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COMMITTEE REPORT

HOUSE

HEALTH, EDUCATION AND SOCIAL SERVICES

(7)

FURTHER: FINANCE

3/25/85

Date: April 11, 1985

The Committee on LABOR & COMMERCE has had HB 319
"An Act relating to physical agents."

under consideration and recommends:

- do pass do not pass
- do pass with attached amendments(s)
- replace with CS for HR 319 same title
 new title
- and recommends to pass
- AND attaches a "Letter of Intent" New Fiscal Note
- reports it back without recommendation Zero Fiscal Note Attached
- referred to the _____ Committee

MEMBERS SIGNING
DO PASS

MEMBERS HAVING
OTHER RECOMMENDATIONS:

[Signature]

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CHAIRMAN

HB 319 File Contents

April 9, 1985 Tuesday

- 1) Bill Summary -- Legislative Reporting Service
- 2) Overview -- R. Poppe, Committee Staff
- 3) Fiscal Note, Analysis, and Position Paper -- Dept. of Labor
- 4) AS 14.60.030-105 "Right to Know" law
- 5) Packet of Materials from Rep. Pourchot -- April 5, 1985
(sent to members by the sponsor)
 - a. Cover Memo: Pourchot to Committee Members
 - b. 1983-84 TLV Physical Agents Committee report Preface
(select pages from pp. 66-116.
 - c. Occupational Injury and Illness Information: Alaska 1982
by Dept. of Labor, select pages from pp. 12-78
 - d. Hot Environments: 1980, US Dept. of Labor, pp. 1-8
 - e. Construction Health Hazards Prevention: Action Tips, A5-6
 - f. Heat Stress: DC 37 Safety and Health Factsheet, 2 pp.
 - g. Noise Control: US Dept. of Labor. (4 pp)
 - h. News Release, U. S Dept. of Labor: Noise Exposure Standards
 - i. Noise: by International Assoc. of Machinists, 7 pp.
 - j. Vibration Syndrome: U.S. Dept. of Health & Human Services
15 pp.
 - k. Nonionizing Radiation by Intern. Assoc. of Machinists, 2 pp.
 - l. Ionizing Radiation, by Intern. Assoc. of Machinists, 4 pp.
 - m. Miscellaneous newspaper articles + other brief brochures

April 11, 1985 Thursday

- 6) Proposed CS for HB 319, (3 amendments), by sponsor

To: Mike
From: Roger

April 8, 1985

MB 319

I really dont see that there will be much opposition to this bill. If there are any snags, it will most likely come from private industry who are concerned about the added cost. I think that Pourchot has this point covered in his memo and I cover it additionally in mine--it shouldn't cost the employer a nickel.

You might want to establish with a question whether an employer is required to provide this information only if he is asked to by the employees, or whether he is requiried to supply it whether they ask for it or not.

M E M O R A N D U M

To: All Members, Labor and Commerce Committee

From: Roger Poppe, Committee Staff

Date: April 9, 1985

Subject: Overview: HB 319: Worker Right to Know about Physical Agents
in the Workplace

On Tuesday, April 9, 1985, the House Labor and Commerce Committee met in Room 102 of the Capitol Building at 1:15 pm on HB 319.

The issue of workers having the right to know or be informed about hazardous and toxic substances in the work place was enacted into law in 1983 (see item #4 in your file). That legislation was supported by industry, labor, environmental and health groups. This legislation should receive the same general support. Basically, it simply expands the current act to add "physical agents" to the list of hazardous and toxic substances already being covered.

Thus, employers would be required to provide information to employees about the potential hazards of such "physical agents" as the following (which are not currently covered by statute, but should be, because of their potentially harmful effects):

1. Ionizing radiation (x-rays)
2. Heat and Cold Stress
3. Impulsive and Impact Noise
4. Radiofrequency, microwave, ultraviolet, and infrared radiation
5. Lasers
6. Hand-arm (segmented) vibration

The details on each of these potentially harmful physical agents is found in various articles, etc. in your file under #5.

This bill doesn't mean that the employers have to go to the added expense of protecting the employees from these additional hazards, merely that they have to inform them of the potential hazards. Further, employees do not have to go to the added expense of doing the research on these physical agents. Background information has been already prepared by a wide variety of groups, including the American Conference of Industrial Hygienists, OSHA, various labor unions, etc. This information can be made available to the employers through the Dept. of Labor at no extra cost to the employer or to the Department.

The sponsor of the bill will be proposing two minor housekeeping amendments.

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 - k. Nonionizing Radiation by Intern. Assoc. of Machinists, 2 pp.
 - l. Ionizing Radiation, by Intern. Assoc. of Machinists, 4 pp.
 - m. Miscellaneous newspaper articles + other brief brochures
6. Two proposed technical amendments -- by Sponsor Pourchot

AMENDMENT

Offered in the House

To: HB 319

Page 5, after line 1: Insert a new bill section to read:

"Sec. 5. AS 18.60.105 (a)(1) is amended to read:

(1) 'be exposed' means to ingest, inhale, or absorb through the skin or eyes a substance or physical agent, or fumes or other potentially harmful aspect of a substance or physical agent."

Page 5, lines 3-6: Delete all material and insert

"(11) 'physical agent' means 'physical agent' as defined by the department by regulation; the department shall initially define the term to include only physical agents listed in the 1984-1985 edition of 'Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment' published by the American conference of Governmental Industrial Hygienists, and shall amend the definition to include physical agents listed in future additions as they are published; but 'physical agent' does not include an agent, the exposure to which, because of the agent's low dosage, does not pose a health hazard."

Insert a new section of the bill to read:

AS 18.60.105(b) is amended to read:

(3) "health hazard" means a substance or physical agent capable of causing acute or chronic adverse effects to health;

Original sponsors: Pourchot, Gruenberg,
Koponen, et al

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IN THE HOUSE

BY THE LABOR AND
COMMERCE COMMITTEE

CS FOR HOUSE BILL NO. 319 (L&C)
IN THE LEGISLATURE OF THE STATE OF ALASKA
FOURTEENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act relating to physical agents."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 18.60.030 is amended to read:

Sec. 18.60.030. DUTIES OF DEPARTMENT OF LABOR. The Department
of Labor shall

(1) study ways and means for prevention of accidents to
persons on the streets and highways, in and on the water, in aircraft
usage, in homes, on the farms, at schools, industrial and commercial
plants, and in public places;

(2) plan and execute safety programs, including educational
campaigns, designed to reduce accidents in every field of activity;

(3) work in cooperation with official and unofficial orga-
nizations and instrumentalities in the state which are interested in
the promotion of safety so that possible resources can be marshalled
and utilized to reduce the menace of accidental death and injury;

(4) work toward obtaining better observance and enforcement
of laws governing street and highway traffic, and assist in bringing
about, wherever feasible, the application of modern engineering mea-
sures for the prevention of traffic accidents;

(5) confer [ADVISE] with the public agencies responsible
for safeguarding the people against accidents, and especially with the
Department of Transportation and Public Facilities, the Department of
Public Safety, the Department of Education, Department of Natural
Resources, Department of Health and Social Services, and the heads or

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representatives of federal departments and agencies operating in the state particularly concerned with safety programs and accident prevention;

(6) establish and enforce occupational safety and health standards that prescribe requirements for safe and healthful working conditions for all employment, including state and local government employment, and the requirements are to be at least as effective as those requirements promulgated by the United States Secretary of Labor under sec. 6 of Public Law 91-596;

(7) require an employer to maintain records and submit reports to the department which records and reports are necessary or appropriate for the enforcement of AS 18.60.010 - 18.60.105 and to maintain records and submit reports to the United States Secretary of Labor in the same manner and to the same extent as set out in federal law and regulations;

(8) require an employer to maintain records and submit reports appropriate for use in developing information regarding the causes and prevention of occupational accidents and illnesses;

(9) require an employer to make periodic inspections when necessary to carry out the record and reporting requirements of (7) and (8) of this section;

(10) participate in occupational safety and health programs if it finds they are necessary to meet the occupational health and safety needs of the state;

(11) execute on behalf of the state agreements or contracts necessary or desirable to enable the state to participate in occupational safety and health programs, and to receive and expend funds made available for programs of the state;

(12) annually publish a list of toxic and hazardous substances

1
2 and physical agents;

3 (13) maintain a current set of OSHA form 20's or equivalent
4 information for toxic and hazardous substances and for physical
5 agents, and other information relevant to toxic and hazardous sub-
stances and physical agents;

6 (14) assist employers, upon request, to develop employee
7 safety education programs and to identify and obtain information on
8 toxic and hazardous substances and physical agents [AND DEVELOP EM-
9 PLOYEE SAFETY EDUCATION PROGRAMS].

