNDED KNEE MEMORIAL

The following letter was sent to GASP last week, and we wanted to share it with all of you.

Brothers and Sisters in the Struggle,

We extend a most sincere invitation to attend the Wounded Knee Memorial, February 27th, 1980, being held at the Porcupine Community Center.

At this time we honor those sisters and brothers who have given their lives or suffer in the prisons for the human rights of our People.

In solidarity,

Women of All Red Nations

GASP regrets that we were not able to attend this memorial which is of such importance to our Indian sisters and brothers all over this country and the world. The Indian people who were murdered at Wounded Knee are victims of the same Energy War that we are fighting. We honor them, and those who carry on, in our thoughts and in our prayers.

On Monday, February 25th, protesters assembled at the Pope County courthouse in Glenwood for the first time since the Oeltjen acquittal last fall. The occasion was the long-delayed and almost-forgotten arraignment of Darus Ehlers (Traverse County) on a charge which is now almost 1½ years old.

The charge stemmed from an incident last November 1978 when folks were out and about the countryside by the powerline one night and Trooper Mike Senf decided to be a noble and forceful cop. A search of Darus' car ensued, and Senf found a handgun (which didn't work) and ticketed Darus for carrying a handgun without a permit. So, that was that...and we all went home.

So, on February 25th, what most of us were expecting was your typical arraignment before Judge Claeson. But, no sooner had people gotten their coats off, when young-wonder-prosecutor Kuhn said, "Well, after reviewing the complaint, I don't really see how the law was violated, so I move for dismissal." To which Claeson replied with a grin, "Case dismissed." To which protesters replied, "Huh?"

After court, we ended up spending more time arguing with Trooper Senf (who we found lurking on the back streets of Glenwood) about when Darus was going to get his gun back, than we did in the arraignment itself! Such a deal.

GENERAL MEETING

At the February 19th meeting of the General Assembly, a number of things were discussed including the ongoing negotiations between GASP and Art Sidner. The negotiation process and what we wanted to come out of it was talked over in length and there was a rather hopeful but cautious attitude that prevailed. As should be evident by other portions of the newsletter, we feel that things are looking good.

There was a report from the people who attended the last of the Power Plant Siting meetings. Those who were there felt that the Siting Staff was finally realizing that the people of Minnesota are upset with the whole siting process and that there is no need for any more power plants, therefore there is no need for the Power Plant Siting Staff.

At the last PPS meeting in Brainerd our people got together with the folks fighting fluoridation. We discovered that they were circulating a petition to impeach Dr. George Pettersen, head of the state Health Department, on the grounds that he was ruining the health of Minnesotans rather than protecting it. We brought some copies of the petition back with us and circulated them at the meeting. Needless to say, everyone in the room signed it.

At the end of the meeting we watched a film we ordered from Northern Sun entitled "Lovejoy's Nuclear War". It was about Sam Lovejoy and his battle with the utilities who wanted to build a nuke plant in his back yard. He was having a time getting people in his community to inform themselves about the dangers of nuclear power and trying to gather some sort of resistance against the plant. The utilities then went and built a weather observation tower not far from his house, although he warned them that somebody might try to knock it over. Every morning he would step out his door and look to see if it was still there. One evening he decided that he would take it down himself, which he did. The next morning he wrote a statement about why he did it and went to town to turn himself in. The movie then dealt with his trial and subsequent acquittal and the impact it had on his local community. All in all, it was a great movie which everyone seemed to enjoy. A special thanks again to Northern Sun for bringing it.

You'll notice in this issue of Hold That Line, we've enclosed what we feel is an excellent pamphlet on uranium exploration and mining in northern Minnesota. As a result of our contact with these people, we hopefully will have a slideshow on the subject at the March 18th meeting of the General Assembly. It should be an interesting as well as educational way to keep updated on what's going on in other parts of the Energy Wars. Our next meeting is Tuesday, March 4th at 8:30pm in Lowry. See you there!!

"Planned power plant moved out of state." That's how the headline read for an article in the February 25th Minneapolis Tribune. The story is about a new but familiar twist in the 5 year old battle between Minnesota Power and Light and local residents in the Duluth area over a coal-fired plant.

