

ALASKA LEGISLATURE COMMITTEE FILES 1987-1988 86/2

4559 HHS HB 388 - HB 390

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Coalition for Alternatives in Nutrition and Healthcare (CANA H)

P.O. Box B-12
Richlandtown, PA 18955

Compilation of Bioassay Data (Cont'd.)

Page 8

Foc : Product of Plant Origin

reduced biological value
reduced fertility
reduction of life span
teratogen effect
cytotoxic effect in animal cells
carcinogen effect
mutagen effect on animals

Fructose

inhibited growth of plants or plant tissues
decreased gain in plant tissue weight
cytotoxic effect in animal cells
inhibited growth of normal animal cells
inhibition of microbial growth
impaired respiration and oxidative phosphorylation
inhibition of the labelling of protein and DNA by radioactive precursors

Gelatine

reduced nutritive value
reduced growth rate
cytotoxic effect

Glycine

increased chlorophyll mutant rate

Glucose

leucopenia
lymphopenia
disorder of haematopoiesis
decreased gain in plant tissue weight
lower number of emerging insect
longer duration of larval development
increased chromosome aberrations in animal cells
increased chromosome aberration in plant cells
inhibited growth of rhizoma tissue
inhibited growth
inhibition of microbial growth

Glucose (Cont'd.)

impaired respiration and oxidative phosphorylation
inhibition of the labelling of protein and DNA by radioactive precursors
inhibited reproduction of microorganisms
cytotoxic effect in animal cells
inhibited growth of normal animal cells
antibacteric (bactericide, bacteriostatic) effect

reduced rate of respiration
cytogenetic abnormalities
increased rate of chlorophyll mutants
increased dominant lethality in *Drosophila*
Increased sex linked lethal mutation in *Drosophila*
increased autosomal recessive lethal mutation in *Drosophila*
increased forms of phenotypic alteration in *Drosophila*
Mutagen effect by HMA
mutagen by in vitro microbial test

Gluten

reduced protein value
reduced growth rate
reduced number of eggs laid
reduced hatchability of eggs

Grape

inhibited physiological activity of *Saccharomyces*

Green Bean

reduced intensity of growth
increased spleen weight
fertility disorder

Ham

retarded growth
reduction of weight
reduced weight gain
reduced number of pups per litter
reduced RBC
reduction of life span

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Herring (marinated)

extended chronaxy time
increased excitability of CNS

Histidine

inhibited growth of microorganisms

Indian Mackerel Fish

(*Rastrelliger kanagurta*)

anaemia

Jelly Powder

reduced growth

Lima Bean

reduced biological value

Lipid

reduced digestibility

Macaroni

worse acceptance

Marinades

hypothermia of central origin
extended chronaxy time

Meat (culinary, preprepared, etc.)

reduced fertility
disturbance in metabolism of fat
and vitamins
change in allergen
vitamin E deficiency
vitamin B₂ deficiency
internal bleeding
increased mortality of progeny
haemorrhagic syndrome
inhibited growth of microorganisms
late effect on microorganisms

Meat (organs)

reduced body weight of youngs

Meat Product (culinary)

vitamin B₁ deficiency
vitamin B₂ deficiency

Medium

inhibited growth of seeds
inhibited growth of root tip per
meristem
inhibited growth of insect
inhibited growth of plant or plants
tissue
supression of root hair formation
lower number of emergin insects
reduced emergence rate of adults insect
increased chromosome aberration in animal
cells
increased chromosome aberration in plant
cells
increased chromosome aberration in
microorganisms
increased chromosome aberration in
Drosophila
increased mutation of *Drosophila*
increased number of polyploid animal cell:
chromatid aberrations in plants
cytotoxic
cytotoxic effect in animal cells
cytotoxic effect in plant
cytotoxic effect in *Drosophila*
antimitotic effect (retardation or
inhibition of mitosis) in animal cells
antimitotic effect
micronucleus formations
inhibited growth of normal animal cells
inhibited growth of microorganisms
inhibited RNA synthesis capacity of
fibroblast
inhibited DNA synthesis in bacerria
reduced DNA synthesis
antibacteric (bactericide, bacteriostatic)
effect
reduced number of microbe colony
reduced number of viable microbes
reduced physiological activity of microor-
ganisms
mutagen effect on microorganisms
increased mutations in plant tissue

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Compilation of Bioassay Data (Cont'd.)

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Medium (Cont'd.)

increased mutation in *Drosophila*
increased sex-linked lethal mutation
test in *Drosophila*
increased aberrant forms and phenotypic
alteration in *Drosophila*
mutagen effect on animals

Milk (evaporated, powdered, whole)

reduced biological value
worse acceptance
reduced body weight
loss of body weight
changed anaphylactogenic activity
increased lethal shocking dose to
allergenic response
reduced allergenic properties
reduced antigen-allergen activity
increased mortality
antibacterial (bactericide, bacterio-
static) effect

Mushroom

reduced food efficiency
reduced food consumption
reduced weight gain
reduced weight of liver in male
reduced weight of pituitary
reduced weight of uterus
reduced weight of kidney
disturbance in reproduction
(unreadable) of toxic substances,
radiotoxins
toxic
increased prenatal mortality
inhibition of growth of microorganisms

Oil

reduced reproductive capacity
disturbance in breeding performance
reduced sexual function in females
increased mortality of progeny

Oil (animal)

Fish oil

reduced food efficiency
reduced protein utilization
retarded growth
reduction of weight
reduced weight gain
positive BSP
disturbances in absorption
reduced total protein content
hypoproteinaemia
higher globulin gamma fraction value
increased mortality
pigmentation of liver
pigmentation of spleen

Herring oil

reduced food consumption
reduced growth
less rate of oxidative drug meta-
bolism in the endoplasmic retic
greater induction of the oxidation
metabolism of drugs
reduced rate of oxidative demethylati
of aminopyrine
increased oxidative demethylation of
aminopyrine
reduced hydroxylation of aniline
lower hydroxylation of biphenyls
reduced rate of metabolism of benzpyr
decreased peroxide concentration of
endoplasmic retic
inhibited rate of lipid peroxidation
high lipid peroxidation
greatly increased resistance to pero-
xidation
increased antioxidant titer
changes in fatty acid composition of
endoplasmic retic. of liver

Oil (plant)

Cereal oil

incidence of encephalomalacia

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Oil (plant - cont'd.)

Corn oil

reduced digestibility
reduced food consumption
reduced growth
increased liver weight
increased fat content in liver
changes in fatty acid composition
of endoplasmic retic. of liver
less rate of oxidative drug metabolism
in the endoplasmic retic.
reduced rate of oxidative demethylation
of aminopyrine
reduced hydroxylation of aniline
reduced rate of metabolism of benzpyrene
greater induction of the oxidation
metabolism of drugs
decreased peroxide content ration of
endoplasmic retic.
inhibited rate of lipid peroxidation

Cotton seed oil

reduced growth
lymphocyte infiltration

Soyabean oil

reduced utilization of metabolizable
energy
reduced digestibility
reduced food efficiency
reduced protein utilization
reduced food consumption
disturbances in absorption
decreased or disturbed fat absorption
reduced growth
retarded growth
reduced body weight
reduction of weight
reduced weight gain
increased liver weight
more fragile RBC
hypoproteinaemia
reduced serum protein content
increased serum gamma globulin level
reduced serum lipid content
reduced serum phospholipid content
increased serum cholesterol level
bradycardia

Oil (plant - cont'd.)

Soyabean oil (cont'd.)

functional disorder of the liver
positive BSP
reduced thyroid function
toxic effect
decreased body temperature
reduced oxygen uptake
hypothermia of central origin
diarrhoea
incidence of encephalomalacia
reduced excitability of CNS
reduced life span
increased mortality
thyroid degeneration
dilatation of small intestine, liver
pigmentation in liver
pigmentation in spleen
testicular atrophy
progressive transformation of adrenal
cortex

Oil (Wisson-oil)

increased frequency of lymphoblaston:
in liver, thymus, lung, spleen,
kidney

Onion

increased spleen weight
increased testicle weight
increased liver weight
reduced ovary weight
reduced gonads weight
reduced RBC
reduced WBC
leucopenia
reduced haematocrit value
fused rib cartilages
more frequent skeletal abnormality
higher incidence in abnormalities
of trunk skeleton
myeloid and RES hyperplasia
leucocytosis in liver
haemosyderosis
pigmentation in liver
pigmentation in spleen
pigmentation in kidney

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Onion (Cont'd.)

osteodystrophia
deformation of testicles
degeneration of ovary

Orange

reduced growth rate
haemosyderosis
mucinous cerebral degeneration
inhibited growth of seeds
increased chromosome aberration
in plant cells
cytotoxic effects in plant
radiomimetic effect in plants
reduced medullar hyperplasia of
adrenal

Orange Juice

antimitotic effects (retardation or
inhibition of mitosis) in plant
cells

Papaya

increased liver weight
aspermia
detrimental effect on offspring
aplasia of small intestine

Parsley

formation of toxic substances, radio-
toxins

Peach

reduced growth
loss of body weight
reduced weight gain
reduced viability of offspring
toxic effect
more frequent tumour incidence

Peanut

increased frequency of lymphoblastoma
in liver, thymus, lung, spleen, kidney

Peas

reduced biological value

Pepton in medium

cytotoxic effect

Pineapple

Jam

increased haemoglobin content
increased haematocrit value
incidence of primary lymphocytic
thyroiditis
reduced fructose oxidation in heart
glycosuria

Juice

increased chromosome aberration in
plant cells
cytotoxic effect in plant
radiomimetic effect in plant
depressed rate of mitosis
increased mutations in plant tissue

Plant

allergen reaction
formation of toxic substances, radio-
toxins
increased chromosome aberration in
plant cell
cytotoxic effects in plant
antimitotic effects (retardation or
inhibition of mitosis) in animal
cells
micronucleus formations
inhibited reproduction of microorganisms
increased mutations in plant tissue

Plant Extracts (leaves, Vicia faba)

reduced growth
inhibited growth of seeds
inhibited development of seeds
inhibited growth of root
inhibited growth of plants on plants
tissue

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Plant Extracts (Cont'd.)

increased chromosome aberration in
plant cells
cytotoxic effects in plant
antimitotic effects (retardation on
inhibition of mitosis) in
animal cells
antimitotic effects (retardation on
inhibition of mitosis) in
plant cells
micronucleus formations
inhibited growth of normal animal cells
inhibited growth of malignant tissue
inhibited growth of microorganisms
reduced germ cell survival
inhibited DNA synthesis of plant
inhibited reproduction of micro-
organisms
reduced number of microbe colony
mutagen effect on microorganisms
increased mutations in plant tissue

Pork (corned)

worse acceptance
decreased or disturbed fat absorption
reduced growth rate
retarded growth
reduction of weight
reduced weight gain
reduced weight of offspring
reduced weight of pups at weaning
conceptual difficulties
reduced number of progeny
reduced number of pups per litter
reduced number of young at weaning
increased phagocytosis due to antigen
effect
reduced auto-oxidation rate
reduced fatty acid oxidation in
kidney mitochondria
increased cytochromoxidase activity
in liver
increased cytochromoxidase activity
in kidney
increased cytochromoxidase activity
in heart
reduced transketolase activity in
erythrocytes

Pork (Cont'd.)

increased cytochromoxidase activity
in tissues
vitamin B₆ deficiency
increased mortality
increased postnatal mortality
increased mortality of progeny
haemorrhagic syndrome
myocardial lesion
thyroid gland cancer
increased ATP-ase activity in tissues

Potato (white, cooked, raw)

reduced net energy
reduced biological value
reduced food consumption
reduced growth
retarded growth
reduction of weight
reduced weight gain
reduced weight of liver in females
affected ovary weight
reduced weight of ovary
reduced relative weight of spleen
reduction relative weight of lung
lowered weight of progeny
reduced weight of offspring
delayed opening of eyes
delayed opening of ear
delayed appearance of pelage
delayed coming out of teeth
reduced fertility
conceptual difficulties
increased resorption
altered measure of ovarium
extension of gestation period
reduced litter size
reduced number of progeny
influenced tolerance of galactose
loading
toxic effect
more frequent diseases
more frequent respiratory diseases
more frequent incidence of cataract
increased embryonal resorption
increased embryo mortality
increased perinatal mortality
increased mortality of progeny

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Potato (Cont'd.)

focal myocarditis
coronary arteriosclerosis
more frequent abscesses pneumonia
bronchiectasia
intestinal nephritis
lesion in spleen, liver and lymph nodes
testicle laesion
more frequent tumour incidence
spleen oedema
reduced fecundity of insect females
increased chromosome aberration in
animal cells
cytotoxic effect in animal cells
micronucleus formations
inhibited growth of microorganisms
mutagen effect by DLT
increased mutagen index

Potato Extract

loss of body weight
injured spermatozoon, early spermatid,
developing spermatocytes
increased postimplantation loss
reduced WBC
allergen reaction
formation of toxic substances,
radiotoxins
toxic effect
inhibited growth of seeds
inhibited development of seeds
increased chromosome aberration in
animal cells
increased chromosome aberration in
plant cells
cytotoxic effect in animal cells
antimitotic effect (retardation on
inhibition of mitosis) in
animal cells
antimitotic effects (retardation on
inhibition of mitosis) in
plant cells
micronucleus formations
inhibited growth of malignant tissue
inhibited growth of microorganisms
antibacteric (bactericide, bacteriostatic)
effect

Potato Extract (Cont'd.)

mutagen effect on microorganisms
mutagen effect by DLT
mutagen effect on animal

Potato in medium

inhibited growth of seeds
inhibited growth of root tip
increased chromosome aberration in plant
cells
antimitotic effects (retardation on
inhibition of mitosis) in
plant cells
micronucleus formations