10
11 * Sec. 2. AS 18.60.066 is amended to read:

12 Sec. 18.60.066. EMPLOYEE SAFETY EDUCATION PROGRAMS. (a) An
13 employer shall conduct a safety education program for an employee
14 before the employee performs a new work assignment that may result in
15 the employee being exposed to a toxic or hazardous substance or a
16 physical agent for which the employee has not received safety instruc-
17 tion as provided under (b) of this section.

18 (b) An employee safety instruction program shall inform the
19 employee of

20 (1) the location, properties, and known or suspected acute
21 and chronic health effects of the hazardous or toxic substances or
22 physical agents to which the employee is exposed in the workplace;

23 (2) the nature of the operations that could result in
24 exposure to hazardous or toxic substances or physical agents [,] as
25 well as any necessary handling or hygienic practices or precautions;
26 and

27 (3) the location, purpose, proper use, and limitations of
28 personal protective equipment used in the workplace.

29 * Sec. 3. AS 18.60.067(a) is amended to read:

(a) An employer shall make available to an employee on request a

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2 copy of the most recent OSHA form 20 or equivalent written information
3 for a toxic or hazardous substance or for a physical agent to which
4 the employee may be exposed. If the employer does not have the copy
5 or information requested, the employer shall request a copy from the
6 department or the manufacturer of the substance within three state
7 government working days after receiving the request.

8 * Sec. 4. AS 18.60.068 is amended to read:

9 Sec. 18.60.068. POSTING OF INFORMATION IN WORKPLACE. (a) The
10 department shall print and make available to employers posters that
11 contain notice of the provisions of this chapter relating to toxic and
12 hazardous substances and physical agents.

13 (b) An employer whose employees are or may be exposed in the
14 workplace to a toxic or hazardous substance or a physical agent shall
15 display the following information in a manner designed to notify the
16 employees:

17 (1) a poster printed by the department under (a) of this
18 section; and

19 (2) an OSHA form 20 or equivalent information for each
20 toxic or hazardous substance and for each physical agent to which an
21 employee may be exposed in the workplace

22 (A) under normal conditions of work; or

23 (B) during a reasonably foreseeable emergency, includ-
24 ing equipment failure and rupture of containers.

25 (c) Instead of posting the information required under (b)(2) of
26 this section, an employer may post a list of the chemical name and
27 product name of each toxic or hazardous substance and each physical
28 agent to which an employee may be exposed in the workplace, together
29 with an identification of a location, in or near the workplace and
accessible to employees, where an employee may inspect the information

1 listed under (b)(2) of this section.

2
3 * Sec. 5. AS 18.60.105(a)(1) is amended to read:

4 (1) "be exposed" means to ingest, inhale, or absorb through
5 the skin or eyes a substance or physical agent, or fumes or other
6 potentially harmful aspect of a substance or physical agent;

7 * Sec. 6. AS 18.60.105(a) is amended by adding a new paragraph to read:

8 (11) "physical agent" means "physical agent" as defined by
9 the department by regulation; the department shall initially define
10 the term to include only physical agents listed in the 1984 - 1985
11 edition of "Threshold Limit Values for Chemical Substances and Phys-
12 ical Agents in the Work Environment" published by the American Confer-
13 ence of Governmental Industrial Hygienists, and shall amend the defi-
14 nition to include physical agents listed in future editions as they
15 are published; but "physical agent" does not include an agent the
16 exposure to which, because of the agent's low dosage, does not pose a
17 health hazard.

18 * Sec. 7. AS 18.60.105(b) is amended to read:

19 (b) In AS 18.60.030(14), 18.60.065 - 18.60.068, and 18.60.105-
20 (a)(9)

21 (1) "employee" means a person who works for an employer,
22 but not in a place used primarily as a personal residence;

23 (2) "employer" means a person, including the state and a
24 political subdivision of the state, who has one or more employees
25 working in a place not used primarily as a personal residence;

26 (3) "health hazard" means a substance or physical agent
27 capable of causing acute or chronic adverse effects to health;

28 (4) "workplace" means a place of employment other than a
29 place used primarily as a personal residence.

* Sec. 8. Notwithstanding the amendments to AS 18.60.068 made by sec. 4

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of this Act, the department may continue to use existing posters until the next printing of the posters.

Bill No. House Bill No. 319

Date April 4, 1985

Title "An Act relating to physical agents."

Contact: Richard Arab
465-4856
Eileen Plate
465-2700

Under existing law, employers are required to provide information and training to employees on certain toxic and hazardous substances. House Bill No. 319 seeks to expand the "Right-to-Know" law to include physical agents.

Physical agents are defined as those listed in the "Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment" as published by the American Conference of Governmental Industrial Hygienists. The latest edition of this publication lists the following physical agents:

- Heat Stress
- Ionizing Radiation
- Lasers
- Noise
- Impulse or Impact Noise
- RF/Microwave Radiation
- Ultraviolet Radiation
- Airborne Upper Sonic and Ultrasonic Acoustic Radiation
- Cold Stress
- Hand-Arm (Segmental) Vibration

Exposure to physical agents can result in permanent disabilities, such as deafness. Often employers and employees are not aware of the harmful effects of a particular physical hazard present in the workplace, and the training and information requirements provided in this bill would assist in filling this void. This would, in turn, effect implementation of protective measures by the employer to safeguard employees, as well as provide employees with an understanding of the importance of following safe and healthful work practices.

As part of its Occupational Safety and Health program, the Department of Labor enforces regulations to protect employees from certain physical hazards (ionizing radiation, lasers, noise, RF/microwave radiation, and ultraviolet radiation). The information and training requirements of this bill would, therefore, enhance the Department's efforts to protect Alaska's workers.

The Department would offer one additional amendment to AS 18.60 to incorporate physical agents into the definition of "be exposed" currently set out in AS 18.60.105(a)(1), as follows:

AS 18.60.105(a)(1) is amended to read:

(1) "be exposed" means to ingest, inhale, or absorb through the skin or eyes a substance, or fumes or other potentially harmful aspect of a substance or physical agent;

POSITION PAPER/Department of Labor

The Department of Labor supports House Bill No. 319. It will not have a fiscal impact on the Department.

APPROVED:

A handwritten signature in cursive script that reads "Jim Robison".

Jim Robison
Commissioner

Workers who suffered radiation at Clear look for answers and someone they can trust

Continued from Page A-10

medical records. They were told the base legal department would have to review the reports first.

"They said they mailed them yesterday," Foster said Friday. "They've been mailing them yesterday for two weeks now. We need to get these records so we can get started on some treatments."

Felec conducted its investigation into the accident, which it submitted to the Air Force on Nov. 29.

Foster made an independent investigation. He concluded that the company left out important information about the cause of the accident. He gave his own report, which he initially prepared for the Air Force Inspector General, to the Alaska Department of Labor.

At the heart of the safety system for the Clear tracker radar is a series of key interlocks. If the system was used as it was designed, it would have prevented the accident, Foster said.

Foster and Congressional aide William Sharrow, who is investigating the Clear accident for Alaska Rep. Don Young, said inadequate communication contributed



Ron Foster gets an eye lost.

you give me the price of a coffin for a seven-year-old girl!" She couldn't figure out what the caller was talking about and hung up. The next night, the same person called, this time asking, "Could you give me the price of a coffin for a nine-year-old boy?"

Those were the ages and sexes of two of her children. Mrs. Jessop said she went to the FBI and alerted her children's teachers and school driver. She didn't tell her husband at first. He had enough

ing Felec and its workman's compensation insurance company to send them to non-Air Force physicians who specialize in their injuries.

But the workers got another setback. In a letter dated Feb. 1, the insurance company said that a recommended specialist, Dr. Charles Becker of San Francisco University, "chooses not to become involved in this particular case due to the political nature of the claim."

Dr. Herbert Pollack, a physician who led Project Pandora, a secret government study in the 1960s and 1970s into the effects of the Moscow Signal, downplayed the severity of the Clear accident in a telephone interview at his office in Palm Beach, Fla.

"The amount of damage one can expect in this particular situation is minimum, if any at all," he said.