People opposing the plant were at one time in a long court battle with MP&L on the issue of whether that utility complied with Minnesota site-selection procedures when choosing the Duluth location. Last year, however, the state supreme court said that the way the EQB went about finding a site was just fine by them. Sound familiar?

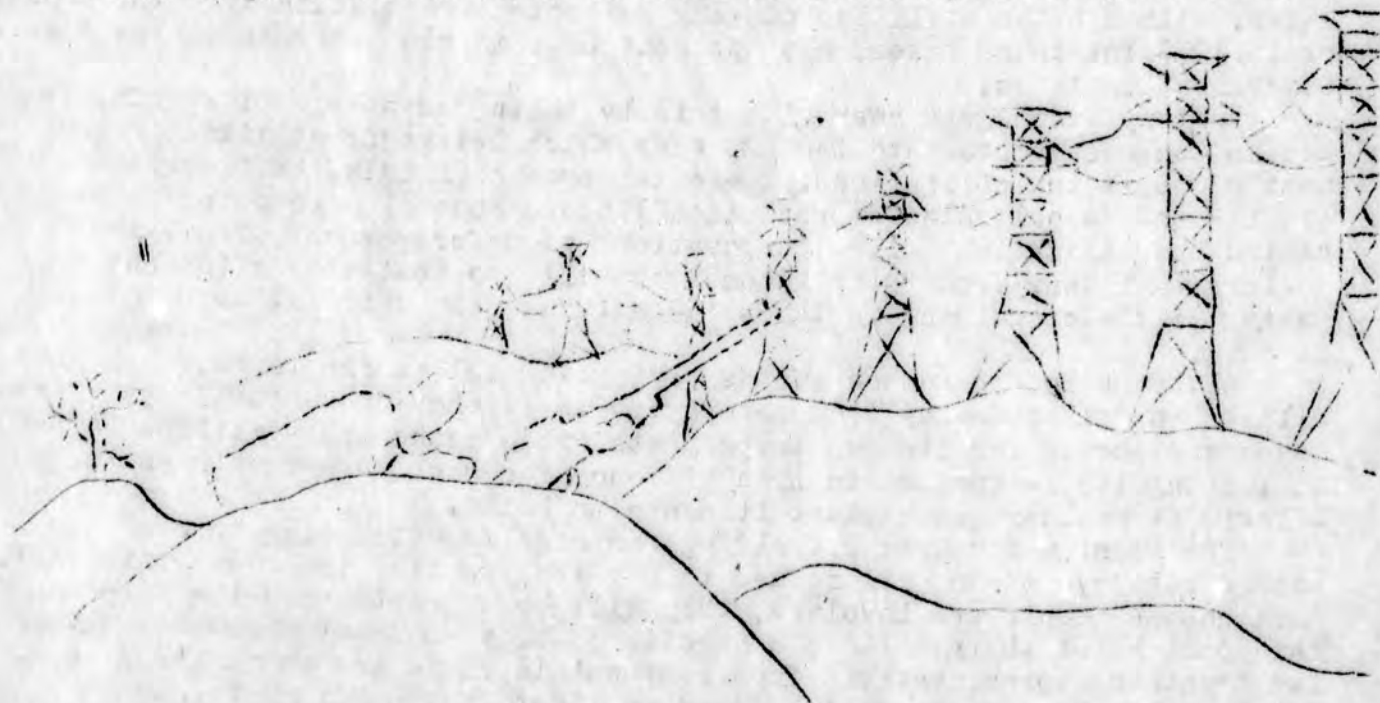
But then comes the new but familiar twist; MP&L announces that it's been investigating an alternative site in North Dakota for almost a year now. And according to company spokesman Warren Hudelson, "The indications are rather promising."

The Tribune article goes on to say that, "Worsening economic conditions in the taconite and wood product industries have reduced the need for the new plant." And that, "Wood processors and the taconite industry account for the bulk of electricity used in the MP&L area."

They even have MP&L President Jack Rowe telling his New York "stock and security analysts" that he expects the company's growth rate to drop from 15% to 1% annually in 1980. But after 1980, well then everything's going to pick up in growth and demand, according to Rowe.