Protein

reduced biological value

Protein (animal)

Milk protein
reduced biological value
change in antigenicity
increasing lethal shocking dose
in gross anaphylaxis
slight diarrhoea
Corn protein
reduced protein digestibility

Raisin

reduced food efficiency
reduced growth rate
retarded growth
reduction of weight
reduced weight gain

Red Fish (Ocean Perch) (Sebastes marinus)

increased weight of spleen
lower serum cholesterol level
longer sleeping time from hexobarbital
elevated SAP
inhibited liver microsomal enzyme
activity
decreased liver aminopyrine N-demethyl-
ating and aniline-hydroxy-
lating activity

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Ribose

inhibition of microbial growth
reduced rate of respiration
mutagen by *in vitro* microbial test
impaired respiration and oxidative phosphorylation
inhibition of the labelling of protein and DNA by radioactive precursors

Rice (polished too)

worse acceptance
reduced growth
increased neonatal mortality
increased perinatal mortality
lower free amino acid content in liver

Sausage

worse acceptance

Shrimp

worse acceptance
functional disorder of the thyroid

Soy Bean

extended chronaxy time

Spice Mixture

(allspice, black pepper, coriander, cumin, marjoram, nutmeg, paprika)

reduced growth rate
slightly reduced body weight
reduced weight gain
reduced liver GOT activity
reduced liver GPT activity
reduced depot fat

Starch

reduced digestibility
cytotoxic effect
reduced water intake
reduced body weight
reduced thymus weight in females
reduced kidney weight in male
increased WBC
reduced RBC

Starch (Cont'd.)

reduced haematocrit value
changed blood glucose level
increased BUN
reduced BUN
changed serum Na⁺ level
reduced serum P level
reduced SGOT
reduced SAP
increased male mortality
increased postnatal mortality
hyperplasia of stomach mucosa
changes in renal tubules
incidence of kidney cyst
cytotoxic
altered generating time of *S. cerevisia*

Sterol (beef, egg, pork, yeast)

hepatoma

Strawberry

reduced food consumption
worse acceptance
reduced growth
retarded growth
reduction of weight
reduced weight gain
increased weight of testicles
increased pituitary gland weight
reduced prostate weight
increased rel. thyroid weight
increased rel. adrenal weight
increased rel. kidney weight
reduced liver weight in female
reduced liver weight in male
reduced heart weight in female
reduced spleen weight in female
reduced weight of offspring
first hatch chickens of F₁ performed poorly
greater incidence of head abnormalities in semen
decline in RBC
decline in haemoglobin content
periodical drop in egg production
increased mortality
increased embryo mortality

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Strawberry (Cont'd.)

increased mortality of progeny
incidence of liver fatty infiltration
increase in kidney concretions
incidence of cystic kidney
incidence of chronic nephritis
more frequent tumour incidence
trend to higher incidence of tumours
chromatid aberrations in animals
increased aberrant anaphase in plant cells

Sucrose (saccharose)

growth inhibition
inhibited lipid synthesis
inhibited protein synthesis
inhibited DNA synthesis
inhibited liver mitochondrial oxidative phosphorylation
improved oxidative phosphorylation in liver mitochondria
inhibited growth of seeds
inhibited growth of root tip per meristem
inhibited growth of plants tissue per cell
decreased gain in plant tissue weight
increased chromosome aberration in animal cells
increased chromosome aberration in plant cells
chromatid aberrations in animals
chromatid aberrations in plants
increased meiotic chromosome aberration
increased aberrant anaphase in plant cells
cytotoxic effect in animal cells
antimitotic effects (retardation or inhibition of mitosis) in animal cells
aberrant mitosis in animal cells
impaired respiration and oxidative phosphorylation
inhibition of the labelling of protein and DNA by radioactive precursors
inhibited growth of normal animals cells per tissue
inhibited growth of malignant tissue
inhibited growth of microorganisms
inhibited growth of pollen
reduced rate of respiration

Sucrose (Cont'd.)

increased mutations in plant tissue
increased mutation in *Drosophila*
increased dominant lethality in *Drosophila*
increased sex linked lethal mutation in *Drosophila*
increased autosomal recessive lethal mutation in *Drosophila*
increased aberrant forms of phenotypic alteration in *Drosophila*
mutagen by *in vitro* microbial test

Sugar

chromosome aberrations
cytotoxic effect
mutagen by *in vitro* microbial test

Sweet Cherry Juice

antibacteric (bactericide, bacteriostatic) effect

Thiamin in medium

cytotoxic effects in plant

Tomato

permeability changes in tissue hemomembrane of different organs

Tuna fish (Thunnus thynnus)

conceptual difficulties
reduced number of pups per litter
increased mortality of progeny

Turkey

reduced growth
reduced weight gain

Vitamin Solution

increased mortality

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Wheat

reduced protein value
loss of body weight
increased liver weight
changed female liver weight
increased testicle weight
increased spleen weight
affected spleen weight
decreased spleen weight
changed male spleen weight
reduced reproduction of insect
reduced spermium number
reduced primary spermatocyte
affected spermatogonia
reduced spermatogonial A & B cells
reduced fertility
longer reproductive cycle
reduced germ cell count in testis
reduced RBC
decreased reticulocyte number
reduced number of neutrophilic
leucocytes
changed serum albumin level
raised blood glucose
changed serum Ca level
formation of toxic substances, radio-
toxins
lower serum inorganic phosphatase
level
lower survival
increased mortality of progeny
pathological alteration in female liver
incidence of oedema in liver of females
periacinar infiltration in liver
tendency of steatosis
more frequent epithelioma
more frequent tumour incidence
more frequent incidence of lymphosarcoma
increased embryonal death
increased chromosome aberration in
animal cells
more frequent incidence of polyploida
at weaning
increased number of polyploida
in animal cells
increased meiotic chromosome aberration
increased number of aneuploid cells
in tests

Wheat (Cont'd.)

aneuploidia
aberrations in chromatids and centrome:
cytotoxic in animal cells
reduced germ cell survival
reduced viability of insect
mutagen by DLT
increased mutagenic index
increased chlorophyll mutants rate

Wheat Extract

increased incidence of chromosome
abberation
inhibition of seed germination
mutagen effect

Wheat Flour (biscuit)

reduction of weight
reduced weight gain
increased weight of spleen
reduced prepubertal growth
fertility disorder
reduced litter number at weaning
reduced number of pups reared
reduction of life span
more frequent cannibalism
more frequent tumour incidence
more frequent mummary adenoma
increased number of non viable progeny
increased mortality of progeny
increased stillbirths
increased meiotic chromosome abberation
in animal cells
increased cytogenetic abnormalities

Wheat Middling

reduced growth rate
reduced number of eggs laid
reduced hatchability of eggs

Wheat Product

increased number of polyploid animal cel

Xylose in medium

decreased gain in plant tissue weight

Yeast (dried)

inhibited growth of microorganisms

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Compilation of Bioassay Data

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"Storage time following irradiation can also alter the results of animal feeding studies or cytotoxicity, mutagenicity tests in a way that changes disappear during storage or decrease gradually with it. In some cases detrimental results of feeding studies may be attributed to poor quality or improper preparation of food prior to irradiation or to inadequate storage conditions after irradiation. Adverse effects could be considerably reduced when irradiation was carried out in a nitrogen atmosphere or under buffered conditions at neutral pH."

"Often vitamin deficiencies were involved in the disorders, since supplementation of vitamins reduced or eliminated the adverse symptoms (growth retardation, fertility disturbances, increased mortality, etc.) of deficiencies. It is worth noting that supplementation of vitamin E did not necessarily reduce or eliminate the disorders in reproduction. Supplementation of other components of diets have also been observed to correct adverse effects in the parameters investigated. Thus addition of antioxidants reduced mortality and increased growth rate. Adverse effects in feeding studies have been eliminated by correcting amino acid imbalance."

"Among the biotechnical factors, adverse effects ascribed to ingestion of irradiated food may be derived from the test organisms used. Thus pathological effects observed during feeding test with irradiated food occurred spontaneously in animals fed on similar but non irradiated diet."

"The author is deeply indebted to the staff of the Biology Department of the Central Food Research Institute, Budapest, for their valuable technical assistance; he wishes also to thank Prof. K. Vas for his interest and help in this work."

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A Short History of Trouble Irradiation Hall Of Shame

The industrial irradiation industry is relatively new. Created in the mid 1970's to sterilize medical supplies and packaging materials, this young industry has had a troublesome safety record. Problems have included radioactive leaks, spills, worker overexposures, failed or bypassed safety systems and failure to report to the Nuclear Regulatory Commission. The state of New Jersey hosts many of these problem plants. What follows is a summary of the 13 most significant incidents which have occurred in the last 12 years.

JUNE 16, 1974 Chief of radiation operations at the Isomedix irradiation plant in Parsippany, N.J. received an estimated 400 rem radiation dose, when he failed to take proper safety precautions. William McKim barely survived the one or two second overexposure to 147,000 curries of cobalt-60. Mr. McKim was in critical condition for one month before recovering.

1976-1980 In 1976 a double encapsulated cobalt-60 source was found leaking at the Isomedix irradiation plant in Parsippany, N.J. Following ion-exchange filtration, the source pool water was dumped down the plant's toilet. An extensive cleanup program followed which involved jackhammering concrete from the walls and floor of the source pool. During cleanup operation, Chem Nuclear Corp. found the toilet and toilet pipe to be radioactive. Eventually, the toilet, tools, and parts of the source pool were shipped to a radioactive burial ground.



MARCH 14, 1977 The Nuclear Regulatory Commission fines Radiation Technology Inc. (RTI) \$4050.00 following an October 1976 inspection which identified 10 violations of RTI's license. Violations included, failure to report a leaking cobalt-60 source, failure to adequately evaluate radiation doses to workers, disposing of radioactive material as normal trash and failure to provide required training to employees.

SEPTEMBER 23, 1977 An employee at the Radiation Technology Inc. (RTI) plant in Rockaway, N.J. entered the radiation cell for 10-20 seconds and received a whole body dose between 150-300 rems. The direct cause of the overexposure was a decision by RTI management to operate the facility with the safety interlock system inoperative.

SEPTEMBER 2, 1982 A service technician at the irradiation plant at the Institute for Energy Technology Norway, was exposed briefly to the 650,000 curie cobalt-60 source. The plant worker received an estimated dose of 1,000 rems, and died on September 15, 1982 from radiation injury.

JUNE 11, 1986 Radiation Technology Inc., cited in 1982 as a source of groundwater pollution, was ordered by the State of New Jersey to pay a \$600,000 directive to study the problem. Volatile organics such as trichloroethylene, methylene chloride, and trichloroethane were found in test wells drilled on RTI's 15 acre site in Rockaway, N.J. The toxic products were stored in 100 bulging, rusty, leaky 55 gallon drums on the company's property.

JUNE 24, 1986 A federal grand jury indicts Eugene T. O'Sullivan, San Jose, Calif., and Bruce J. Thomas of Somerville, N.J., both employees of International Nutronics Inc. (INI) of Palo Alto, Calif. INI and the two employees are charged with conspiracy, mail fraud, wire fraud, and concealing a radiation spill from the Nuclear Regulatory Commission (NRC). In 1982, INI found a leaking cobalt-60 source in their source pool. A cleanup was begun which involved pumping the radioactive water through filters. During the filter operations, which were left running unattended overnight, a discharge line became detached, spilling radioactive water onto the floor of the plant. INI employees were then instructed to dump the water down bathroom drains and into the public sewer system. INI then delayed an NRC inspection and attempted to hide radiation contamination from inspectors. (see detailed article in this issue)

JUNE 24, 1986 The Nuclear Regulatory Commission (NRC) revokes operating licenses for Radiation Technology Inc. (RTI) at their Rockaway, N.J. facilities. The license suspension comes after an NRC investigation into charges that RTI lied and deceived the NRC in regards to a March 3, 1986 shutdown. The March shutdown came after the NRC found RTI had bypassed safety equipment during plant operations, a repeated RTI failure, identical to the failure which led to the worker overexposure in Sept. 1977. The NRC has turned this case over to the N.J. Justice Dept. for consideration.

SCIENCE BOX

COBALT-60 is a radioactive isotope of the metal cobalt. It is created by bombarding nonradioactive cobalt rods in a nuclear power reactor. Cobalt-60 gives off gamma rays and beta particles as it decays.

REMS are an arbitrary measure of radiation effects on living tissue. Like degrees or pounds, the number of rems increase as exposure to radiation increases. One chest X-ray, given to a 150 pound adult gives a dose of 5/100ths of one rem.

LIST OF THE 40 IRRADIATION FACILITIES IN THE U.S.

(not including those that can be found at hospitals of Universities)

This information was received by correspondence with the NRC (Nuclear Regulatory Commission) or the state licencer's who is in charge of radioactive materials. Information on the specific irradiation companies was received by correspondence or through phone calls with the companies.

ALABAMA - None

ALASKA - None

ARIZONA - None

ARKANSAS - (1) PROCESSED TECHNOLOGY INC., P.O. BOX 256, West Memphis, AR, 72301. They irradiate: Food (on research basis), medical products, cosmetics, and pharmaceutical products with Cobalt 60. P.T.I. is a subsidiary of Radiation Technology out of Rockaway, New Jersey.