Others are not so sure. Dr. Hans-Arne Hansson, a clinical and laboratory researcher at the university in Goteborg, Sweden and a leading expert in microwave radiation, said in a telephone interview that it would be hard to assess the damage to the men because so little is known about microwave exposure. Accidents like the one at Clear

plete. "The eye is really a disabled eye from that point on. You can't focus anymore," Zaret said.

Because additional exposure could cause cumulative and irreversible damage to the workers at Clear, Zaret said, they might be wise to avoid microwave radiation sources, whether at Clear or from leaking microwave ovens, computer video display terminals or even citizen's band radios.

Zaret examined Richard Eldridge in December and found swelling of the eye lens. He said it was too early to predict whether Eldridge would develop cataracts.

Tb: Blays that the Clear workers went through before receiving treatment may have had more than medical effects, Zaret said.

"Part of the problem with these fellows now is that they're so suspicious that they wouldn't feel a good doctor-patient relationship with any of the physicians being put forward by the military establishment or some of the (military) sponsored research scientists," Zaret said.

The Clear case has caught the interest of Alaska's congressional delegation. On Jan.

actions in the case

"In December, Sen. Stevens and Sen. Murkowski both wrote the Air Force and asked that the victims get proper medical attention," said an aide to Stevens. "We got a letter back that was not satisfactory to either office."

Young has also called for an independent evaluation to measure how much radiation the workers were exposed to. He is not alone.

According to state documents, the Alaska Department of Labor requested the U.S. Occupational Safety and Health Administration office in Seattle to provide assistance in a new survey three times since Nov. 1. The request was repeated to Jim Lake, OSHA regional administrator in Seattle, when he visited Juneau Thursday on other matters.

Ray Jorgensen, chief industrial hygienist for the state labor department, said state investigators lack the equipment and experience for a survey. Though OSHA is usually "more than conducive to provide assistance," Jorgensen said, in this case the answer from Lake has so far been negative.

In an internal memo to Lake, Robert Curtis, senior industrial hygienist for

made up our minds that the Air Force is competent to handle it. It wouldn't have made a difference what kind of exposure (the workers) had because the medical evaluation that was done would take care of any situation. I don't know what we would buy by going back in and doing a re-measurement."

But Foster said Lake is wrong. "It happens everyone is sick from this, and this is going to be with us for the rest of our lives. Every one of our doctors is telling us an accurate survey is important."

John Jessop, the welder, noticed something very strange while working in an underground utility corridor near the giant detection radar dishes at Clear. The discovery has him nervous.

"I'm no expert, but I know what I've seen," Jessop said. "I've seen some very disturbing, grossly deformed little critters, shrews and red-backed voles. I've seen them with crooked tails, crooked legs, humps on their back, deformities in their heads, and some without even any eyes. They run around out here in back of the screens."

Jessop said he talked about the rodents in the meetings

to the accident. "There's not adequate manning when the government is paying for it," Foster said. "To tell the truth about the accident is to tell the truth about a lot of money not accounted for."

One ITT subsidiary or another has operated and maintained the Ballistic Missile Early Warning System for 12 of the past 22 years. Under its current contract, ITT's Felec subsidiary is paid \$47,753,189 to operate and maintain the BMEWS headquarters at Colorado Springs and BNEWS stations at Clear, Greenland and England.

The Alaska Department of Labor cited Felec for two "serious" occupational safety violations on Dec. 29 and threatened to fine it \$840.

Jorgensen said the labor department and Felec have reached a tentative settlement in the case. Under the agreement, which is not yet in writing, Felec will be allowed to pay a reduced penalty of \$420 without admitting wrongdoing. Jorgensen said he is satisfied with the company's efforts to avoid a repeat of the accident. Foster is not.

Five months after the radar accident, Ed Forsling, 44; John Jessop, 42; Ron Foster, 36; and Richard Eldridge, 40, say some of their initial symptoms — short-term memory loss, vertigo, exhaustion and sleeping problems — have slackened. But they have not gone away.

Foster said that sometime, he loses control of his arms, which start "flapping like a chicken." While on the job Wednesday, his legs buckled beneath him. He was sent home on a medical leave.

Linda Jessop, John's wife, said their family life has suffered.

"It hurts watching what's going on with my husband," she said in Fairbanks recently while waiting for her husband to complete an eye examination. "I see the signs and symptoms, and the pain."

Jessop used to be an extremely active man, she said, generally working on welding projects in his own shop on Saturdays and spending all day Sunday with the four children still at home. Now he spends all day Saturday sleeping and only after lying in bed through Sunday morning can he find the energy to spend with his youngsters.

"All of a sudden, we don't do anything anymore. I have to tell the kids, 'Daddy don't feel well.' It's really hard on them because they can't see it. It's hard to explain that someone can be hurt without showing outside symptoms. It's not like the measles or chicken pox, or seeing a Band-aid."

On top of that, Mrs. Jessop said, she has had to cope with anonymous telephone threats.

About a month ago, someone called and asked, "Could

Neither William Emmons nor Carl Keppler, the two mechanical specialists from Sacramento, could be reached for comment.

Forsling has also been suffering pain, faint spells and numbness to his left side. Both Foster and Jessop said that in addition to headaches, they have trouble seeing backlit objects like television.

Forsling, who never wore glasses before, has been told he needs bifocals. Foster said his eye doctor has seen a rupture inside his eyeball.

Jessop has gone through two eyeglass prescriptions since the accident. On Feb. 14, while undergoing a follow-up eye examination in Fairbanks, Dr. Alfred DeRamus said, "It looks like something is starting to happen in there." Though it was too early to make a definite diagnosis, DeRamus thought the change he was seeing in Jessop's right eye might be the start of a cataract.

Foster said that he, Jessop and Forsling have been press-

Hansson said.

But research is slowly catching up, Hansson said. Technical improvements in equipment and methods have enabled researchers to detect minute changes in body chemistry caused by microwaves — changes that could have significant impact on a person as time goes on.

Hansson is now doing clinical studies for the Swedish armed forces on workers who have been exposed to radar, but he wouldn't reveal his preliminary findings.

"This is hot stuff," he said. "Swedish doctors are convinced of one thing: In the case of a microwave overexposure, patients should be treated 'in the range of a day or so,'" Hansson said.

If the men at Clear develop cataracts, they can be treated surgically, said Dr. Milton Zaret, an ophthalmologist from Scarsdale, N.Y., who identified a "microwave" cataract when conducting research for the Air Force.

But the cure is never com-

plete. A full-scale investigation of safety procedures at Clear in a letter he sent to Verne Orr, the Air Force secretary.

Young said the Air Force and Felec "did not cooperate in good faith with the affected employees in evaluating and treating any injuries or physical damage that may have incurred."

Young's aide, William Sharrow was unhappy with the public responses of both Felec and the Air Force. "One refers public questions to the other, and the other refuses to answer. It almost smacks of collusion."

K. Cormier, a spokeswoman for the Air Force Space Command in Colorado Springs, Colo., said Friday the Air Force has not yet responded to Young's demands. While a contract compliance team from the Air Force is scheduled to arrive at Clear today, she said, the visit is a routine annual inspection, not an investigation of the accident.

Sens. Ted Stevens and Frank Murkowski of Alaska have asked the Air Force to keep them informed of official

response team in Salt Lake City, suggested Jan. 12 that a second survey be done to alleviate the doubts expressed by the workers. The memo was obtained under the Freedom of Information Act.

In his memo, Curtis reported that Col. Roger Graham of Brooks Air Force Base had said the official Air Force position is to "discourage additional measurements." Curtis said he was told by Dr. John Mitchell, also of Brooks, that the problems of the Clear workers could be attributed to "age and smoking habits."

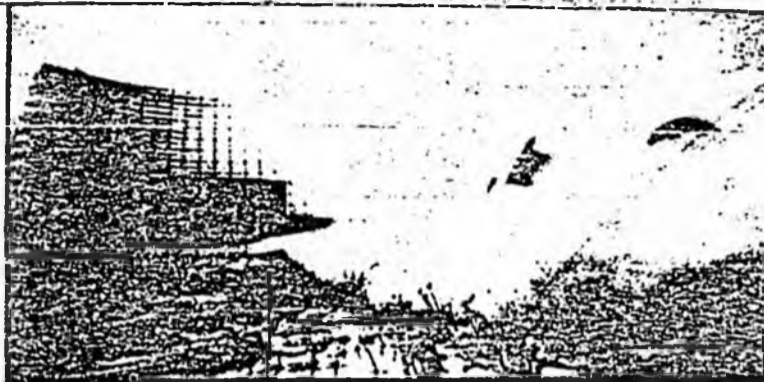
In an interview, Curtis said his OSHA supervisors in November asked him to prepare to fly to Alaska to conduct a second survey at Clear. But Lake, who has jurisdiction over OSHA activities in Alaska, called "and told us not to come."