Rowe is quoted in the Tribune as saying, "We see this as a breather and (it) lets us concentrate on distribution systems and allows us to get ready for the next growth period."

And what about these distribution systems commonly known as power-lines? Well, MP&L has that all figured out too. See there's an existing line in North Dakota so all they'll have to do is "upgrade it". According to the Tribune, "which might spare the company a long fight similar to the dispute in Central Minnesota." People of North Dakota, beware of an out-of-state corporation who wants to build an unneeded plant in your back yard!



The Public Service Commission (PSC) last December approved Union Electric's (UE) proposed 345 kilovolt (kV) transmission line from the Callaway nuclear plant to a substation in Bland, Missouri. However, since controversy surrounds the health effects of kV lines, the PSC has commissioned the University of Missouri Rolla Electrical Engineering Department to do a \$5,000 study on the electrical fields around kV lines and the subsequent health risks.

The Missouri study on the 345 kV lines will begin in late January or early February and will be paid for by Union Electric. Relatively little research has been done on the health effects to humans posed by the electromagnetic radiation from kV lines, especially long term effects. So the final verdict is still out. However, studies by Biophysicists Andrew Marino and Robert Becker, and others, suggest heart disease and strokes, stunted growth and cataracts may result from exposure. An additional concern stems from the use of highly toxic herbicides by utilities along transmission line right-of-ways. (A UE subcontractor employed unsupervised teenagers below the legal age to apply herbicides containing dioxin along 345 kV right-of-ways in Montgomery County.)

The New York Public Service Commission (NYPSC) acknowledges that "765 kV lines will probably cause biological effects in humans exposed to them on a chronic basis" and has set limits on the proximity of 345 kV and 765 kV lines to residential areas. In addition, the NYPSC has enlisted the help of the N.Y. Health Department to do a \$5 million study of the health hazards posed by high voltage lines.

SAFE ENERGY NEWS, JAN.-FEB. 1980

Mobilization for Survival has agreed to sponsor and form a task force to promote the Phantom Tax Rate Withholding Campaign. This campaign is a ratepayers movement against the tax breaks and the rate structure of the Boston Edison Company.

When the ratepayers receive their electric bills each month, almost 10% of it is charged by Boston Edison for Federal Income Taxes on the profit it makes. Although the utilities company collected \$26 million from the consumer in 1977 for these taxes, not one cent of this sum was paid to the Federal Government in taxes.

Boston Edison gets away with this by taking advantage of special tax breaks Congress wrote into the IRS code which let major utilities circumvent most of their tax obligations. These tax breaks (mainly the "investment tax credit" and "accelerated depreciation") and a special accounting method called "normalization" allow corporations to defer payment of millions of dollars each year from their income tax bill, so that they often end up paying little or nothing in taxes (even though the official corporate tax is 48%).

Although Boston Edison avoids paying federal income taxes, they are allowed to collect money from ratepayers as if they had actually paid these taxes and use it for its own investments. This means the utilities company is forcing its ratepayers to loan it money for such investments as the Pilgrim II nuclear power plant it wants to build.

The Phantom Tax Rate Withholding Campaign is attempting to organize enough ratepayers who will refuse to pay that part of their electric bill. When enough people are involved, they will be asked to send the "phantom tax" portion of their bill to a special "escrow" account that will have as its trustees representatives from responsible civic and community groups. Interest on the account will be used to fight Boston Edison through public education, DPU hearings and court actions. This campaign is an opportunity for citizens to express their dissatisfaction with the collusion between the government and the utilities companies in a tangible way. If you are interested in this campaign call the Mobilization for Survival office.

BOSTON MOBILIZER, DEC./JAN. 1980

The first federal review of the health effects of ultra-high-voltage powerlines may be in the offing, the result of the long struggle of Floyd County, Virginia residents to keep an Appalachian Power Co. (APCO) line from crossing their land. (7)

Now that Citizens for the Preservation of Floyd County (CPFC) has convinced the National Park Service to do an impact assessment on a proposed 765-kilovolt APCO line slated to cross the Blue Ridge Parkway, there is reportedly a "90-percent chance" that a full environmental impact statement will follow, delaying the project several years.