CALIFORNIA - (3) INTERNATIONAL NUTRONICS INC., 1962 Barranca Rd., Irvine, CA 92714 and INTERNATIONAL NUTRONICS INC., 1237 North San Antonio Rd., Palo Alto, CA 94303. They irradiate: Spices, Medical devices, medical products, electronic components, parts for nuclear reactors, gem stones, and cosmetics. Cobalt 60 is used.
RADIATION STERILIZERS, 1401 Morgan Circle, Tustin, CA, 92680. They irradiate: Spices, medical devices, and "Bag in a Box" - a plastic bag that slips into a cardboard box that wine comes in. Cobalt 60 is used.

COLORADO - (2) COBE LABORATORIES, 1185 Oak Street, Lakewood, Colorado, 80215-4407. They irradiate: Medical devices and Gem stones. Cobalt 60
IOTECH INC., 11080 Irma Drive, Northglenn, CO, 80233. They irradiate: Medical products. Cesium 137 is used.

CONNECTICUT - (1) BECTON DICKENSON, North Canaan, CT. Cobalt 60

DELAWARE - None

FLORIDA - (1) SHERWOOD MEDICAL, 2010 New Daytona Rd., Deland, Florida, 32720. They irradiate: Medical products. The Florida licensing office said they are aware of two other irradiation facilities both tentative as of Jan. 1987. One to be operated by a commercial firm out of Tampa and the other to be a joint facility by the D.O.E. and the Dept of Agriculture out of Gainesville. Construction by CH2M Hill. The commercial firm will irradiate strawberries and D.O.E. food.

GEORGIA - (1) RADIATION STERILIZERS INC., 2300 Mellon Court, Decatur, Georgia, 30035. They irradiate primarily medical supplies but also irradiate spices and "Bag in a Box." They use Cesium 137.

HAWAII - None

IDAHO - None

ILLINOIS - (3) ISOMEDIX INC., 7828 Nagle Ave., Morton Grove, ILL. 60053. They irradiate: Spices, disposable medical supplies, medical devices, nuclear device testing, cosmetic research and food research.

- ILLINOIS - (cont.) ISOMEDIX INC., 1880 Industrial Dr., Liberty, Ill., 60048
They irradiate: Some spices, disposable medical supplies,
medical devices, some nuclear device testing, cosmetic research
and food research.
RADIATION STERILIZERS INC., 711 East Cooper Court, Schamberg, Ill.
60195. They irradiate: Spices, medical products, cosmetics, gem
stones, and nuclear testing equipment.
- INDIANA - (1) ELI LILLY AND COMPANY, Lilly Corporation Center, Indianapolis,
Indiana, 46285. They irradiate: pharmaceutical products.
(address: 307 East McCarty Street)
- IOWA - None
- KANSAS - None
- KENTUCKY - None
- LOUISIANA - None
- MAINE - None
- MARYLAND - (2) Both irradiators are NEUTRON PRODUCTS, 22301 Mount Ephraim Rd.,
Maryland, 20842. They irradiate: food stuffs (non-commercial),
cosmetics, baby powder, hand lotion, cosmetics packing, gem stones,
personal care products, nuclear reactors parts, polymers, and
medical devices. One irradiator has one and a half million curies
and the other 400 curies of Cobalt 60. Neutron Products is
primarily involved in construction of Cobalt 60 rads.
- MASSACHUSETTS - (1) ISOMEDIX, 435 Whitney Street, Northborough, MA., They irradiate:
some spices, disposable medical supplies, medical devices,
some nuclear device testing, cosmetic research and food research.
- MICHIGAN - None
- MINNESOTA - (1) 3M (Minnesota mining and Manufacturing Company), 220 -2E-02,
3M Center, St. Paul, MN, 55144-1000
- MISSISSIPPI - (1) ISOMEDIX INC., Industrial Park South, Box 2044, Columbus, MS,
39704. They irradiate: Some spices, disposable medical supplies,
medical devices, some nuclear device testing, cosmetic research,
and food research.
- MISSOURI - None
- MONTANA - None
- NEBRASKA - (2) BECTON DICKINSON AND COMPANY, 150 South 1st, P.O. Box 686, Broken
Bow, NE, 68822. They irradiate: Medical supplies only.
SHERWOOD MEDICAL, P.O. BOX 1169, Norfolk, NE 68701. They irradiate:
medical supplies.
- NEVADA - None
- NEW HAMPSHIRE - None
- NEW JERSEY - (6) ISOMEDIX, 9 Apollo Drive, Whippany, NJ, 07981. They irradiate:

NEW JERSEY -(cont.) Isomedix- Some spices, disposable medical supplies, medical supplies, medical devices, some nuclear device testing, cosmetic research and food research.
ISOMEDIX, 25 Eastmans Rd., Parsippany, NJ 07054. They irradiate: see above, Isomedix.
ETHICON, (Johnson and Johnson), Route 22, Sommerville, NJ, 08876
They irradiate: Medical Products
RADIATION TECHNOLOGY, 108 Lake Denmark Rd., Rockaway, NJ 07866
They irradiate: Food (research and development), medical devices, cosmetics, Spices, electronic components, testing of nuclear devices, Gem stones, personal care products, and food packaging. They use Cobalt 60.
PRECISION MATERIALS CORPORATION, Replogle Ave., Mine Hill, NJ 07801.
PROCESSED TECHNOLOGY, Salem, NJ. (Subsidiary of Radiation Technology. They irradiate: Food on a research basis, medical products, cosmetics, and pharmaceutical products. Cobalt 60 is used.

NEW MEXICO - None

NEW YORK - None

NORTH CAROLINA - (1) PROCESSED TECHNOLOGY INC., P.O. BOX 757, Haw river, NC, 27258.
They irradiate: Food on a research basis, medical devices, cosmetics, and pharmaceutical products. (Subsidiary of Radiation Technology) Cobalt 60 is used with a 1.3 million curie source.

NORTH DAKOTA - None

OHIO - (2) ISOMEDIX, 4405 Marketing Place, Groveport, Ohio, 43125, They irradiate: see Isomedix New Jersey.
RADIATION STERILIZERS, 305 Enterprise Drive, Westerville, Ohio, 43081.
They irradiate: see Radiation Sterilizers, California. They use Cesium 137 for irradiation.

OKLAHOMA - None

OREGON - None

PENNSYLVANIA - (1) PERMAGRAN PRODUCTS INC., 115 Reactor Road, Karthaus, PA. 16845.
They irradiate: Manufactured floor products.

RHODE ISLAND- None

SOUTH CAROLINA - (2) BECTON-DICKENSON AND COMPANY, Airport Rd., Sumter S.C., 29150.
They irradiate: Medical Supplies.
ISOMEDIX, Highway 295, P.O. Box 3408, Spartanburg, SC, 29304
They irradiate: Some spices, disposable medical supplies, medical devices, some nuclear device testing, and food research.

SOUTH DAKOTA - (1) 3M, 601 22nd Ave., South, Brookings, SD 57006. They irradiate: Medical Products.

TENNESSEE -None

TEXAS - (6) RADIATION STERILIZERS INC., 3001 Wichita Ct., Ft Worth , TX, 76140.
They irradiate : Spices, Food on a research basis, medical products, cosmetics, gem stones, and nuclear device testing.
SHERWOOD MEDICAL, 400 Maple Street. Commerce, TX. They irradiate:

TEXAS -(Cont.) Sherwood Medical: Medical Products.
AMERICAN PHARMASEAL COMPANY: one Butterfield Trail, El Paso, TX
79906. They irradiate: Medical Products. (Two unit facility.)
ETHICON INC., P.O. Box 511, San Angelo, TX 76902. They irradiate:
Medical Products. (A Johnson and Johnson Company.)
SURGIKOS INC., P.O. Box 130, Arlington, TX 76010. They irradiate:
Medical devices. (A Johnson and Johnson Company)
JOHNSON AND JOHNSON, U.S. Highway 75 South, Sherman TX 75090
They irradiate: Medical Products.

UTAH - (1) ISOMEDIX, 9120 South 150 East, Sandy ,Utah, 84070. They irradiate:
disposable medical supplies, some spices, some nuclear devices,
cosmetics research and food research.

VERMONT - None

VIRGINIA - (1) APPLIED RADIANT ENERGY CORPORATION, 2432 Lakeside Dr., Lynchburg,
Virginia, 24501. They irradiate: Spices, Flour, Wheat, Medical
devices, Pharmaceutical products, Electronic components, personal
care products, douches (expermental to date) and marine samplers.

WASHINGTON- None, But two are in the conceptual phase. One will be a fixed location
irradiator and the other a transportable unit for agricultural products.

WEST VIRGINIA -None

WISCONSIN - None

WYOMING - None

Representative Randy Phillips
File on Food Irradiation
January 18, 1988

NOTE: *indicates a report attached to Karla Hart's 11/19/87 research
**indicates a report attached to Hart's 11/30/87 supplemental
research

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-The Proposal for Creating a Nuclear Food Industry-

What is food irradiation?

Food is irradiated by exposure to gamma rays or x-rays after harvest (or slaughter). This is done to kill insects and bacteria, to prevent sprouting, and to slow ripening by altering the chemical structure of these organisms. Irradiation changes the food itself.

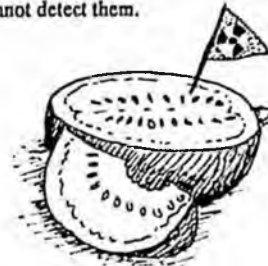
Food irradiation facilities use radioactive isotopes (*Cobalt 60 and Cesium 137*) or x-ray generators. This creates health and safety hazards and raises large ecological issues, discussed in this brochure.

How does it work?

Generally, food is irradiated in a specially constructed chamber that has concrete walls 6-8 feet thick. The radioactive material is in the center of the chamber. Food is carried to the radioactive source on a conveyor belt.

Irradiation levels range from 15,000 rads (to kill sprouting enzymes in potatoes) to 3 million rads (to kill bacteria in spices). By comparison, a chest x-ray gives off about 0.05 rads. The dosage of irradiation given to spices equals 60 million chest x-rays.

When radiation strikes food, it alters and damages cells by rearranging their molecular structure. This kills organisms and delays ripening. Radiation changes the food as much as it does insects or bacteria. Vitamins and enzymes are destroyed. New and altered compounds are produced. These changes do not affect the appearance of the food, so the consumer cannot detect them.



Industry representatives say that irradiation is permitted in 28 countries. Only limited amounts of a few food items are irradiated commercially in very few countries. Most countries allow irradiation only for experiments and don't irradiate food for public consumption. It is illegal to irradiate food in Great Britain. It is illegal to irradiate food for domestic consumption in West Germany. Consumers in Japan and the Netherlands protested food irradiation, and the Netherlands stopped irradiating food for domestic use; the Japanese government halted its exploration of food irradiation. To avoid further protest, distributors of irradiated potatoes in Japan stopped labeling them as such.

Is It Safe to Eat?

We believe irradiated food is unhealthy safe to consume.

- Animals fed irradiated foods have developed testicular tumors, kidney disease, shortened lifespans, loss of weight, increased rate of infertility and death in offspring.
- In the only study done on humans, malnourished children were fed irradiated wheat. The children developed abnormal blood cells called polypoids, which contain more than the normal set of chromosomes. The study was repeated on rats and monkeys, with similar results.
- At currently authorized dosages (100,000 rads) there is great danger of increased production of carcinogenic aflatoxins in food.
- There is significant nutrient injury at 100,000 rads, and even greater nutrient destruction at higher dosages. Vitamins C, B₁, B₂, and B₆, A, E, and K, amino and nucleic acids are damaged. If food irradiation is used to kill microorganisms that are currently destroyed by freezing and heating procedures, very high dosages of radiation will be required (1 million rads). This will dramatically damage food, depleting it of nutrients like thiamine (B₁), and creating toxic radiolytic products.

- When food is irradiated, radiolytic products are formed. George Tritsch, Ph.D., cancer research scientist says, "Until one knows what compounds are produced, one cannot be assured that no carcinogens are being formed. The amounts are irrelevant, since food is consumed during the entire lifetime, and only a single carcinogenic insult is needed to produce a malignant tumor."
- The most extensive survey ever undertaken on irradiated food research was conducted by Dr. Joseph Barna for the Hungarian government in 1979. Dr. Barna reviewed 1,223 studies on the wholesomeness of irradiated foods and tallied the reported effects. Dr. Barna's findings reveal 1,414 adverse effects on food and animals. Only 185 beneficial effects were found.

How was it approved?

In 1980, the Food and Drug Administration, using "theoretical calculations in radiation chemistry," determined that irradiated food was safe and wholesome. By 1982, the FDA had found 5 out of 413 studies it reviewed which "could be said to support safety." On April 18, 1986, the FDA approved its own theoretical hypothesis, rejecting all contrary evidence, and authorized the irradiation of fruits, vegetables, pork, spices, herbs, teas, and seeds.

Where does the radiation come from?

The major sources of gamma radiation for food irradiation are *Cesium 137* and *Cobalt-60*. *Cesium 137* is a by-product of Department of Energy nuclear weapons production and nuclear power generation. Water soluble, it is the most abundant isotope in the nation's nuclear waste and will be the most important source of gamma radiation. Radioactive *Cobalt-60* is made from non-radioactive *Cobalt-59*, and its production generates new nuclear waste.

Is it environmentally safe?

The leading government food irradiation proponent envisions a thousand irradiation facilities operating in the U.S. near agricultural areas, airports, seaports, and large cities. Since the irradiation service industry (which now deals mostly with medical supplies) began in the mid 1970's, there have been three *Cobalt-60* leaks, several contaminations and worker exposures, as well as numerous safety violations. With a thousand irradiation facilities operating in the U.S., shipments of large quantities of radioactive materials on the nation's highways will increase dramatically. The probability of more safety violations and radiation accidents will rise frighteningly. Such consequences are usually irreversible.

What foods are irradiated?