Lake said in an interview that he "was still struggling" over whether to order a new survey.

"Hell, I don't know myself what I'm going to do," Lake said. "Based on the Air Force expertise in this area, we've

lowering the accident. A doctor from Eielson Air Force Base seemed interested at the time, but so far no one has gone to Clear to capture them.

After seeing what microwave radiation may have done to the mice and feeling what it already has done to him, Jessop is wondering what the future holds.



U.S. Air Force photo

Clear Air Force Station, part of the United States' ballistic missile early warning system.

After their exposure to microwaves at Clear, workers are looking for help

By RICHARD MAUER
Daily News reporter
Copyright © Anchorage Daily News

CLEAR — On a normal day, the giant aluminum web dish of the Clear tracking radar is pointed at the heavens, casting two powerful microwave beams skyward. The invisible, 5 million watt searchlight probes space for operating satellites, orbiting junk or ballistic missiles aimed at North America.

But on Sept. 14, the tracker beams were cut off and its motor drives stilled. The only noise within the dome sheltering the tracker dish came from eight men at work.

Richard Eldridge and John Jessop were welding a cracked aluminum tube. Carl Keppler and William Emmons, civil service inspectors from California, inspected the work and checked the alignment of critical parts. Ronald Foster and Ed Forsling, two radar technicians, helped the others. Two electri-

cians were installing floodlights beneath the dish.

Sometime after 3 that afternoon, strange things began to happen.

Eldridge, Jessop and Emmons couldn't understand why it was becoming so uncomfortably warm. The radome temperature had been about 60 when they walked in that morning.

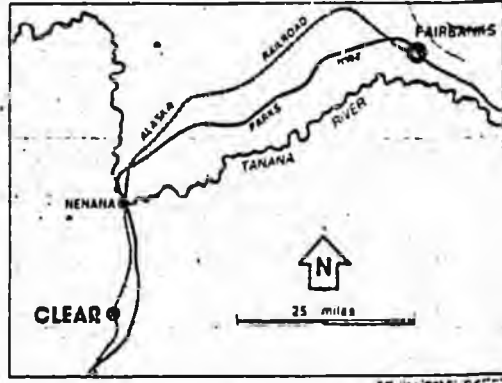
Their scalps were especially annoying, as if they had worn hats all day in the summer sun.

Even odder were the stinging metal filings. The welders prepared the aluminum for welding with a grinding wheel, which threw off hot and biting bits of metal.

As Foster crawled around the tracker radar looking for a hole where a fallen bolt belonged, he also felt the strange warmth.

Keppler left his spot on top of the dish and came over to the others. His flashlight was hot to the touch. The bulb had burned out.

See Page A-10. WORKERS



Map shows location of Clear Air Force Station.

Richard Eldridge, a welder at Clear, and his wife, Kathy, discuss the accident and its aftermath at their home in Fairbanks.

Radiation victims remain uncertain about the extent of damage and what future holds

Continued from Page A 1

Before it died, the light shined even when the switch was off, he told them.

"Are you kidding me?" Foster said. It sounded like a weird joke.

"Someone asked Emmons, 'Do you have a flashlight?'"

Emmons reached into his shirt pocket and pulled out a penlight.

It was glowing. The switch was off.

Emmons swept his arm around in an arc. The light in his hand shined brightly first, then dimmed as he swung it in front of him. At the end of the arc, it started blinking in a rapid rhythm.

At the same time, Eldridge heard something overhead on the aluminum screen. It was a crackling electrical arc, shooting between the tubular pieces. The blue spark was washing in time with Emmons' light.

The mystery was over.

"We got no radiation. We've got to get the hell out of here," Eldridge said.

Jessop on this job less than a year, he said.

"John, we've got to get out of here now," Eldridge told him.

The tracker had turned into an enormous, glowing ball.

No one panicked. While the six minutes ticked down, Eldridge asked Jessop the question.

"The instructions shielded from the radiation by distance and the bottom of the tracker tank, wondered what the commotion was about."

As the men left the radome with changes in their minds and bodies they don't understand this day, it brought an end to the most serious reported radiation accident at the Clear Missile Early Warning System base.

By the way it began, and the subsequent course of the Air Force and the International Telephone & Telegraph Co. subsidiary that runs the site, have raised serious questions about safety and operations at Clear, a key site in the strategic defense of North America.

Documents submitted to government agencies in connection with the microwave oven, reports prepared by ITT and the Air Force, and interviews with Clear employees and others close to the investigation show:

- An ingenious and foolproof radar switch that could have prevented the accident.
- Equipment bypassed as a matter of convenience.
- Monitoring panels and automatic controls that don't match the actual layout of the emitting equipment because of an equipment switch made before the base was opened in 1962. The switch, which was never corrected, contributed to the accident.
- Men who were not fully trained working alone on key control panels, while a critical work station was unmanned at the time of the accident.
- A simulation of the accident by the Air Force to determine the workers' exposure levels. A second working meter was used incorrectly.
- Despite repeated requests by the Alaska Department of Labor to the U.S. Occupational Safety and Health Administration for help in conducting a second, independent exposure simulation, the federal government has failed to respond. Last November, an OSHA radiation specialist in Salt Lake City was told to pack his bags for a flight to Alaska, but the trip was called off by the regional OSHA administrator in Seattle.
- The men, who continue to suffer from the exposure and whose conditions may deteriorate with time, say they have been treated dishonestly by officials who appear to be more eager to minimize the accident than to provide them with proper medical care. They are especially concerned about their eyes because cataracts have been linked to microwave exposure.
- Of the six, only Eldridge has seen independent doctors who are experts in the field of microwave overexposure; and he was fired by the ITT subsidiary, Felec Services Inc., while undergoing consultations on the East Coast. He said he was forced to remain away from his job longer than he expected because the Air Force wouldn't provide his medical records. It was not until he asked Sen Ted

Stevens, R-Alaska, for assistance that the records were finally sent to his doctors in New York and Massachusetts, he said.

When Dr. Don Justesen read about the Clear accident in Microwave News, a trade publication specializing in the kind of radiation emitted by radio transmitters and electrical devices, he noticed some striking parallels to his observations of laboratory mice and rats.

For the same reason that microwave ovens cook so rapidly — the radiation penetrates the food, warming it inside at the same time the surface is heated — microwaves from any source can be harmful to living organisms.

The great danger in exposure to high levels of radiation is that there is no way to know what is happening, said Justesen, director of the Veterans Administration Behavioral Radiology Laboratories in Kansas City.

The human body is designed to recognize heat that goes from "the outside in" because the nerve sensors that recognize heat are near the skin's surface, Justesen said. Intense microwave radiation, especially at the 420 megahertz frequency used by the Clear tracker, penetrates deep into tissue, Justesen said. Cells begin to die at temperatures several degrees lower than heat that triggers pain, he said.

When microwaves are beamed at rats or mice — animals that surpass most species in their ability to escape noxious situations — "they seem to get confused," Justesen said in a telephone interview. "They don't attribute the warming to external forces."

While it's difficult to translate effects from rats to man, one thing is clear, he said. "You could absorb quite a dollop of energy and even feel thermally discomforted and not know where it's coming from."

Whatever happened to the men at Clear, Justesen said, it would have been important for them to see a physician at once, especially if they complained of being warm or overheated. "The danger, as I see it, is delay," he said.

Four hours passed before the men saw even a nurse, Justesen was told.

"Oh, lord," he said.

When the workers got out of the radome, Ron Foster, the radar technician, asked his lead man, Andrew Souders, if the radar was on. Souders blanched.

A Nov. 29 ITT investigation would level most of the blame on Souders, who had opened the switches that allowed the radiation to enter the tracker and had pushed the button, that, unbeknown to him, had started the radar transmitter.

But employees familiar with the site say the accident occurred because of a compounding series of errors. Souders' actions wouldn't have put the men in jeopardy if other precautions had been followed, they said.

While Foster was talking with Souders, welder Richard Eldridge was calling his boss, Vern Finch.

"We just had a radiation accident," Eldridge told him.

When Finch arrived, the two welders weren't showing any signs of serious medical problems other than feeling warm and a bit out of sorts. He told them to go back up and finish the job. They balked.