CPFC organizer Bill Blatter also says the impact assessment, by a University of Tennessee team headed by zoologist Arthur Echternacht, represents "the first time the federal government has ever addressed the health and safety issues of UHV lines."

With the Energy Department and the Electric Power Research Institute racing to popularize their own positions on UHV health impacts, Blatter suggests powerline opponents may want to comment on the draft statement.

Entitled "Draft Assessment of Alternatives Concerning the APCO 765-KV Transmission Line," it will soon be available from Gary Everhardt, Superintendent, The Blue Ridge Parkway, 700 Northwestern Bank Building, Asheville, North Carolina 28301.

POWERLINE, FEBRUARY 1980

The U.S. Department of Transportation has just issued a long-awaited proposed rule regulating the transportation of radioactive materials by highway in the United States. The proposed rule, "Highway Routing of Radioactive Materials", appeared in the Federal Register on January 31, 1980. We are alerting you to this rule-making because your town, county, or state is among the many which have prohibited or restricted nuclear shipments through local legislation or resolutions.

The proposed rule, if finalized, would pre-empt all state and local laws which ban radioactive shipments between any two points served by highways. States and communities would be allowed to suggest "preferred" routes; however, these suggestions could be ignored in the route-setting process if they are ruled "impracticable". The proposed rule specifically denies citizens and local officials any veto over the shipment of nuclear materials through their towns and counties.

The period for the public to comment on the proposed rule lasts until May 31, 1980. We hope that as many people as possible will make comments to the Department of Transportation. In particular, we are urging citizens to demand public hearings on the proposed rule in their state or region, with a reasonable time allowed for preparation. The DOT is presently planning to hold public hearings in just three locations - which have not yet been announced - within the next three months. Obviously, few communities will be able to send representatives to distant cities to attend the hearings. Write to the DOT and demand hearings in your area. Urge your local officials to do the same. All communities are potentially affected by the proposed rule and everyone should have the opportunity to comment. Written comments should be addressed to: Dockets Branch, Materials Transportation Bureau, U.S. Department of Transportation, Washington D.C. 20590.

NUCLEAR INFORMATION & RESOURCE SERVICE, FEB. 1980

Eleven Burns security guards at the Trojan Nuclear Power Plant in Oregon were arrested in early November of 1979 on drug charges stemming from the sale and furnishing of cocaine, amphetamines, marijuana, and LSD.

IT'S ABOUT TIMES, FEBRUARY 1980

* * *
Speaking of security guards, seems there's a new outfit at the plant in North Dakota which has a very funny name! So if you call up there and they say, "Hello this is BISMAN", say "What man is that?"
* * *

LETTERS

Dear Friends,

Enclosed is a check to cover our newsletter subscription, and the rest to be used where you think best. Keep up the good work!

Farwell, Minn

To whomever it may concern,

I am very interested in your cause. Although I live far from your state, this should effect and concern all "human beings". Please send me some more information on your group, your plans for the future, and how I could help.

Brookline, Mass

Dear Gaspers,

Enclosed find \$10. We appreciate the coverage that Hold That Line gave to our struggle with expressway 60, several months ago.

We enjoy reading Hold That Line and encourage you to keep up the good work in your struggle against big power and big business.

Butterfield, Minn

Dear Friends,

Please send me a copy of Hold That Line and whatever other good stuff the 5 bucks will buy. Yours in struggle.

Nashville, Tenn

Dear Sirs,

I would like information on how I can receive your newsletter and other information on the powerline. Any help you could give me would be greatly appreciated. Thank you.

St. Peter, Minn

Dear Folks,

Thank you for your part in the fight against those individuals and corporations who seek to gain a private profit at the public's expense. The companies who have temporarily put their powerlines across your land and seek to force their deadly centralized energy program on all of us are motivated only by greed. Let's not let them get away with it. Here's \$20 to help you keep up the fight.

Please send a subscription of Hold That Line to my home address in Connecticut so that my family and friends out there can become aware of what is happening here. Thanks.