The FDA has approved the radiation of wheat, wheat flour, fresh fruits and vegetables, pork, and 60 herbs and spices. So far, only herbs and spices are being irradiated. About 1% to 2% of our nation's spices and herbs are currently irradiated.

Will irradiated foods be labeled?

The FDA does not require labeling of irradiated ingredients. For example, potato soup made of irradiated potatoes need not be labeled. In fact, millions of pounds of spices were irradiated in 1986 (*Food Processing Magazine, June, 1985, p. 89*), with no indication to consumers. These spices were all used as ingredients in processed foods.

DO YOU KNOW THIS
SYMBOL MEANS
TREATED WITH
GAMMA RADIATION?



The FDA does require that irradiated whole foods carry a written label, but this requirement expires on April 18, 1988. The only indication of irradiation then will be a flower symbol called the "radura." Most irradiated foods will be *unlabeled* ingredients. Consumers will not be informed or protected.

Will food irradiation replace pesticides?

Irradiation proponents say food irradiation will reduce dependency on pesticides. Actually, food irradiation is a post-harvest treatment. It will not replace one ounce of chemical soil treatment or pesticide used during growth. In all cases, irradiation will be used *in addition* to chemicals applied in the fields. In some cases, chemicals will be *added*, to facilitate irradiation.

Food irradiation has been touted as a replacement for the post-harvest fumigant, EDB. EDB was banned in 1983 when it was found to be carcinogenic. On detailed examination, very little EDB was ever actually used as a fruit and vegetable fumigant. Non-toxic alternatives to EDB, such as CO₂ and "double-dipping" water baths are cheap, proven, and available.

Who promotes food irradiation?

Private contractors and the federal government are its chief promoters. Food irradiation research is now being funded by the U.S. Department of Energy (D.O.E.), with taxpayers' dollars. For each of fiscal years 1986 and 1987, \$5,000,000 was appropriated for this purpose by Congress. The D.O.E. would like to find some use for their troublesome nuclear waste. The D.O.E. is trying to build six demonstration irradiation facilities in the U.S. to promote industry use of Cesium-137.

Who's working for consumers?

The National Coalition to Stop Food Irradiation—over 70 chapters, affiliated groups, and supporting organizations—is working to protect consumer interests across the U.S. To find the affiliate nearest you, write N.C.S.F.I.

What you can do

- **Educate yourself** on food irradiation and share your concern. Reproduce and distribute this brochure as often as you like.
- **Avoid irradiated foods.** Consumer power speaks loudly through our choices. Inform your grocers of your concern. Tell them you do not want irradiated foods, and that you want them to identify foods with irradiated ingredients. *You have the right to know.*
- **Contact your elected officials.** Ask your Congressman to co-sponsor and support the Food Irradiation Safety and Labeling Requirement Acts of 1987 (HR 956 & S461) introduced on February 4, 1987 in the House of Representatives and in the U.S. Senate.

These bills, if passed, will halt the irradiation of fresh fruits, vegetables, and pork, and mandate detailed disclosure of irradiation's impact on our food environment. HR 956/S461 require clear and honest labeling of irradiated foods—whole foods *and* ingredients—and prohibit the export and import of illegally irradiated foods.

As of November, 1987, 83 members of the House have co-sponsored HR 956, and 10 Senators have co-sponsored S461. Write your Representative/Senator and urge their co-sponsorship of HR 956/S461.

Write to:
Your U.S. Representative
House of Representatives
Washington, DC 20515

and

Your U.S. Senator
U.S. Senate
Washington, DC 20510

What is N.C.S.F.I.?

The National Coalition to Stop Food Irradiation is a non-profit organization that began in 1984. N.C.S.F.I. was organized to educate the public, and provide assistance to groups and individuals who are concerned about food irradiation.

SIGN ME UP!

_____ INDIVIDUAL membership in N.C.S.F.I. or local chapter. Includes a year's subscription to *Food Irradiation Alert* and a complimentary bumper sticker. (\$15.00)

_____ INDIVIDUAL RETAIL OUTLET/NON-PROFIT ORGANIZATION membership, including Information MANUAL, subscription, and bumper sticker selection. (\$75.00)

_____ FOR-PROFIT ORGANIZATION membership, includes same material as for non-profit organizations, above. (\$125.00)

_____ Send me information on STARTING A LOCAL CHAPTER.

_____ I ENCLOSE A SPECIAL CONTRIBUTION FOR YOUR WORK.

_____ Information MANUAL, 238 pages of scientific studies, articles, fact sheets, media clips in a 3-ring binder. (\$20.00)

_____ Buttons and bumper stickers (\$1.00 each + one 22-cent stamp for each two items. Bulk prices on request.)

_____ This brochure (10 for \$10.00; 100 for \$10.00)

_____ 2" diameter "Say No to Food Irradiation" stickers (10 for \$1.00)

_____ T-shirts (\$10.00 each) (11/87)

Shirts are 100% cotton and will shrink!

RED ___ Small ___ Med ___ Large ___ X-Lrg
BLUE ___ Small ___ Med ___ Large ___ X-Lrg

Name: _____

Address: _____

City: _____ State: _____

Zip: _____ Phone: (____) _____

We pay postage on all orders. Proceeds from the sale of these items go to the work that we do.
Please make your check or money order payable to:

The National Coalition to Stop Food Irradiation

FOOD IRRADIATION



A Health Hazard

National Coalition to Stop Food Irradiation

P. O. Box 590-488
San Francisco, CA 94159
(415) 566-2734



Alaska State Legislature

Please enter into the record my testimony to the House HESS
 committee name
 committee on HB 388, dated 1/15/88
 bill/subject

I am opposed to food irradiation because the process uses waste products from the nuclear power and nuclear weapons industry. This industry should be dismantled in its entirety, because it is a threat to all life on Earth. The industry is eager to legitimize itself by finding a so-called non-polluting use for its waste products. In truth however the development of such a market for nuclear waste will only encourage the industry to expand and generate more waste. Even though the radiation from the waste is utilized for a brief period of time, the waste still remains radioactive and still has to be disposed of ultimately.

Regardless of the health effects with irradiated food, this technology should be stopped in its tracks because of its unavoidably long-term effects.

Signed: Ed Berg
 Testifier

Representing (Optional)
2682 Goldhill Road, Fairbanks AK 99709
 Address
479-3796
 Phone No.

Irradiated food

Jan. 11, 1992
Cordova, AK 99574
Box 82
99569

To the editor:
Great Britain, New Zealand and West Germany have all banned the sale of irradiated food. Japanese parliament has withdrawn all support for food irradiation. Japan prohibits it. New Jersey and Oregon are in the process. Maine ka F airbanks plans to build a irradiator using atomic waste to zap Alaska food. Japanese irradiator was exposed through a chamber and involves the trans- porting and storage of atomic waste. Each plant would house roughly the same amount of Cesium-137 as was released in the Chernobyl accident.

The university claims that irradiation will increase shelf life and destroy pathogens. However, the botulism organism is "perversely resistant." A dose sufficient to kill other bacteria would leave botulism with no competition to impede its growth. In addition, lab tests show that salmonella develops resistance to infection by molds and "irradiated products are more susceptible to infection by molds and

Malnourished children in India fed irradiated wheat, developed multiple chromosomal anomalies, leukemia, cancers and a leuko- perosis. Irradiated foods are depleted of key vitamins and amino acids. The process will add up to 70 cents per pound to the price of food.

Unless we speak out now, food handlers will be here. If you are opposed, here is what can be done:

1) Tell any food suppliers or Bill 83 requiring foods whose components have been irradiated be so stated.

2) Write legislators requesting a ban on irradiated foods in the state and a halt to building of a food irradiator.

3) Express opposition to John P. Zarlioz—Director, Institute of Northern Engineering, U.A.F., 925 Duckering Bldg., Fairbanks 99775.

4) Ask Sens. Stevens and Murkowski and Congressman Young to co-sponsor and to support the Bill. The National Academy of Sciences, before further irradiation takes place.

5) Join the Alaska Chapter National Coalition to Fight Food Irradiation, 1650 Thruway, Anchorage 99507.

Keep in mind that a handful of concerned citizens can change the course of events.

Sincerely,
Ms. Rocky Stone



Greater Fairbanks

Chamber

of Commerce

First National Center

P.O. Box 74446

709 Second Avenue

(907) 452-1105

Fairbanks, Alaska 99707

RESOLUTION #10-0388

MAR 21 1988

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RESOLUTION ON IRRADIATION

WHEREAS, the State of Alaska has requested the Institute of Northern Engineering at the University of Alaska Fairbanks to conduct a study on the potential social and economic benefits and conduct a study on the potential social and economic benefits and risks that may be realized from food irradiation technology; and

WHEREAS, the Institute of Northern Engineering will not complete the study until the fall of 1988; and

WHEREAS, both the House and Senate have bills before them that would ban the sale of irradiated products in Alaska, thus foreclosing any future window of opportunity; and

WHEREAS, the United States Congress through the Department of Energy has made available to Alaska a \$5 million grant over a period of time for the purpose of conducting a range of studies regarding the feasibility of the process in Alaska; and

WHEREAS, the potential economic benefits to Alaska are in the areas of international trade and increased quality and selection of available food products, especially in rural Alaska; and

WHEREAS, economic development is a priority of the Governor for the State of Alaska and of the Greater Fairbanks Chamber of Commerce for the Interior and the state;

NOW THEREFORE BE IT RESOLVED, that the Greater Fairbanks Chamber of Commerce believes HB388 and SB355 should be postponed, or at least amended, pending the results from the study;

Jerry

HC02, Box 7630-A1
Palmer, Alaska 99645-9709
February 10, 1988

Honorable Ron Larson
Alaska House of Representatives
Pouch "V"
Juneau, Alaska 99811

Dear Representative Larson;

Recently I heard of HB-388 (Phillips & Goll) and a companion bill, SB-355 (Kerttula) which have been introduced and related to prohibiting the sale of irradiated food in Alaska.

I certainly am not an authority on irradiation, however, I know that this process is still undergoing testing by the U. S. Government. To my knowledge no hazard has been detected in, or through the ingestion of, irradiated food. Just as we do not radiate after receiving an X-ray, no radioactivity is retained by irradiated product. I have no direct economic interest in irradiation, but I am concerned that, at the least, HB-388 and SB-355 are premature.

As you may be aware irradiation offers the prospect of significant benefit. Irradiation can be used to sterilize meat, poultry, seafood and other food item and greatly extend their shelf life. It similarly extends shelf life of fruits and vegetables, not only by sterilization, but by delaying ripening and inhibiting sprouting. Lastly, the process is used to inactivate trichinae in pork, and insect pests in grain and other vegetable products without resorting to chemical treatment. The introduction of some of these pests, (weed seed, nematodes and insects) represent a threat to Alaskan agriculture.

Some opposition to Alaskan sale of radiated food is an effort to restrict the importation of materials which might compete with locally grown products. Such a tactic, which restricts trade, has potential to limit the future exportation of Alaskan products. Fine quality Alaskan vegetables, selected fish products and reindeer meat have potential for export and would benefit from shipment without the need for refrigeration. Bills, such HB-388, will inhibit the use of irradiation for this purpose in the state, and certainly would preclude sale of the products here.

Problems with agriculture in Alaska are not biological. The products can be produced here. Our problems are people problems,... financing, marketing, pricing, transporting, competing and attitudes. Such prohibitions as HB-388 represent an additional artificial detriment to development of Alaska's renewable resources.

If there is any assistance that I can be on this issue, please don't hesitate to call. I sincerely appreciate the honor of being recommended by you for the Board of Game.

Respectfully,



Robt. H. Parkerson, Ph.D.

**THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY**



Greater Fairbanks

Chamber

of Commerce

First National Center

P.O. Box 74446

709 Second Avenue

(907) 452-1105

Fairbanks, Alaska 99707

RESOLUTION #10-0388

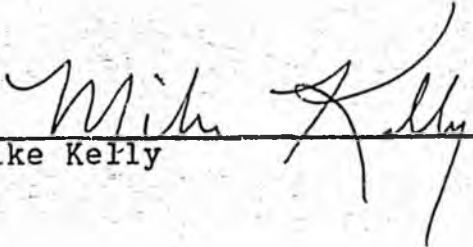
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RESOLUTION ON IRRADIATION

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- WHEREAS, the potential economic benefits to Alaska are in the areas of international trade and increased quality and selection of available food products, especially in rural Alaska; and
- WHEREAS, economic development is a priority of the Governor for the State of Alaska and of the Greater Fairbanks Chamber of Commerce for the Interior and the state;
- NOW THEREFORE BE IT RESOLVED, that the Greater Fairbanks Chamber of Commerce believes HB388 and SB355 should be postponed, or at least amended, pending the results from the study;

BE IT FURTHER RESOLVED that the Greater Fairbanks Chamber of
Commerce urges the Governor and the state
legislators to defer a decision on the proposed
legislation until those results are available.

Dated this 14th day of March, 1988.

By 
Mike Kelly

By _____
W.R. Cox

Jerry

HCO2, Box 7630-A1
Palmer, Alaska 99645-9709
February 10, 1988

Honorable Ron Larson
Alaska House of Representatives
Pouch "Y"
Juneau, Alaska 99811

Dear Representative Larson;

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If there is any assistance that I can be on this issue, please don't hesitate to call. I sincerely appreciate the honor of being recommended by you for the Board of Game.

Respectfully,

Bob

Robt. H. Parkerson, Ph.D.

H B

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HOUSE COMMITTEE REPORT

(7)

Date referred: 1/22/88

FURTHER REFERRALS: Finance

DATE: 2-24-88

The Health, Education and Social Services Committee has considered HB 390

An Act establishing the Alaska Science and Technology Foundation; relating to the membership of the science and engineering advisory commission; and providing for an effective date."