"What guarantees do you have that this won't happen again?" Eldridge asked.

"You've got my word," Finch said.

"That's not good enough," said Eldridge.

Foster and Forsling were also told to return to work.

"They didn't treat it like an accident," Foster said later.

The workers finally agreed to go back and pick up their tools and re-build the parts that would allow the tracker to operate normally.

At 6:30 that evening, they were taken to the base nurse, another Felec employee. Their temperatures were still elevated. She measured their other vital signs.

Keppler had large red areas on his upper torso. Eldridge's wrist was burned where it rubbed a metal snap from his denim work shirt. He said later that the nurse failed to note that in her report.

Air Force officials promised the men that they would get expert care from the aerospace medicine center at Brooks Air Force Base in San Antonio, Texas — a promise that wouldn't be fulfilled for nearly a month.

A dispute developed around \$100,000 over

proving there are no effects," he said. He compared the situation to the debate over Agent Orange, the Vietnam war defoliant blamed for numerous ailments by veterans but which the Defense Department maintains was safe.

Koslov said the Clear workers received a strong enough dose of radiation to cause eye damage. It was critical that they be examined immediately to establish medical and psychological baselines from which future changes could be plotted.

"It would appear to me that responsible Air Force management would have been concerned as hell to get as much information as they can and handle it in a responsible manner."

On Sept. 22, eight days after the accident, the Air Force sent a team to Clear to simulate what happened and determine how much radiation hit the men.

Heading the Air Force team was Lt. Col. David Nuss of Elmendorf Air Force Base. He was accompanied by Capt. John Chigg of Eielson Air Force Base in Fairbanks.

Ron Foster, the radar technician, assisted the two, and he immediately became suspicious about the results. In conducting the tests, Nuss used two radiation detection meters. Though both were the same make and model, their readings were substantially different when placed side by side at the base of the tracker.

"Like 50 percent different," Foster said. Weeks later, when the lower-reading meter was sent to the factory, the company reported the meter probe was broken, Foster said.

The team laid the meter probe where they believed each man was working, on the radar dish just beneath the source of radiation. Then they left the dish to avoid being exposed and radioed technician Ed Forsling in the control room, who turned on the power.

The meter had to be exposed for a minimum of six seconds of radiation to achieve an accurate reading, Foster said, but instead they relied on an live-second count. Though Nuss' written report said his key readings were taken with 10-second exposures, Forsling said log entries would prove that the radar ran for only five seconds.

An internal Felec memo written Oct. 14 by the company's radiation protection officer, Cecil Gates, said Nuss used the meter switch position designed for measuring radiation leaks from microwave ovens, not the enormous and complex radiation fields produced by radar.

When Nuss took his readings, the radar emanated 900,000 watts. It produced about 1.5 million watts on Sept. 14, Foster said.

Nuss turned down a request for an interview, directing questions to the Air Force Space Command Headquarters in Colorado Springs, which is responsible for Clear. An Air Force spokeswoman at the Space Command said she couldn't provide answers about the survey over the phone. A series of written questions about the Clear accident mailed to the Space Command Feb. 9 had not been answered by Friday.

In a meeting after his Sept. 22 survey, Nuss presented his results to the workers. They were told not to worry.

"It was a slight exposure, like a minor sunburn. You don't require any medical attention," the men were told, according to Foster.

Nuss said the overexposure lasted eight minutes, ranging from a low of 19 milliwatts per square centimeter for Eldridge to a high of 102 milliwatts for Keppler. The maximum exposure allowed by the Air Force is 10 milliwatts, a standard that is about to be lowered to four milliwatts, according to Dr. John Mitchell, who directs the Air Force radiation research lab at Brooks.

During the Sept. 22 meeting, Foster did some rough calculations and concluded that the exposure was closer to 800 times the standard.

The next Monday, there was a conference call to Brooks. The doctors there would see all six men for intensive "flight physicals," but not for two weeks. Keppler, Eldridge, Emmons and Forsling agreed to go. Jessop and Foster would not. They were getting too suspicious of the Air Force.

Foster and Jessop finally visited Brooks last month, but they have yet to receive their

There seems to be more of an effort

Miller declined to comment for this article. He referred all questions to Robert Laird, industrial relations manager for Felec Services in Colorado Springs, Colo. Laird, who has represented the company in meetings with the Alaska Department of Labor, refused to comment about any aspect of the radiation accident and referred questions to ITT's public relations department in Paramus, N.J. There, John O'Grady, who oversees the public relations department as an ITT vice president and director of administration, also refused to discuss the accident. "We have no comment at all," O'Grady said.

Miller promised to send the badges to a lab for processing. "We'll fly them out and in 24 hours, we'll know the level of radiation," he told Eldridge.

The men spent a restless night. They reported for work the next morning. After lunch, they were taken by van to Fairbanks Memorial Hospital, 80 miles away.

While the doctors there acknowledged their lack of experience in microwave radiation, they diagnosed the men as suffering nothing more than a "mild sunburn," according to the workers. The symptoms the men were complaining about — restlessness, dizziness, disorientation, headaches and pain through their bodies — could be attributed to stress, they said.

While at the hospital, Jessop began feeling wobbly and sick to the stomach. He was hospitalized about a week. Eldridge checked in the next day.

Seven days after the accident, the secretary for the Clear site manager called Eldridge and Jessop at home. The results from the film badges had finally come back.

The men had not been radiated, she said.

"Why the hell did they give them radiation badges?" said Samuel Koslov, former special assistant for science to the assistant secretary of the Navy and now a researcher at Johns Hopkins University in Baltimore. "I would suspect that was really stupid."

Film badges can't detect microwave radiation, Koslov said in a telephone interview.

Though the radiation at Clear failed to darken the film badges as X-rays would have, it could have done something to the men, said Koslov, who based his opinion on reports of the exposure in Microwave News.

"That's a very high exposure, but a fairly short time," he said.

After decades of research into the biological effects of microwaves, scientists are sharply divided.

Some scientists say that even at low-power levels, radio waves at certain frequencies, especially in the microwave range, can change body cells and chemistry in subtle ways and also alter behavior.

Cataracts, or clouding of the eye lenses, are one possible effect, they say. Genetic changes and alterations in the body's disease-fighting immunological system are also possible.

Russian scientists long ago concluded that microwaves change behavior and have set an occupational standard one-thousandth that of the U.S. standard.

The Russian research has led some American scientists to speculate that the "Moscow signal" — a low-power microwave transmission beam at the U.S. Embassy in Moscow for more than a decade — was designed to disrupt the thoughts of U.S. diplomats. That belief was not shared officially by the State Department or the CIA.

Koslov said that despite all the years of U.S. research into microwaves, most of it, paid for by the Pentagon, has been misdirected.

WORKER RIGHT TO KNOW AMENDMENTS

HB 319 amends the "worker right to know" statutes to include physical agents with other toxic and hazardous substances about which employers must inform their employees.

The existing statute (AS 18.60) directs the Department of Labor to prepare for employers, information data sheets on hazardous and toxic materials to which employees may be exposed in the workplace. Information which is compiled by the Department is transmitted to the workers through the employers, includes: description of the substantiated effects of the substance, known threshold levels where effects occur, activities and situations where the substances are encountered and practices, technology and preventative measures which are available to the workers which will reduce or eliminate the negative impacts of the substance.

These notification and educational efforts, organized by the Department were instituted with the enactment of the right to know legislation (SB 79) in 1983 which was supported by industry, labor, environmental and health groups and interests.

Physical agents, which would be subject to these informational requirements with passage of these amendments, are those identified by the American Conference of Governmental Industrial Hygienists (ACGIH) and include:

- Ionizing radiation (X-ray)
- Heat and Cold Stress
- Impulsive and Impact Noise
- Radiofrequency, microwave, ultraviolet, and infrared radiation
- Lasars
- Hand-arm (segmented) vibration

Physical agents often are not recognized as dangerous substances. With enactment of this bill's amendments industrial accidents will be reduced in number and severity. For example, accidents such as the microwave exposure at Clear Air Force Station may be avoided if workers are better informed of the substances to which they may be exposed and are aware of preventative and safety precautions. Many occupations are not readily associated with exposure to dangerous levels of physical agents. Welders and pipe fitters for example are often exposed to hazardous exposures of ionizing radiation (x-rays) when examining welds and joints.