Alexandria, Minn

Dear Hold That Line,

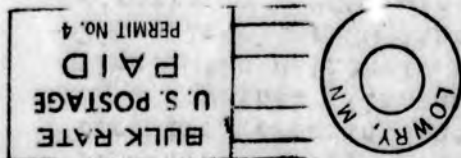
I would appreciate any information concerning the powerline that was constructed in Minnesota, as I am now doing research on a proposed powerline that may run through our valley, The North Fork Valley of Paonia. I would appreciate information concerning matters dealing with construction to health effects. Thank you very much.

Paonia, Colo

Dear Editor,

I am currently doing research on the environmental effects of high voltage transmission lines. I am very interested in the opinions of people living near and effected by the UPA-CPA transmission lines and would like to receive "Hold That Line". I have several back issues but can't find a subscription price, Is \$5 sufficient? I look forward to hearing from you.

Los Angeles, Cal



*MARK WITLOW
HOUSE POWER ALTERNATIVES
POUCH V
DANIELA, ALASKA 99811*

*HOLD THAT LINE
LOWRY TOWN HALL
LOWRY, MN. 56349*

State Involvement in Power Project Financing

Sources of Funds
Direct Appropriations →

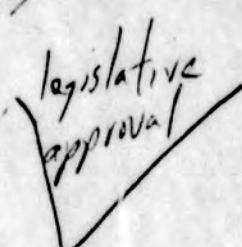
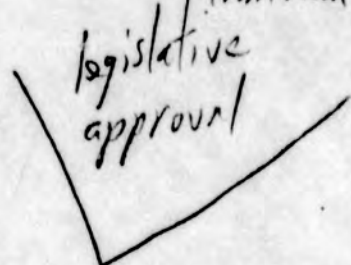
APA

↓
 op. budget → \$504^k total, \$294^k contractual for Susitna, Cordova
 also Petersburg \$10^k
 capital budget → vehicle this year for APRRF
 APRRF (probs) → \$3m all for loans up to APRRF*
 *doing bulk approp. like this doesn't
 provide for legis approval for projects going
 from recon to serv. + design

Commerce Div. of Business Loans
 WRRRF one shot deal for 3
 specific projects

APRRF open all year, no appies,
 Gov. could have prepurch.

Small Business for private + coops



first legis. approval requires financing
 plan - look at APRRF for K budget for a
 project. Is this enough should include
 1) how much spent for what by who up to now
 2) what is asked for now
 3) what are future + contingent liabilities
 4) when gets paid back, at what rate

Procedures

project concept → reconnaissance → feasibility (FERC) → construction → operation

↓
 locality
 engineering firms
 Feds - Corps, APA admin.
 state

↓
 APA

↓
 APA

← pay back loans from
 bond proceeds

↓
 APRR or
 utility or
 locality

← pay back rev. bonds

↓
 APRR or
 utility or
 locality

Key Functions

Ec. Dev.

| | | | | |
|-------------------------------|---------------------|--------------------------------|----------------|--------------------------------|
| Research Technical Assistance | Pilot Demonstration | Commercialization Financing | private sector | other assistance - maintenance |
| Ec. Ent. ARRC | " | ARRC; loan progs.; pri. sector | | Ec. Ent. |

Power Dev.

| | | | |
|--------------------|------------------------------------|----------------|---------------------|
| planning | R+D pilot demonstration | Feas. + Reson. | Fin. + Construction |
| Feds ISER E+PD APA | E+PD ARRC | APA | APA |

DOT PF

Economic Planning + Analysis

Ec. ent vs. DDDP
300 money etc.

DOT

| | | | | |
|--------------|----------------|------------------|----------|-------------------|
| Conservation | Rationing etc. | non-Fed Outreach | Fed. R+D | Power Development |
| | | E+PD | ? E+PD | ? E+PD |

of clearing houses for information too many?

Q. Where should demand estimation and planning take place?

A. → E+PD, Reorganized Div. of Energy + Development, DDDP, ARRC, etc.

WHAT IS NEEDED: load projections, planned additions; look at resources + alternatives select best approach thru hard path, soft path framework, communicate with utilities + state agencies

PLS For each community and/or project identification of state aid anticipated from who and when - plan should get state on notice for its role.