RECOMMENDS:

- replace with CS HB 390 (HESS) the same title
- attached amendment(s) a new title
- do pass
- do not pass
- no recommendation
- individual recommendations
- additional referral to the _____ Committee

ADOPTS: _____ letter of intent

ATTACHES NEW FISCAL NOTE(s):

- fiscal impact same as previous fiscal note published _____
- zero fiscal note same as previous zero fiscal note published _____
- zero with analysis

SIGNING DO PASS:

Bill Ellis
Will Koyama
Clayton Stanley
ROD E. HARRIS
Mr. Stuenkel

SIGNING OTHER RECOMMENDATIONS:

Bill Hudson - No Rec. -
David Wiley NO REC

Will Koyama
 COF Chairman's signature
Bill Ellis

STATE OF ALASKA THE LEGISLATURE

POUCH Y - STATE CAPITOL
JUNEAU, ALASKA 99811
907-465-3800

LEGISLATIVE AFFAIRS AGENCY LEGISLATIVE REFERENCE LIBRARY

May, 1988

Copies of minutes listed below were originally included in this file. The minutes are available on the STAIRS database CMPR. In order to save space copies of minutes have not been left in the files.

Mary Van Nimwegen

| | | |
|--------|---------|-----------|
| H HESS | 2-19-88 | 9:00 a.m. |
| H HESS | 2-23-88 | 8:30 a.m. |
| H HESS | 2-24-88 | 8:30 a.m. |

By House HESS

HOUSE BILL 390

Amendment #2

Page 6, line 13:

Delete "of" and insert in its place "in"

Page 5, line 3:

Delete "shall" and insert in its place "may"

By House HESS

HOUSE BILL 390

Amendment #1

Page 3, lines 19 - 21:

Delete all material after "AS 39.2C.180" and insert:

. Board members not employed by the state or university receive an honorarium of \$400 for each day spent on official business of the board.

STATE OF ALASKA THE LEGISLATURE

POUCH STATE CAPITOL
JUNEAU, ALASKA 99811
907 465 3800

LEGISLATIVE AFFAIRS AGENCY

MEMORANDUM

February 23, 1988

SUBJECT: Constitutionality of resident preference
 measures in HB 390 (Establishing the Alaska
 Science and Technology Foundation)

TO: Representative Johnny Ellis
 Co-chairman, House HESS Committee

FROM: Teresa B. Cramer *JBC*
 Legislative Counsel

You have asked for an opinion concerning whether the provision of HB 390 which requires that the board of directors of the Alaska Science and Technology Foundation give preference to state residents in making grant awards pose constitutional problems.

The bill provides that the foundation is a state agency funded by legislative appropriations. The purpose of the foundation is to encourage basic and applied research in Alaska by making grants to fund the research project. The board of directors is required to give preference to an applicant who is an Alaska resident, association, organization, or institution when awarding grants. If a state applicant lacks the expertise or capability to perform the research without assistance from a nonresident, the board may jointly award the grant to the resident and a nonresident.

In my opinion, the resident preference portions of HB 390 may be subject to challenge under the state equal protection clause, Art. I, sec. 1 of the state constitution.

The state supreme court has adopted a sliding scale for determining whether legislation violates the equal protection clause, depending on the importance of the individual right that is infringed. Alaska Pacific Assur. Co. v. Brown, 687 P.2d 264 (Alaska 1984). The court looks first to the nature of the interest. In HB 390,

Representative Johnny Ellis

Page 2

February 23, 1988

nonresidents are placed at a substantial disadvantage in applying for grants to perform research. This right is akin to the right to employment, which has been held a substantial right, requiring that the state demonstrate greater justification for the discrimination and establish that the means used to achieve its goals fit closely with the ends that the legislation seeks to accomplish.

In Sec. 37.17.010(b), set out in sec. 1 of the bill, the purpose of the foundation is given as

to promote and enhance economic development, technological innovation and capability, and public health in Alaska through basic and applied research.

Economic development is a justifiable state interest. However, the tie between encouraging economic development and restricting the research to achieve it to state residents is less clear. To survive a challenge under the equal protection clause the state would have to demonstrate that state residents as a group were substantially better able to accomplish this goal than nonresidents. The court has held in Lyndon Transport v. State, 532 P.2d 700, 711 (Alaska 1975) that

[a] discrimination between residents and nonresidents based solely on the object of assisting the one class over the other economically cannot be upheld under either the federal privileges and immunities or the equal protection clauses.

The justification for preferring residents cannot be based on providing residents jobs at the expense of nonresidents.

HB 390 might also be subject to challenge under the federal privileges and immunities clause, Art. IV, sec. 2 of the federal constitution. That clause applies to "fundamental rights" and protects "citizens" and not corporations and therefore might not apply to all potential plaintiffs. If the court held that the right to compete for grants was an employment right, the clause would clearly apply. Francis v. Robison, 713 P.2d 259 (Alaska 1986). The analysis under the clause would be similar to analysis under the state equal protection clause. The state would have to demonstrate that the reason for the discrimination against nonresidents was to remedy a problem that was causing social ills and that nonresidents were a "peculiar source of the

Representative Johnny Ellis
Page 3
February 23, 1988

evil." The preference imposed would have to be shown to be closely tied to solving the problem.

If I may be of further assistance, please advise.

TBC:bb
wkb3/019



Alaska State Legislature

Please enter into the record my testimony to the House HESS
committee name

committee on HB 390 & HB 391, dated February 23, 1988
bill/subject

We believe HB 390/HB 391 is an investment in Alaska's future and we therefore strongly support it and hope you will as well. One of Alaska's greatest resources is the creativity of its citizenry. This fact has been demonstrated time and again. HB 390/HB 391 provides an opportunity to draw upon that creative resource and direct it to applied research leading to enhancement of economic development, enhancement of public health and enhancement of technological innovation in and for Alaska.

Some additional points we would like to make:

1. Because of the large engineering profession that exists in Alaska - engineers have played a vital role in the past and present development in the state and will be a critical element in the future of the state - we believe the name of the bill should be changed to Alaska Science and Engineering Foundation. Consider if you will the role engineers have played in the design, construction and operation of the North Slope oil fields or their role in improving public health facilities in rural and urban Alaska.

2. To ensure balanced representation of science and engineering on the Board of Directors of the Alaska Science and Engineering Foundation (Sec 37.17.040) we recommend that the section be amended so the:

Two members residing in Alaska be one scientist and one engineer

Two members residing outside Alaska be one scientist and one engineer

3. Finally, we believe the emphasis of the research projects funded by Alaska Science and Engineering Foundation be on applied research. I mean by this research directed at solving Alaska's problems, the type of problems that engineers can provide a leadership role in solving.

Signed: _____

Testifier - John P. Zarling Ph.D., P.E., Director

Institute of Northern Engineering, University of Alaska Fairbanks

Representing (Optional)

539 Duckering Building, UAF, Fairbanks, AK 99775

Address

Office - 907 474-7775

Phone No.



Alaska State Legislature

Please enter into the record my testimony to the House HESS
 committee name
 committee on HB 390 & HB 391, dated 1/22/88
 bill/subject

The bills are an excellent concept and will materially assist the State of Alaska in stabilizing the economy by developing new methods and techniques of accomplishing needed solutions to our problems. The concept iterates the role of the engineer but does not fully address the fact that the engineer is the translator between science fact and usable end product. To this end it is strongly urged that the word "technology" be replaced in the title of the bill, in the name of the foundation, and in the name of the endowment in both bills by the word "ENGINEERING". "Technology" describes both science and engineering. The National Science Foundation has had continuing problems with the exclusion of the word "ENGINEERING" from it's title. Dr. E. Block, Director of the National Science Foundation, continues to point to the role of engineering and has had to make significant organizational changes to compensate for the omission. The further change of appointment of a "scientist and an engineer" in Section 37.17.040 b 1 and b 2 instead of "scientists or engineers" will help to assure a balance.

Vincent S. Haneman, Jr.

Signed: _____

Testifier
 Dean, School of Engineering, University of Alaska Fairbanks

Representing (Optional)

1258 Viewpointe Drive, Fairbanks, AK 99709

Address

Office 907 474 7330

Phone No.

Science Foundation Hearing scheduled for 2/19/88
status as of
2/17/88 15:25

| <i>Name of witness</i> | <i>Affiliation</i> | <i>Points witness is expected to make.</i> | <i>How much time estimated for testimony?</i> | <i>Will have written material to distribute?</i> | <i>Received yet?</i> | <i>Confirmation status</i> | <i>Location (ANC, FAI, or JUN)</i> |
|------------------------|--------------------------------|---|---|--|----------------------|----------------------------|------------------------------------|
| Henry Cole | Science Advisor to Gov. Cowper | Introduction and overview | 12-15 min. | yes | no | Confirmed | ANC |
| David Reaume | Alaska Economics Inc. | Economic links between high tech. and economic development. | 15-20 min. | yes | out-line | Confirmed | JUN |
| Ole Matheson | UAS-biologist | Impact of research to fisheries, and Scandinavian examples. | 10-12 min. | yes | no | Confirmed | JUN |
| Ed Clinton | Dowland-Bach (Anc. inventor) | A foundation in high tech. promotes the private sector | 10-12 min | yes | no | Confirmed | ANC |
| John "Spike" Karmon | Alliance Bank | Financial community perspective. | 10-12 min. | probably | | Confirmed | ANC |
| Syun Akasofu | Dir., Geophysical Inst., UAF | Foundation as a catalyst of additional federal and private research investment in Alaska. | 10-12 min | yes | no | Confirmed | FAI |
| Wm. Wood | Former Pres., U of A | Impact of knowledge & education on progress of mankind, Alaska, etc. | 10-12 min | yes | no | Confirmed | FAI |

HB 390

SECTIONAL ANALYSIS

*** Section 1**

Sec. 37.17.010

The Alaska Science and Engineering Foundation is housed in the Department of Revenue. Its purpose is to promote economic development, technological innovation and public health through basic and applied research in Alaska.

Sec. 37.17.020

The endowment of the Alaska Science and Engineering Foundation is managed along with other moneys of the permanent fund, but the identity of this money is kept separate and the interest on this money is distributed as grant funds.

Sec. 37.17.030

- a) At the request of the board of directors, the interest income from the endowment shall be released to the foundation. Net capital gains are split between the principal and income of the endowment.
- b) In addition, to endowment income, the foundation can distribute money received from gifts, grants, and other aid; funds received by the foundation do not lapse.
- c) The foundation's administrative expenses come from the endowment income, subject to the Executive Budget Act.
- d) Grants are distributed through a competitive bidding process.
- e) Income may be deposited to the principal, but cannot be withdrawn by the board at a later time.

Sec. 37.17.040

The nine members of the board of directors are appointed by the Governor to staggered four year terms and may be removed for cause. The membership is specified and is designed to represent the interests of the scientific community

as well as the general public. Four members must be scientists or engineers, two from in-state and two from out-of-state.

Sec. 37.17.050

The board shall elect its officers to terms of no more than two years.

Sec. 37.17.060

A majority of the board constitutes a quorum.

Sec. 37.17.070

The board must meet at least twice a year. Per diem and travel expenses, as well as a \$400 per day honorarium, are paid to the members for meetings of the board and its subcommittees (the same arrangement and dollar amount as the Alaska Permanent Fund Corporation).

Sec. 37.17.080

Provides for the hiring of an executive director and additional staff. All employees are in the exempt service.

Sec. 37.17.090

- a) Notice of all solicitation for grant proposals must be given at least annually.
- b) Grant proposals shall be reviewed by an anonymous peer review panel appointed by the board. Grants of less than \$5000 may be exempted from this peer review.
- c) The policy and research priorities for the state set by the Alaska Science and Engineering Advisory Commission shall be considered by the foundation in making grant awards.
- d) At least 50 percent of endowment income must go to grants of \$100,000 or less.
- e) The board will specify the amount of each grant that can be used for overhead.
- f) Grant recipients will be required to file reports. Research results will be distributed to the public regularly, unless deemed proprietary by the board.

- g) A fair percentage of income from royalties, licenses, and patents resulting from grant research shall be paid to the endowment principal.
- h) All qualified Alaskans may be eligible for grants. Preference shall be given to Alaskan grant proposals be they individuals, firms, organizations, or academic institutions. Out-of-state recipients may have to associate with an Alaska organization. Grants must further purposes of the foundation to solve Alaska problems.
- i) If grant money is awarded for equipment purchases, the foundation owns that equipment.
- j) An annual report to the Governor and legislature is required.

Sec. 37.17.100

The Alaska Executive Branch Ethics Law shall apply to board members, and they shall adopt a conflict of interest policy for themselves and the peer review panel.

Sec. 37.17.110

Permits the board to adopt necessary regulations.

*** Section 2**

Sec. 39.25.110

Adds the executive director and staff of the foundation to the exempt service.

*** Section 3**

Sec. 44.19.257(a)

Adds the executive director of the foundation to the membership of the Alaska Science and Engineering Advisory Commission.

*** Section 4**

Sec. 44.19.259

Exempts the executive director of the foundation from the staggered term provision of the Advisory Commission.

*** Section 5**

Immediate effective date.

***** AN OUTLINE OF *****
AN ECONOMIST'S VIEW OF THE PROPOSED ALASKA SCIENCE FOUNDATION

The economic questions which deserve answers if one is to judge the merits of the proposed Alaska Science Foundation are (1) Why should state government involve itself in research & development ? and (2) What can Alaska expect to realize in the form of a return on its investment in R&D ? My answers to these questions should not be interpreted as a blanket endorsement of any specific proposal, but rather as a basis for my belief that a properly designed and implemented science foundation of the sort proposed can in the long run help to stimulate both economic growth in Alaska and an intellectual broadening of our community. The corollary to this statement is that a badly designed or badly implemented program will do neither.