It is anticipated there will be little or no fiscal impact as a function of these amendments to the right to know statute. The Department of Labor will essentially be editing information from national organizations relating to health and safety in the workplace, including the ACGIH, the Center for Disease Control, and Occupational Safety and Health Administration (OSHA).

A M E N D M E N T

#1

Offered in the HOUSE

By Pourchot

To: HB 319

Page 5, after line 1: Insert a new bill section to read:

"* Sec. 5. AS 18.60.105(a)(1) is amended to read:

(1) 'be exposed' means to ingest, inhale, or absorb through the skin or eyes a substance or physical agent, or fumes or other potentially harmful aspect of a substance or physical agent."

Renumber remaining sections.

Hein ,

A M E N D M E N T

#2

Offered in the HOUSE

By Pourchot

To: HB 319

Page 5, lines 3 - 6: Delete all material and insert

"(11) 'physical agent' means 'physical agent' as defined by the department by regulation; the department shall initially define the term to include only physical agents listed in the 1984 - 1985 edition of 'Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment' published by the American Conference of Governmental Industrial Hygienists, and shall amend the definition to include physical agents listed in future editions as they are published; "

Alaska State Legislature

REPRESENTATIVE
PAT POURCHOT

HOUSE FINANCE COMMITTEE
COMMITTEE ON OIL AND GAS



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House of Representatives MEMORANDUM

DATE: March 28, 1985

TO: Representative Mike Navarre
Chair, House Labor and Commerce Committee

FROM: Representative Pat Pourchot

SUBJECT: HB 319, Worker Right-to-Know, Physical Agents in the
Workplace

This bill amends the 1983 "right-to-know" which required employees to provide information and training to employees on hazardous and toxic substances in the workplace. This bill would require the same information and training for certain specifically potentially hazardous "physical agents" such as x-rays, microwaves, and noise.

It is my sense that this is not a controversial measure - we fought the major battles on right-to-know in 1983. No new requirements are included in the bill, only several more health hazards.

Let me emphasize that the burden of providing original information will fall to the Department of Labor and not to individual employers. It is my understanding that the Department is preparing a zero fiscal note, as the information for the needed safety data sheets is largely available and only in need of editing.

I would most appreciate your early consideration of this bill. If I and my staff can help you and the committee in any manner, please let me know.

Thank you for your assistance.

PJP:RJR:jl

1983-84 TLV PHYSICAL AGENTS COMMITTEE

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Any comments or questions regarding these limits, or requests to reprint should be addressed to:

Executive Secretary
American Conference of Governmental
Industrial Hygienists
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Cincinnati, OH 45211: (513) 661-7881

PREFACE

PHYSICAL AGENTS

These threshold limit values refer to levels of physical agents and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Because of wide variations in individual susceptibility, exposure of an occasional individual at, or even below, the threshold limit may not prevent annoyance, aggravation of a pre-existing condition, or physiological damage.

These threshold limits are based on the best available information from industrial experience, from experimental human and animal studies, and when possible, from a combination of the three.

These limits are intended for use in the practice of industrial hygiene and should be interpreted and applied only by a person trained in this discipline. They are not intended for use, or for modification for use, (1) in the evaluation or control of the levels of physical agents in the community, (2) as proof or disproof of an existing physical disability, or (3) for adoption by countries whose working conditions differ from those in the United States of America.

These values are reviewed annually by the Committee on Threshold Limits for Physical Agents for revisions or additions, as further information becomes available.

Notice of Intent — At the beginning of each year, proposed actions of the Committee for the forthcoming year are issued in the form of a "Notice of Intent." This notice provides not only an opportunity for comment, but solicits suggestions of physical agents to be added to the list. The suggestions should be accompanied by substantiating evidence.

As Legislative Code — The Conference recognizes that the Threshold Limit Values may be adopted in legislative codes and regulations. If so used, the intent of the concepts contained in the Preface should be maintained and provisions should be made to keep the list current.

**THRESHOLD LIMIT VALUES
HEAT STRESS**

These Threshold Limit Values refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs shown in Table 1 are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C.^{11, 21}

Since measurement of deep body temperature is impractical for monitoring the workers' heat load, the measurement of environmental factors is required which most nearly correlate with deep body temperature and other physiological responses to heat. At the present time Wet Bulb Globe Temperature Index (WBGT) is the simplest and most suitable technique to measure the environmental factors. WBGT values are calculated by the following equations:

1. Outdoors with solar load:
WBGT = 0.7 NWB + 0.2 GT + 0.1 DB
 2. Indoors or Outdoors with no solar load:
WBGT = 0.7 NWB + 0.3 GT
- where:

WBGT = Wet Bulb Globe Temperature Index
NWB = Natural Wet-Bulb Temperature
DB = Dry-Bulb Temperature
GT = Globe Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer.

Higher heat exposures than shown in Table 1 are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant to work in heat than the average worker. Workers should not be permitted to continue their work when their deep body temperature exceeds 38.0°C.

EVALUATION AND CONTROL

I. Measurement of the Environment

The instruments required are a dry-bulb, a natural wet-bulb, a globe thermometer, and a stand. The

**TABLE 1
Permissible Heat Exposure Threshold Limit Values
(Values are given in °C, WBGT)**

Work — Rest Regimen	Work Load		
	Light	Moderate	Heavy
Continuous work	30.0	26.7	25.0
75% Work — 25% Rest, Each hour	30.6	28.0	25.9
50% Work — 50% Rest, Each hour	31.4	29.4	27.9
25% Work — 75% Rest, Each hour	32.2	31.1	30.0

measurement of the environmental factors shall be performed as follows:

A. The range of the dry and the natural wet bulb thermometer shall be -5°C to 50°C with an accuracy of ±0.5°C. The dry bulb thermometer must be shielded from the sun and the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet-bulb thermometer shall be kept wet with distilled water for at least 1/2 hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillarity. The wick shall be wetted by direct application of water from a syringe 1/2 hour before each reading. The wick shall extend over the bulb of the thermometer, covering the stem about one additional bulb length. The wick should always be clean and new wicks should be washed before using.

B. A globe thermometer, consisting of a 15 cm. (6-inch) diameter hollow copper sphere painted on the outside with a matte black finish or equivalent, shall be used. The bulb or sensor of a thermometer (range -5°C to 100°C with an accuracy of ±0.5°C) must be fixed in the center of the sphere. The globe thermometer shall be exposed at least 25 minutes before it is read.

counted as rest time when additional rest allowance must be given because of high environmental temperatures.

IV. Water and Salt Supplementation

During the hot season or when the worker is exposed to artificially generated heat, drinking water shall be made available to the workers in such a way that they are stimulated to frequently drink small amounts, i.e., one cup every 15-20 minutes (about 150 ml or 1/4 pint).

The water shall be kept reasonably cool (10°-15°C or 50.0°-60.0°F) and shall be placed close to the workplace so that the worker can reach it without abandoning the work area.

The workers should be encouraged to salt their food abundantly during the hot season and particularly during hot spells. If the workers are unacclimatized, salted drinking water shall be made available in a concentration of 0.1% (1g NaCl to 1.0 liter or 1 level tablespoon of salt to 15 quarts of water). The added salt shall be completely dissolved before the water is distributed, and the water shall be kept reasonably cool.

V. Other Considerations

A. *Clothing*: The permissible heat exposure TLVs are valid for light summer clothing as customarily worn by workers when working under hot environmental conditions. If special clothing is required for performing a particular job and this clothing is heavier or it impedes sweat evaporation or has higher insulation value, the worker's heat tolerance is reduced, and the permissible heat exposure limits indicated in Table 1 and Figure 1 are not applicable. For each job category where special clothing is required, the permissible heat exposure limit shall be established by an expert.

B. *Acclimatization and Fitness*: Acclimatization to heat involves a series of physiological and psychological adjustments that occur in an individual during his first week of exposure to hot environmental conditions. The recommended heat stress TLVs are valid for acclimated workers who are physically fit. Extra caution must be employed when unacclimated or physically un-fit workers must be exposed to heat stress conditions.

References:

1. *Health Factors Involved in Working Under Conditions of Heat Stress*. WHO Technical Report Series No. 412 (1969).