If even a well designed program could not be justified, then we would be foolish to waste time on this proposal. The main theme of this paper is that a well designed publicly funded research & development agency would be an important public asset.

WHY SHOULD STATE GOVERNMENT GET INVOLVED ?

There are five justifications for Alaska state government involvement in an R&D program aimed at broadening our economic base: (1) the widespread sharing of risk and thereby its effective reduction; (2) the recognition that economic growth in Alaska is of secondary importance (at best) to private investors; (3) the tendency towards under investment in R&D by the private sector that follows from the inability of

innovators to capture all of the benefits of their innovations; (4) the desire on the part of some players to protect their investments in what may be obsolete skills and technology; and (5) government's accepted role as guardian of the interests of the unrepresented, in this context future Alaskans.

***** DETAILS TO BE PROVIDED IN FINAL REPORT *****

WHAT RATE OF RETURN CAN BE EXPECTED ON AN INVESTMENT IN R&D ?

The consensus is that in the long run the mean gross social return to investment in research and development lies between 30 percent and 50 percent. Of considerable importance is the generally accepted fact that there is a great deal of variation across programs, and for a given program over time. An investment in R&D is risky and acknowledged to be so. Many well designed and well implemented R&D programs show zero or negative returns on investment. It is expected that there will be numerous failures before a success is achieved, just as it is expected that an oil company will drill many dry holes for every discovery.

Of the 30 percent to 50 percent mean gross return on R&D investment about one-third to two thirds is typically captured by the investor with the remainder accruing to other players. The IBM company benefited greatly from prior investments by Apple Computer. Other companies, some outside of the United States, benefit from the developments pioneered by Apple and by IBM. In principle there exist many

innovations with a more than adequate gross social return on investment which will not come to market or which will be delayed for some time because the innovator cannot capture enough of the return. This is a key reason for government involvement.

Translated into direct impacts on Alaska these observations can be restated in the form of a small set of propositions.

Proposition #1: There are no guarantees that an expenditure on R&D will have any measurable impact on the Alaska economy beyond the creation of R&D jobs per se.

Proposition #2: For every \$1 million invested in Alaska R&D an expected return of 40 % on investment means that the possible outcomes measured in terms of annual income created center around \$1.4 million per year.

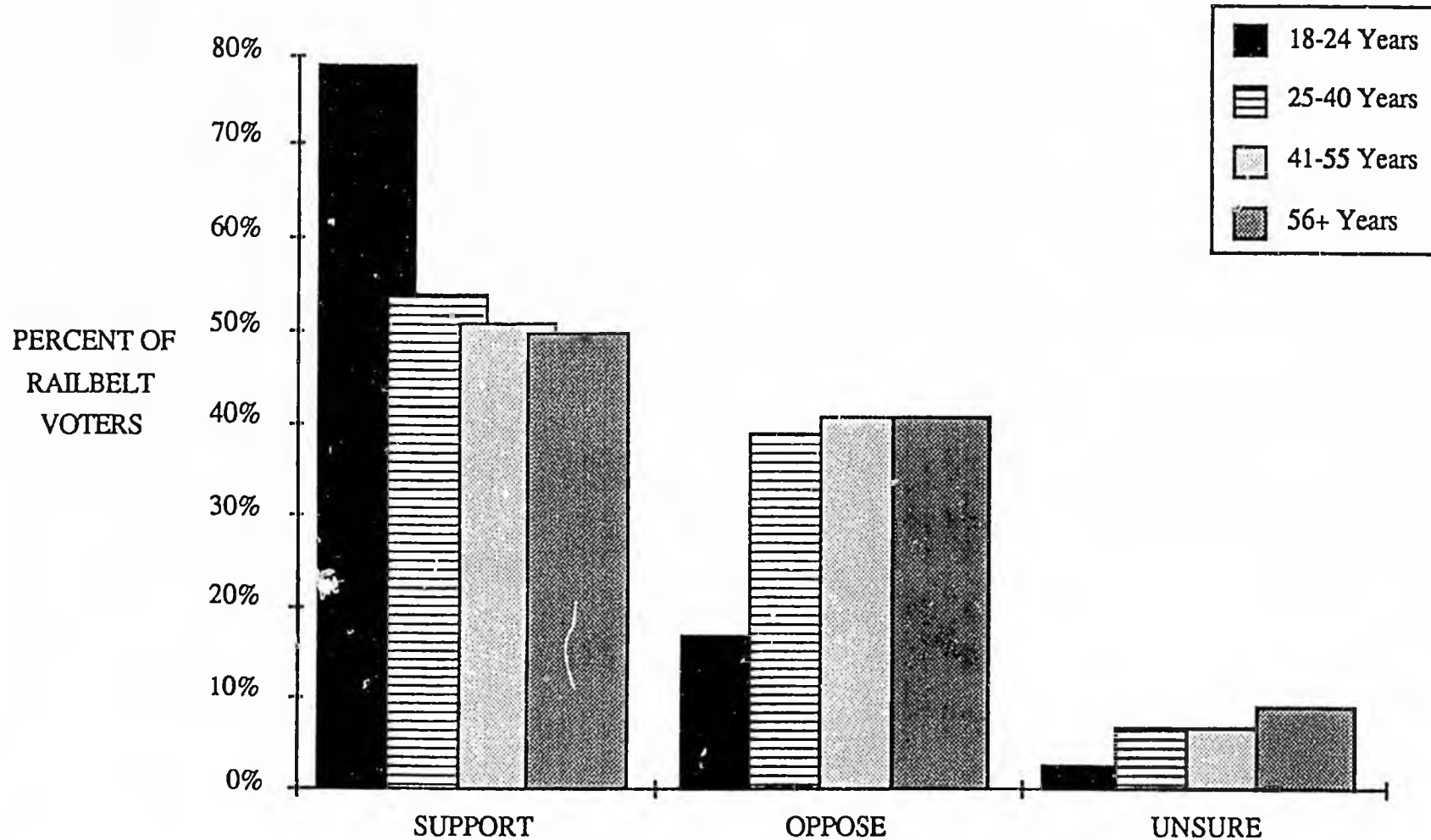
Proposition #3: The potential for a bonanza exists. Publicly funded R&D could lead to breakthroughs with very large rates of return.

The latter possibility, that of a bonanza, is to many people the chief reason why an Alaska Science Foundation is desirable. On average, the results can be expected to be unexciting but solid, the downside risk is minimal (at most we lose our investment), and the upside potential is worth reaching for.

David M. Reaume
February 16, 1988

Railbelt Attitudes Toward The Science Foundation, By Age

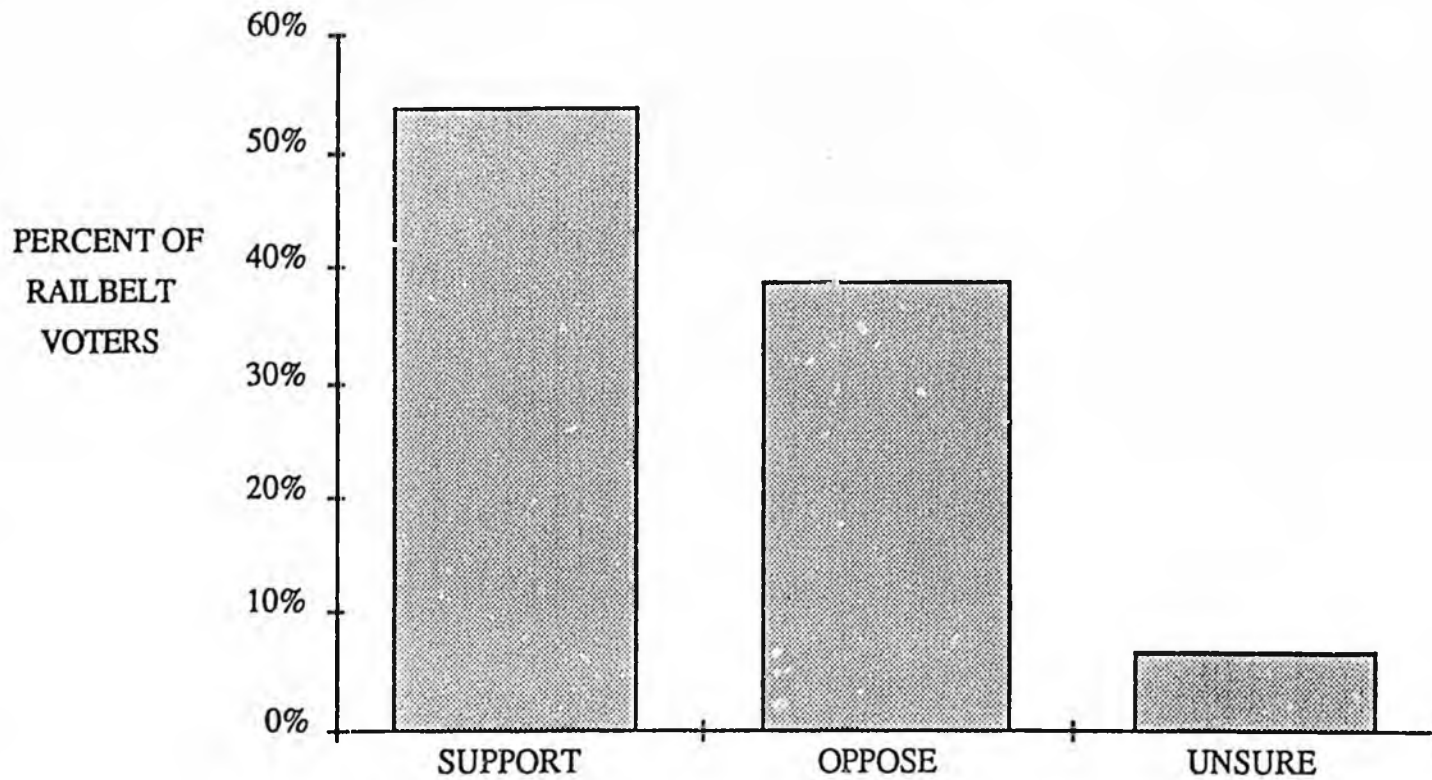
Would you support or oppose establishing a \$100 million science and applied technology fund to encourage scientific research in Alaska?



Source: Dittman Research Corp., January 1988

Railbelt Attitudes Toward The Science Foundation

Would you support or oppose establishing a \$100 million science and applied technology fund to encourage scientific research in Alaska?



Source: Dittman Research Corp., January 1988

ALASKA CONFERENCE OF MAYORS

RESOLUTION NO. 88-19

RESOLUTION OF THE ALASKA CONFERENCE OF MAYORS
SUPPORTING ESTABLISHMENT OF THE
ALASKA SCIENCE FOUNDATION.

WHEREAS, the link between scientific/technical achievement and economic development has been clearly demonstrated in communities around the world; and

WHEREAS, local governments are playing a leading role in efforts to achieve economic development in Alaska; and

WHEREAS, there is no institution in Alaska with responsibility to apply scientific knowledge to locally defined and selected economic development issues; and

WHEREAS, the scientific resources of the University of Alaska, state government, and other Alaska organizations have not been effectively mobilized to meet technical and economic development and health needs identified by local leaders; and

WHEREAS, the state administration has proposed to establish and endow the Alaska Science Foundation to provide and focus scientific and technical resources on clearly defined Alaska needs.

THEREFORE, BE IT RESOLVED that the Alaska Conference of Mayors urges the legislature to establish the Alaska Science Foundation; and

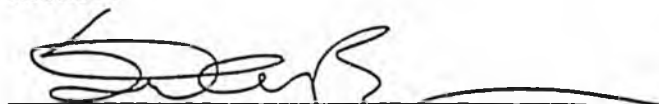
BE IT FURTHER RESOLVED that municipal and community and industry leaders be provided formal representation on the governing board of the Alaska Science Foundation to insure a practical and applied orientation to the research.

Adopted this 10th day of February 1988.



Erling T. Johansen, President
Alaska Conference of Mayors

ATTEST:



Scott A. Burgess, Executive Director
Alaska Municipal League

TESTIMONY BEFORE THE HEALTH, EDUCATION AND SOCIAL SERVICES
COMMITTEE OF THE HOUSE OF REPRESENTATIVES
ON HOUSE BILL 390, 391

Anchorage, Friday, February 19, 1988
Dr. Henry Cole, Science Advisor

It is a pleasure to be here and I thank the Committee for the opportunity to present arguments and information in support of the Alaska Science and Engineering Foundation. I am Henry Cole, Science Advisor to Governor Cowper and before introducing the various witnesses, I would like to briefly describe the Alaska Science and Engineering Foundation and make some remarks about the nature of the technological possibilities in Alaska.

The purpose of the Foundation is to promote and enhance economic development, technological innovation and capability, and public health in Alaska through basic and applied research. It will be governed by a nine member board of directors who represent a broad range of scientific, academic and public interests. Policy for the Foundation will be set by the basic statement of purpose plus other research priorities as may be determined by the Alaska Science and Engineering Advisory Commission. The executive director of the Foundation will sit as a voting member of the Commission.

The work of the Foundation will be accomplished through the funding of research proposals for a broad range of applied and pure scientific and engineering research topics dealing with

Alaska. Proposals shall be competitively reviewed by a group of technical advisors in various fields selected from the State and Nationwide or outside the country. Any qualified Alaskan resident, institution, University or business may be eligible to apply for funds. Preference will be granted to Alaskan proposers - all other scientific criteria being met. If it turns out that in some cases that we do not have sufficient technical expertise in Alaska to successfully accomplish the work then grants may be given to out of state proposers or to proposers who join with out of state bidders.