2. Dukes-Dobos, F. M. and A. Hanschel: Development of Permissible Heat Exposure Limits for Occupational Work. *ASHRAE Journal* 15(9):57-62 (Sept. 1973).
3. Minard, D.: *Prevention of Heat Casualties in Marine Corps Recruits, Period of 1955-60, with Comparative Incidence Rates and Climatic Heat Stresses in Other Training Categories*. Research Report No. 4, Contract No. MR 005.01-0001.01, Naval Medical Research Institute, Bethesda, MD (Feb. 21, 1961). Published in *Military Medicine* 126(44):261-272 (April 1961).
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6. *Ergonomics Guide to Assessment of Metabolic and Cardiac Costs of Physical Work*. *Am. Ind. Hyg. Assoc. J.* 32:560 (1971).
7. *Energy Requirements for Physical Work*. Research Progress Report No. 30, Purdue Farm Cardiac Project, Agricultural Experiment Station, West Lafayette, IN (1961).
8. Dumin, J. V. G. A. and R. Passmore: *Energy, Work and Leisure*. Heinemann Educational Books, Ltd., London (1967).
9. Lehmann, G. E., A. Muller and H. Spitzer: *Der Kalorienbedarf bei Gewerblicher Arbeit*. *Arbeitsphysiol.* 14:166 (1950).

IONIZING RADIATION

The Committee accepts the philosophy and recommendations of the National Council on Radiation Protection and Measurements (NCRP) for the ionizing radiation TLV. The NCRP is chartered by Congress to, in part, collect, analyze, develop and disseminate information and recommendations about protection against radiation and about radiation measurements, quantities and units, including development of basic concepts in these areas. NCRP Report No. 39 provides basic philosophy and concepts leading to protection criteria established in the same report.¹ Other NCRP reports address specific areas of radiation protection and, collectively, provide an excellent basis for establishing a sound program for radiation control. The Committee recommends the listed references as substantive documentation of a sound basis for ionizing radiation protection. The committee also strongly recommends that all exposures to ionizing radiations be kept as low as reasonably achievable within the stated guidance.

References:

1. *Basic Radiation Protection Criteria*. NCRP Report No. 39 (January 15, 1971).

2. *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure*. National Bureau of Standards Handbook 69, (June 5, 1959), with *Addendum 1* (August 1963). Available as NCRP Report No. 22.

The above documents, as well as information on numerous other NCRP Reports addressing specific subjects in ionizing radiation protection are available from: NCRP Publications, PO Box 30175, Washington, DC 20014.

LASERS

The threshold limit values are for exposure to laser radiation under conditions to which nearly all workers may be exposed without adverse effects. The values should be used as guides in the control of exposures and should not be regarded as fine lines between safe and dangerous levels. They are based on the best available information from experimental studies.

Limiting Apertures

The TLVs expressed as radiant exposure or irradiance in this section may be averaged over an aperture of 1 mm except for TLVs for the eye in the spectral range of 400-1400 nm, which should be averaged over a 7 mm limiting aperture (pupil); and except for all TLVs for wavelengths between 0.1-1 mm where the limiting aperture is 10 mm. No modification of the TLVs is permitted for pupil sizes less than 7 mm.

The TLVs for "extended sources" apply to sources which subtend an angle greater than α (Table 7) which varies with exposure time. This angle is *not* the beam divergence of the source.

Correction Factors A and B (C_A and C_B)

The TLVs for ocular exposure in Tables 4 and 5 are to be used as given for all wavelength ranges. The TLVs for wavelengths between 700 nm and 1049 nm are to be increased by a uniformly extrapolated factor (C_1) as shown in Figure 2. Between 1049 nm and 1400 nm, the TLV has been increased by a factor (C_1) of five. For certain exposure times at wavelengths between 550 nm and 700 nm, correction factor (C_2) must be applied.

The TLVs for skin exposure are given in Table 6. The TLVs are to be increased by a factor (C_1) as shown in Figure 2 for wavelengths between 700 nm and 1400 nm. To aid in the determination of TLVs for exposure durations requiring calculations of fractional powers Figures 3, 4, 5 and 6 may be used.

Repetitively Pulsed Lasers

Since there are few experimental data for multiple pulses, caution must be used in the evaluation of such exposures. The protection standards for irradiance or radiant exposure in multiple pulse trains have the following limitations:

(1) The exposure from any single pulse in the train is limited to the protection standard for a single comparable pulse.

(2) The average irradiance for a group of pulses is limited to the protection standard as given in Tables 4, 5, or 7 of a single pulse of the same duration as the entire pulse group.

(3) When the Instantaneous Pulse Repetition Frequency (PRF) of any pulses within a train exceeds one, the protection standard applicable to each pulse is reduced as shown in Figure 6 for pulse durations less than 10^{-3} second. For pulses of greater duration, the following formula should be followed:

$$\text{Standard (single pulse in train)} = \frac{\text{Standard (pulse } n\tau)}{n}$$

where:

n = number of pulses in train

τ = duration of a single pulse in the train

Standard ($n\tau$) = protection standard of one pulse having a duration equal to $n\tau$ seconds.

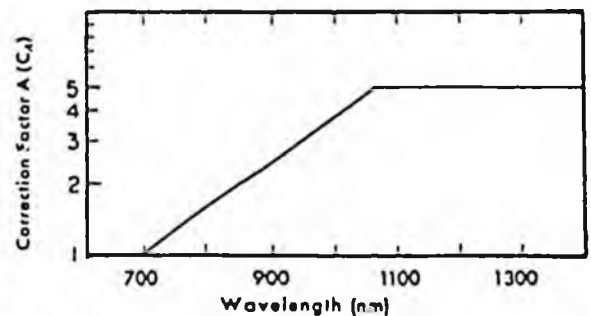


Figure 2 — TLV correction factor for $\lambda = 700 - 1400$ nm*

*For $\lambda = 700 - 1049$ nm, $C_1 = 10^{(11049 - \lambda) / 2000}$
 For $\lambda = 1050 - 1400$ nm, $C_1 = 5$

NOISE

These threshold limit values refer to sound pressure levels and durations of exposure that represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech. Prior to 1979, the medical profession had defined hearing impairment as an average hearing threshold level in excess of 25 decibels (ANSI-S3.6-1969) at 500, 1000, and 2000 Hz, and the limits which are given have been established to prevent a hearing loss in excess of this level.¹⁰ The values should be used as guides in the control of noise exposure and, due to individual susceptibility, should not be regarded as fine lines between safe and dangerous levels.

It should be recognized that the application of the TLV for noise will not protect all workers from the adverse effects of noise exposure. A hearing conservation program with audiometric testing is necessary when workers are exposed to noise at or above the TLV levels.

Continuous or Intermittent

The sound level shall be determined by a sound level meter, conforming as a minimum to the requirements of the American National Standard Specification for Sound Level Meters, S1.4 (1971) Type 32A, and set to use the A-weighted network with slow meter response. Duration of exposure shall not exceed that shown in Table 8.

These values apply to total duration of exposure per working day regardless of whether this is one continuous exposure or a number of short-term exposures and does include the impact and impulsive type of noise that contributes to the sound level meter reading at slow response.

When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions:

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_n}{T_n}$$

exceeds unity, then, the mixed exposure should be considered to exceed the threshold limit value, C_1 in-

¹⁰In 1979, the American Academy of Ophthalmology and Otolaryngology (AAO) included 3000 Hz in their hearing impairment formula.

Table 8
Threshold Limit Values

Duration per Day Hours	Sound Level dBA†
16	80
8	85
4	90
2	95
1	100
1/2	105
1/4	110
1/8	115*

†Sound level in decibels are measured on a sound level meter, conforming as a minimum to the requirements of the American National Standard Specification for Sound Level Meters, S1.4 (1971) Type S2A, and set to use the A-weighted network with slow meter response.

*No exposure to continuous or intermittent in excess of 115 dBA

indicates the total duration of exposure at a specific noise level, and T_1 indicates the total duration of exposure permitted at that level. All on-the-job noise exposures of 80 dBA or greater shall be used in the above calculations.

IMPULSIVE OR IMPACT NOISE

It is recommended that exposure to impulsive or impact noise shall not exceed the limits listed in Table 9 or taken from Figure 7. No exposures in excess of 140 decibels peak sound pressure level are permitted. Impulsive or impact noise is considered to be those variations in noise levels that involve maxima at intervals of greater than one per second. Where the intervals are less than one second, it should be considered continuous.