The \$100 million endowment will reside in the Permanent Fund and only the interest shall be used to provide money for grants, an amount normally between \$6 to \$8 million.

Technology is the application of human ingenuity, science and skill to the natural resources of this world to produce a resource of greater value than it had at first. The enhancement of value may lead to greater beauty, greater utility or a marketable product. We already have important examples of projects for the enhancement of resources in the State:

Coal from the Healy or Beluga coal fields is 27% moisture. This means it produces 7200 BTU/lb rather than 11000 BTU/lb. Technology can create a more saleable "value added" product, with a higher heat content and price when the exact technique for cheaply drying and stabilizing the coal is determined through research.

Coal dust may be pressed into a briquette with a binder of coal tar and starch and can create a three pound packaged fuel for sale to Korea. Engineering studies are required to determine the exact parameters for a low cost process.

These are examples of well defined projects which illustrate the "value added" concept.

So what's the problem? The problem is that each year an appropriation must be sought on a case by case basis and no long range planning may, in reality, be put in place. Long range planning is required to develop facilities and attract competent engineering talent. These particular projects are matching fund arrangements through a joint State/DOE agreement but there is, in fact, no legal mechanism whereby funds for State designated and non-University research may be easily managed.

Part of the need for a long term commitment in research is set by the topic itself. It derives from the differences between geological and biological or hydrological data. If one studies the geologic record in the Arctic Wildlife Refuge, a petroleum survey program could be funded intermittently, responsive to the short-term demands for information at that time. I am not suggesting that this would be an effective way to run a program. But at least there would be no danger of losing data.

On the other hand, if you are concerned with fisheries and other renewable resources, you must establish a base line of observations for many years to investigate the growth and changes through time. A gap in the time sequence of those observations can easily invalidate results. There is no way a single summer long program with large number of ships on the Bering Sea will succeed in producing the years-long temporal data you need on, say, the nutrition cycle, the maximum sustainable yield, and data for multi-million dollar fisheries management decisions.

In other words, the inherent nature of biological processes demands that a significant long term time commitment for observation and study be made to hope for any success whatsoever. Likewise, with genetic studies of forests, and new species of trees, wildlife cycles, the development of more suitable grains for the Arctic, the growth of seaweed cultures or the investigation of red tide, continuity is critical.

Consider important health problems: infectious disease, cancer, injury and suicide, atherosclerosis and the link with diet, or other public health issues. These take time and that commitment must be complete.

That is why we have proposed an endowment as a funding method: in order to protect these programs from the disruption of intermittent funding levels. It is this resultant stability which allows rational growth of research institutions and firms and attracts the best people to be a part of the necessary infrastructure of engineers and scientists. This is the meaning of the word capability in the statement of purpose of the bill. For sustained and credible growth of our ability to solve problems in the future we must build and commit to a strong base of expertise in Alaska.

A second aspect of the technological enterprise is that others can learn as rapidly as we can. If we do not prepare, we can miss our chance, and lose the opportunity to be leaders in innovative technological development in the Arctic.

The Finns, through their well funded Finnish Technical Institute, have been working for years on new Arctic construction techniques with considerable success.

The Canadians also: Based upon an argument of national defense, which leads to a broad national policy to reduce dependence on foreign oil, Canada has spent \$50 million to encourage improved construction practices, investigate more effective insulation, space heating, and city layout for weather protection. We have these skills but need to establish similar or better coherent programs. The Science Foundation could help on that.

China contains 40% discontinuous permafrost. Do we know how to build roads and foundations in permafrost? We certainly do and thus we should seize such an opportunity to expand our capability and export our technology.

There is already a large constituency of scientists, engineers and the general public with ideas for projects and economic development. But the problem is that although many of these projects are unique to Alaska they may not easily fit with the program guidelines of a university or the federal agencies and may be unsuitable for venture capital or loans. It is in these cases that the Science and Technology Foundation could be of great assistance. In other words the Science and Technology Foundation will be able to manage and fund projects which are unique and represent true Alaskan Missions.

What are some of these Alaskan Projects?

A Chemist in Anchorage wishes to evaluate Southwestern Alaska Fisheries as a Dietary source of Omega-3 fatty acids;

Another Chemist from Anchorage has written a proposal to investigate the possibilities in Alaska for Culture of Mollusks and Seaweed for sale;

A biologist has devised a scheme for salmon enhancement in Western Alaskan Coastal Villages through recirculating incubators;

From the Interior: a miner has developed a prototype machine for continuous underground mining in permafrost to mine underground placer deposits without blasting.

In Anchorage there is an engineer who has developed computer operated portable calibration devices for the pipeline but is seeking funds through the Federal Small Business Innovative Research program.

In Wrangell there is a proposal to create an Alaska Pilot Oyster project.

In Petersburg a fisherman wants to work on Littleneck Clam Harvesting, Detoxification, and Marketing.

In Kodiak there is interest in the development of Small Scale Fish Smoking Processors.

And there are other much larger Projects: Ways to make our oil resources go further and the conversion of natural gas to methanol and gasoline.

These are actual proposals for practical short and long term projects written by Alaskans in both rural and urban areas. Our desire through the Foundation is to present and realize the idea to all Alaskans that science and technology can empower them to deal more successfully with their own lives and economic needs.

It must be understood that the Alaska Science and Engineering Foundation cannot perform this function of technical growth and education in the State singlehandedly. The Foundation will work best through the effective link up and mobilization of the other resources of the state necessary for this technological enterprise: The Universities, with their great information and skill base, Private Industry with their support and project definition, the public with their innovative ideas, and the financial community and institutions to transfer ideas to a commercial level. The experience in other states shows that only through a partnership of these institutions, and redefining and modifying their traditional roles will we accomplish our goal. The Foundation will be the essential catalyst and motivator for this change in our state.

QUESTIONS AND ANSWERS ABOUT
THE ALASKA SCIENCE AND ENGINEERING FOUNDATION

1) What is the Alaska Science and Engineering Foundation?

The Foundation is an agency to fund Alaskan projects and programs of a scientific and technical nature whose results will be economically or scientifically useful to the state.

2) What are the goals of the Science Foundation?

The goals are to promote economic development and technological innovation and capabilities, and public health through basic and applied research.

3) How important is the Foundation to Alaska's future?

Science and technology will be a key driving force for future economic development in the State of Alaska. Over the past 50 years, the research and development expenditures in the United States have been responsible for 30 to 50% of the improvements in society. There is no more important single task in Alaska than to convert our economy from one based upon natural resources and their erratic cycles to one of significant value added to our resources and broad economic diversity.

- 4) Have other states established science and engineering foundations?

Yes. Forty-three other states have spent a total of \$700 million to establish research parks, incubator programs, small grant programs or other mechanisms to assist the link up of technology with economic development. The top seven states have spent \$350 million for this purpose. Alaska has spent nothing.

- 5) What are some examples of programs that might be funded?

Research into the enhanced recovery of oil and utilization of natural gas.

The chemistry of the drying and stabilization of coal in order to raise its heating value from 7200 BTU/lb to 11000 BTU/lb and thus increase its marketability.

The determination of the maximum sustainable yield of bottomfish and other fisheries in Alaska waters.

The investigation of causes of seasonal affective disorder in the Arctic climate and its relationship to injury and suicide.

Seed capital for engineering and development of a recirculating salmon hatchery in western Alaska.

Research on the genetic differences between pen reared salmon and the wild stock.

- 6) Why is it important that the foundation be financed through an endowment rather than annual appropriations?

A long-term, serious commitment to science and technology at a suitable level of funding will achieve the maximum effectiveness for the state's science dollar. In technical business, projects only come to fruition after several years. Many scientific projects, particularly those in renewable resources, require data which stretches through time. No satisfactory answer is available unless a long term research commitment is assured.

- 7) Does the need for a long-term commitment and funding mean no immediate returns are foreseeable for funded projects?

No. Many practical and useful technical projects of rapid return will be funded by this foundation.

- 8) About how much money will be available for research support?

An endowment of \$100 million housed in the Permanent Fund will produce an annual basis from \$6 to \$8 million dollars. This is not an excessive amount for research but can be the basis of a long term commitment.

- 9) Who will be eligible to apply for funding?

All Alaskan resident, businesses, organization, institutions, state or private universities shall be given primary consideration for funding. When no Alaskan group or individual is capable of doing the work, whether through lack of personnel or equipment, they are encouraged to enter into a joint venture with a group from outside the state. In cases where there is no one in the state capable of addressing a problem, outside scientists and engineers would be encouraged to apply.

- 10) How does the organization of this foundation compare with well-known examples such as the National Science Foundation or the Ford Foundation?

Aside from differences in their stated objectives, the Alaskan Foundation will have many features similar to other foundations: a nine member board of directors comprised of

four scientists or engineers, two of whom are from outside the state, plus four public members and one member of a state agency. Technical review will be performed by an advisory panel of technical experts selected from within and outside the state. The daily operation of the Foundation will be guided by an executive director and staff.

FEB 22 08 12:28 LEG. AFFAIRS - NASHLEH

P.O. Box 3136
Palmer, AK 99645
February 19, 1988

Dear Legislators:

RE: Comments concerning Alaska Science Foundation

An Alaska Science Foundation would be an excellent method to provide funds for research in renewable natural resources whose development is needed to diversify our economy. Currently we do not have the research base to develop these resources on a sustained yield basis. Little is known about the carrying capacity of our land for forestry, rangelands, wildlife, and other renewable resources. Many additional management questions occur in these fields as well as agriculture and land reclamation. This type research is not very competitive at the national level, and private foundations have indicated that these are local management problems. Availability of state funds on a competitive grant basis would be a real asset to renewable resource development.

Competitive grants, as proposed, is one of the most appropriate ways to ensure quality research at a reasonable price. Researchers would have to develop sound proposals subject to peer review and would have to justify their budgets. It would also provide an avenue for innovation. Most other state research funds are funneled down through agencies or the university to fund on-going projects. None of that money is available for other researchers who may have worthwhile ideas outside the scope of these programs.

The concept of ensuring that Alaskans are performing the research or having outsiders associated with Alaskan institutions is a good idea. Much NSF funding for Alaskan research goes to outside institutions. Having an outsider on the board helps to keep the program's perspective broader.

Requiring reports is essential for technology transfer and insures that the data and results become available instead of sitting in someone's file cabinet.

I would support the idea of using part of the Permanent Fund earnings for this endowment. This could be considered an investment in the same manner as stocks or bonds. However, dividends would be the ability to use our resources wisely and creation of development jobs instead of just returning money.

In summary, the Alaska Science Foundation is an excellent method for obtaining research to obtain needed information concerning management of our renewable natural resources. This, in turn, could help diversify the economy. There are relatively untapped natural resources (forestry, grazing) in the southcentral portion of the state that could be developed with sound, ecological practices if we had the research base.

Sincerely,

Dot Helm/88
Dot Helm



Alaska State Legislature

Please enter into the record my testimony to the House HESS
committee name

committee on HB 390, 391 , dated Feb. 19, 1988
bill/subject

I have four comments to make on House Bills 390 and 391 after hearing the first hour of testimony on Fri., Feb. 19. Thank you for your willingness to accept public input.

First, I support wholeheartedly the general concept and the general design of the Alaska Science and Technology Foundation endowed from the state's general fund. It is appropriate for a forward looking citizenry such as ours to be sowing seeds of technological progress for succeeding generations as much as for our own.

Second, the \$400 amount of the daily honorarium mentioned on p.3 (of HB0390A) in line 19 seems unnecessarily inflated.

Third, the exemption from peer review for small grants mentioned on p. 4, line 12 is not wise, in my opinion. Peer review of ALL proposals is in order.

Fourth, I wish to speak out in favor of that "second class cousin", the word BASIC in the phrase "basic and applied research." Although Dr. David Raouf's testimony mentioned that economic returns MIGHT not be immediate, I sensed in the testimony of him and others that foreseeable potential payoffs in solving pressing state problems ought to be one important measurement of the worthiness of the proposals to be funded. Preoccupation with "money back into the pocket sooner rather than later" is not surprising. Our nation has an attitude of impatience with science for its failure to give us immediate solutions to complex technological problems on demand. That preoccupation is not compatible with the long term welfare of a science dependent culture such as ours. The history of science is richly studded with examples of good research which was discounted or ignored - sometimes for decades - only to be proven a cornerstone of some later advances involving health, understanding of nature or even of great economic gains. If we look only for the list of possible applications before we loosen the purse strings, we shortchange only ourselves.

In short, no mere mortals can determine what the economic effects of a study may be 50 years later. I support the funding of "pure" or "basic" research coequally with that of "applied" research.

Signed: David M. Busey
Testifier

Representing (Optional)

801 Lincoln St., Sitka AK 99835

Address

Home: 747-6316

Office: 747-5233

Phone No.

A STATEMENT ON LEGISLATION
TO ESTABLISH AN ALASKA SCIENCE AND TECHNOLOGY FOUNDATION
PRESENTED TO THE ALASKA HOUSE OF REPRESENTATIVES
COMMITTEE ON HEALTH, EDUCATION, AND SOCIAL SERVICES

BY

Lyle D. Perrigo
1921 Congress Circle, Apartment B
Anchorage, Alaska 99507

February 19, 1988

Messrs. cochairmen and members of the Alaska House of Representatives Committee on Health, Education, and Social Services, my name is Lyle D. Perrigo. My comments today on House Bills 390 and 391, to establish and fund an Alaska Science and Technology Foundation, are based on 30 years of experience in conducting and leading applied research programs in a national laboratory, a nonprofit research institute, and a center of the University of Alaska. Also relevant are the one and one-half years in which I was the senior science director for the University of Alaska Foundation; in that period I participated in the work reported in the document entitled "A Challenge to Alaska." I believe my background provides a useful perspective on how research can be and often is used for pragmatic and economic purposes as well as some of the major research needs that face Alaska. Although I am the deputy director of the Arctic Environmental Information and Data Center (AEIDC), University of Alaska, and I work directly with the U.S. Arctic Research Commission, this statement is solely my own and does not necessarily reflect the views of our center, the University of Alaska, or the U.S. Arctic Research Commission.

Before advancing some specific thoughts about the legislation being considered by your committee, some comments pertaining to research, views on

its importance, and programs elsewhere in the nation which foster research are in order to lay a foundation for my recommendations.

- ° Research is often considered to be comprised of two types of endeavor, basic and applied research. The former comprises work to increase man's knowledge and understanding of natural phenomena and human interactions. The latter is a term used to describe pragmatic efforts to solve problems and employ the products, processes, or systems developed from existing knowledge for economic benefit or the well-being of industry, the government, and/or people. Both types of research are needed in Alaska.
- ° Except for certain technology transfer activities even applied research takes significant amounts of time before tangible results are apparent; for example, five to ten years may pass between onset of an applied research project and achievement of significant economic benefits.
- ° Economic or pragmatic success, even in applied research, is uncertain. Perhaps one project in ten will result in a large payoff, while two in ten may provide acceptable economic or other valued benefits. The remainder likely produced useful scientific and technical results but are otherwise not directly viable.
- ° Basic research is often done in universities. Nonprofit, for-profit, industry, and national laboratories as well as special multidisciplinary centers within some universities comprise the world of applied research. Some focus their work on one or two areas, while others pursue a wider spectrum of activity. The spawning of small nonprofit and for-profit research organizations is one step in the diversification process.
- ° At the present time 43 of the 50 states have programs to stimulate research. Emphasis on the acquisition and application of new knowledge is of interest because they lead to economic diversification and new

jobs. Some of the more successful programs are found in Massachusetts, North Carolina, Ohio, Pennsylvania, and Texas.

- ° The U.S. Arctic Research Commission plans to visit Juneau in early March. A significant consideration in its timing is pending legislation to establish an Alaska Science and Technology Foundation. The Commission expects to meet with the governor, committees of the legislature and the Juneau public to support the concept embodied in current legislation. The Commission believes a research foundation would provide a means of broadening the base of well-qualified research scientists and engineers and acquiring a better understanding of physical, biological, social and medical phenomena in the North. Having an Alaska Science and Technology Foundation is not considered as a gambit that would lessen work on federal and national issues; it would speed the process.

Comments on Proposed Legislation

Because an Alaska Science and Technology Foundation could play a very important role in diversifying the economy of the state and providing a better future for its residents, I support the concepts behind HB 390 and HB 391. Several changes are needed, however, to fine tune the wording in those bills to ensure the foundation is practical, workable, and has a well-defined mission. Amendments to achieve the following would meet those objectives:

- ° Organization and Reportability. Placing the proposed foundation within any existing department could make it a political football. What is needed is a public corporation similar to the Alaska Railroad. Considerable autonomy is required so that good science and technology rather than other agendas govern the preparation of priorities, consideration of proposals, the distribution of funds and evaluations of

performance and results. There are always legislative and administrative procedures to disestablish such a body if it violates the trust placed in it.

- ° Focus and Interests. Language should be included in the legislation to clearly focus the foundation's attention on Alaskan problems and interests. There are parallel federal and national interests in certain parts of the state and in certain scientific fields. There should be no wording to give the impression that Alaskan dollars might be spent to solve federal/national problems. We have more than enough of our own problems to handle without taking care of part of those belonging to the federal government.
- ° Governing Board. Considerable care in defining the length of terms and categorizing qualifications for membership is needed. First, the terms should run for six, rather than four years. We need stability and considerable insulation from political processes. Second, placing exclusionary language in the bill limiting the number of people from Alaskan universities to one will help allay public fears about the creation of a backdoor funding mechanism for universities. Further, at least one board member should come from each of the following basic industries: (a) oil and gas, (b) fisheries, (c) mining and minerals, and (d) forestry/forest products. Nominees from those sectors may or may not be scientists or engineers. We need someone from outside the state on the board; one, not two. A draft version of this bill had the speaker of the house and the president of the senate naming one member each. I hope such wording is not reinserted because naming one member each could involve the legislature in administrative matters. It seems to me that

both bodies would wish to be in a position to overview operations. Entanglements could make that a more difficult process.

- ° Applied and Basic Research. Our university research apparatus is generally geared, with a few exceptions such as the Arctic Environmental Information and Data Center (AEIDC), to undertake basic research. A basic emphasis is normally the role of most universities. Getting new products, processes, and equipment into the market requires applied research. That type of work is often done by private groups and not-for-profit research institutes and occasionally special, multidisciplinary arms of universities. I hope that the final wording used in the bill will clearly call for both types of research and leave the door open for participation to the private sector and nonprofit organizations as well as universities.

Wording charging the foundation with responsibility to support technology transfer of projects with promising results is one means of strengthening the applied side of research. In the sense I use the phrase technology transfer, I mean demonstration and applications research. It is far broader than information transfer, which often involves distributing reports, talking with interested people and accessing files via computer linkages.

- ° Limits on Size of Grants. Current wording calling for half the grants from the foundation to be \$100,00 or less is unnecessarily restrictive. First, there may be fewer technically sound proposals in any one year that might fall below that limit than there are realistic demands for projects costing more money. Second, inflation degrades the dollar's purchasing power. Hanging a specific value on a program such as this

creates housekeeping problems for future legislatures unless those dollars are indexed.

- ° The Endowment. As a matter of personal philosophy, I believe the legislature should loan the foundation a sum for only 12-15 years. If a substantial amount (say \$75-100 million) were provided initially, the foundation could set aside any unused portion of the interest generated each year to build its own base of support while actively soliciting funds from other sources to build an endowment to provide long-term stability for research funding. The public should be much more inclined to support legislation which calls for the return of the principle in 15 years than permanently allocating it to the foundation. In fact, this concept might be applied to a number of other projects wishing to use Permanent Fund monies.

In summary, I have given information on the importance of research, the stages through which it moves from the generation of new knowledge to application and some processes by which research leads to diversification. Also, I presented ideas on methods to strengthen and make workable the concept outlined in HB 390 and which would be funded by HB 391.

Thank you for this opportunity to express my views.

AN ECONOMIST'S VIEW OF THE PROPOSED ALASKA SCIENCE FOUNDATION
David M. Reaume, February 22, 1988

In a review of the professional literature on the relationship between research and development expenditure and economic growth, Morton Kamien and Nancy Schwartz of Northwestern University's graduate school of management had this to say: "All of the evidence at the level of the firm, industry, and economy indicates that the contribution of R&D to economic growth and productivity is positive, significant, and high."

[JOURNAL OF ECONOMIC LITERATURE, Vol. XIII, No.1, page 11 (1975)]

Nothing that has happened since their survey was conducted has changed that conclusion. The present consensus opinion among professionals who have studied the issue is that the gross social rate of return to R&D expenditure lies between 30% and 50%; where by "gross social return" is meant the profits of the innovator plus any profits which accrue to imitators or which can be directly attributed to the use of the innovation.

A question immediately arises. Can a government funded and managed R&D program be expected to perform as well as the average of those which have been shown to yield such large gross social rates of return? In the body of this report I will address two aspects of this question of interest to those who wish to judge the merits of the proposed Alaska Science Foundation. (1) Why should state government involve itself in R&D; and (2) What can Alaska expect to realize in the form of a return on its investment in R&D?

WHY SHOULD STATE GOVERNMENT GET INVOLVED ?

There are five justifications for Alaska state government involvement in an R&D program aimed at broadening our economic base: (1) the widespread sharing of risk and thereby its effective reduction; (2) the possibility that industries important to Alaska's future cannot or will not optimally invest in R&D; (3) the tendency towards under investment in R&D by the private sector that follows from the inability of innovators to capture all of the rewards of their innovations; (4) the desire on the part of some players to protect their investments in what may be obsolete skills and technology; and (5) government's accepted role as guardian of the interests of the unrepresented, in this context future Alaskans.

(1) RISK SPREADING/REDUCTION-- Investment in research & development even under ideal circumstances is risky. Although the average (mean) return may be as high as 50 percent, the variance of returns is also high, possibly comparable to the variance of results in oil exploration. In other words, the R&D equivalent of finding a dry hole is a very common experience. Government funding of R&D helps to spread the losses from R&D dry holes over a larger number of players. This has the effect of making more attractive many actuarially sound but risky R&D plays that might otherwise be left unexploited. If the additional players stand to benefit from the R&D, their participation may be justified.

(2) INDUSTRIES IMPORTANT TO ALASKA ARE AT THE BOTTOM OF THE R&D PILE-- New products and better ways of producing existing products will be found only if they are sought. Alaska's non-oil workhorse industries are near the bottom of the national ladder in terms of R&D expenditure measured either as a percent of sales, as a percent of pre-tax profits, or per employee. For example, in 1985 the metals and mining industry spent only 1.5 percent of sales on R&D, compared to 4.1 percent for the aerospace industry, 3.5 percent for the automobile industry, 7.3 percent for the drug industry, and 4.4 percent for the electronics industry. The food & beverage industry nationally spent an even lower percent of sales on R&D than did metals and mining (0.8 percent). For whatever reason, (a shortage of funds is likely part of the answer), we cannot expect Alaska's existing basic industries to provide the product and process innovations needed if Alaska is to prosper. (Data from Standard & Poor's Compustat Services as published annually in BUSINESSWEEK magazine's R&D Scoreboard.)

(3) INNOVATORS CANNOT CAPTURE ALL OR MOST OF THE REWARDS-- It appears from the research conducted over the past twenty years that between one-third and two-thirds of the profits directly attributable to an innovation are typically captured by imitators and by others, and not by the person or firm making the breakthrough. What this means is that many advances that are expected to produce more than adequate total profits are not pursued if too large a fraction of the total can be captured by parties other than the innovator. The patent system is an imperfect guarantor of property rights. If many Alaska players gain from a single innovator's breakthrough, state government funding may be needed to assure that good projects with dispersed benefits find their way onto the R&D agenda.

(4) ENTRENCHED INDUSTRIES MAY SUPPRESS R&D IN ORDER TO PROTECT EXISTING INVESTMENTS-- This is another way of saying that the goals of companies doing business in Alaska need not include growth and expansion if the risk to existing products and technology is perceived as great. In such cases new products may be much delayed or may be developed by others at some cost in terms of missed Alaska opportunities. Satisfaction with the status quo and mis-estimation of potential demand have been identified as other reasons why R&D may be suppressed. (Examples on request.)

(5) GOVERNMENT HAS A SPECIAL OBLIGATION TO FUTURE ALASKANS-- Future citizens are the special concern of government, or at least have been considered so at most times in U.S. history. Operationally, this means that government in its role of guardian of the interests of the unrepresented should be somewhat more forward looking than a citizen concerned solely with his or her own future. In the context of our discussion of the merits of the proposed Alaska Science Foundation, this means that the long lead times inherent in R&D processes should not weigh heavily against endowing the Foundation.

WHAT RATE OF RETURN CAN BE EXPECTED ON AN INVESTMENT IN R&D ?

The consensus is that in the long run the mean gross social return to investment in research and development lies between 30 percent and 50 percent. Of considerable importance is the generally accepted fact that there is a great deal of variation across programs, and for a given program over time. An investment in R&D is risky and acknowledged to be so. Many well designed and well implemented R&D programs show zero or negative returns on investment. It is expected that there will be numerous failures before a success is achieved, just as it is expected

that an oil company will drill many dry holes for every discovery.
(An excellent summary of research into the impact of R&D on growth is
TECHNOLOGY, LABOR, AND ECONOMIC POTENTIAL, by Roger E. Brinner, Data
Resources, Incorporated Study No. 29.)

In major piece of research conducted for the National Bureau of
Economic Research, John Kendrick and Eliot Grossman had this to say:

'The most important determinant of productivity growth is what
Denison calls 'advances in knowledge'-technological and organizational-
as applied in production. It results from cost-reducing innovations in
the ways and means of production.' (PRODUCTIVITY IN THE UNITED STATES
TRENDS AND CYCLES, Johns Hopkins University Press, 1980, page 16)

Of the 30 percent to 50 percent mean gross return on R&D investment
about one-third to two thirds is typically captured by the investor
with the remainder accruing to other players. The IBM company benefited
greatly from prior investments by Apple Computer. Other companies,
some outside of the United States, benefit from the developments
pioneered by Apple and by IBM. In principle there exist many
innovations with a more than adequate gross social return on investment
which will not come to market or which will be delayed for some time
because the innovator cannot capture enough of the return.

Translated into direct impacts on Alaska these observations can be
restated in the form of a small set of propositions.

Proposition #1: There are no guarantees that an expenditure on R&D
will have any measurable impact on the Alaska economy
beyond the creation of R&D jobs per se.

Proposition #2: For every \$1 million invested in Alaska R&D an expected return of 40 % on investment means that the possible outcomes measured in terms of annual income created center around \$1.4 million per year.

Proposition #3: The potential for a bonanza exists. Publicly funded R&D could lead to breakthroughs with very large rates of return.

A well-designed Alaska Science Foundation is a good idea. On average, the results can be expected to be unexciting but solid; the downside loss potential is minimal (at most we lose the interest on the endowment); and the upside potential is worth reaching for.