Table 9
Threshold Limit Values Impulsive or Impact Noise

Sound Level dB**	Permitted Number of Impulses or Impacts per day
140	100
130	1000
120	10,000

**Decibels peak sound pressure level, re 20 μ Pa

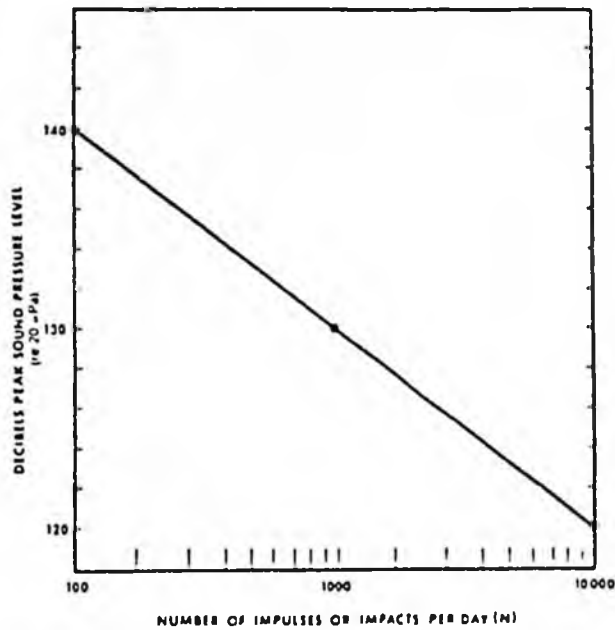


Figure 7 — Threshold Limit Values for Impulse/Impact Noise.

RADIOFREQUENCY/MICROWAVE RADIATION

These Threshold Limit Values (TLVs) refer to radiofrequency (RF) and microwave radiation in the frequency range from 10 kHz to 300 GHz, and represent conditions under which it is believed workers may be repeatedly exposed without adverse health effects. The TLVs shown in Table 10 are selected to limit the average whole body specific absorption rate (SAR) to 0.4 W/kg in any six minutes (0.1 hr) period for 3 MHz to 300 GHz, see Figure 8. Between 10 kHz and 3 MHz the average whole body SAR is still limited to 0.4 W/kg, but the plateau at 100 mW/cm² was set to protect against shock and burn hazards.

Since it is usually impractical to measure the SAR, the TLVs are expressed in units that are measurable, viz, squares of the electric and magnetic field strengths, averaged over any 0.1 hour period. This

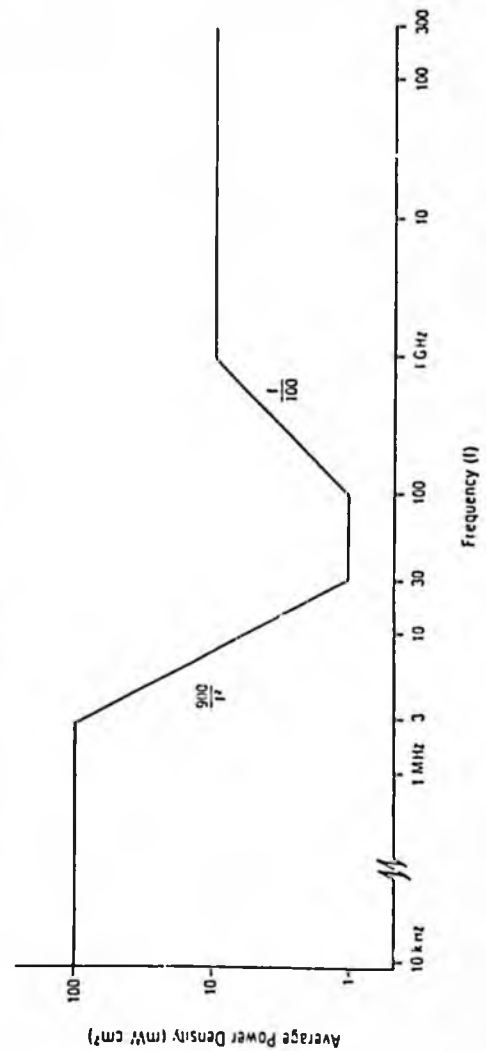


Figure 8 — Threshold Limit Values (TLV) for Radiofrequency/Microwave Radiation in Workplace (Whole Body SAR Less Than 0.4 W/kg).

For example, for frequencies from 3 to 30 MHz, the equivalent power density can be increased by a factor of 10 up to a limit of 100 mW/cm², if it can be assured that exposed individuals are not in contact with the ground plate.

6. At frequencies below 30 MHz, ungrounded objects such as vehicles, fences, etc., can strongly couple to RF fields. For field strengths near the TLV, shock and burn hazards can exist. Care should be taken to eliminate ungrounded objects, to ground such objects, or use insulated gloves when ungrounded objects must be handled.
7. No measurement should be made within 5 cm of any object.
8. All exposures should be limited to a maximum (peak) electric field intensity of 100 kV/m.

ULTRAVIOLET RADIATION*

These threshold limit values refer to ultraviolet radiation in the spectral region between 200 and 400 nm and represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. These values for exposure of the eye or the skin apply to ultraviolet radiation from arcs, gas, and vapor discharges, fluorescent, and incandescent sources, and solar radiation, but do not apply to ultraviolet lasers.* These values do not apply to ultraviolet radiation exposure of photosensitive individuals or of individuals concomitantly exposed to photosensitizing agents.† These values should be used as guides in the control of exposure to continuous sources where the exposure duration shall not be less than 0.1 sec.

These values should be used as guides in the control of exposure to ultraviolet sources and should not be regarded as a fine line between safe and dangerous levels.

Recommended Values:

The threshold limit value for occupational exposure to ultraviolet radiation incident upon skin or eye where irradiance values are known and exposure time is controlled are as follows:

1. For the near ultraviolet spectral region (320 to 400 nm) total irradiance incident upon the unprotected

*See Laser TLVs.

skin or eye should not exceed 1 mW/cm² for periods greater than 10³ seconds (approximately 16 minutes) and for exposure times less than 10³ seconds should not exceed one J/cm².

2. For the actinic ultraviolet spectral region (200 — 315 nm), radiant exposure incident upon the unprotected skin or eye should not exceed the values given in Table 11 within an 8-hour period.
3. To determine the effective irradiance of a broad-band source weighted against the peak of the spectral effectiveness curve (270 nm), the following weighting formula should be used:

$$E_{eff} = \sum E_{\lambda} S_{\lambda} \Delta\lambda$$

where:

- E_{eff} = effective irradiance relative to a monochromatic source at 270 nm in W/cm² (J/s/cm²)
- E_{λ} = spectral irradiance in W/cm²/nm
- S_{λ} = relative spectral effectiveness (unitless)
- $\Delta\lambda$ = band width in nanometers

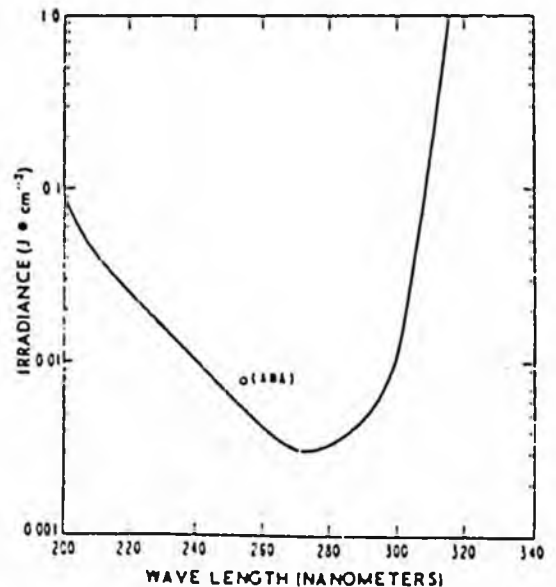


Figure 9 — Threshold Limit Values for Ultraviolet Radiation

TABLE 11
Relative Spectral Effectiveness
by Wavelength*

Wavelength (nm)	TLV (mJ/cm ²)	Relative Spectral Effectiveness S _λ
200	100	0.03
210	40	0.075
220	16	0.12
230	16	0.19
240	10	0.30
250	7.0	0.43
254	6.0	0.5
260	4.6	0.65
270	3.0	1.0
280	3.4	0.88
290	4.7	0.64
300	10	0.30
305	50	0.06
310	200	0.015
315	1000	0.003

*See Laser TLVs.

TABLE 12
Permissible Ultraviolet Exposures

Duration of Exposure Per Day	Effective Irradiance, E _{eff} (μW/cm ²)
8 hrs.	0.1
4 hrs.	0.2
2 hrs.	0.4
1 hr.	0.8
30 min.	1.7
15 min.	3.3
10 min.	5
5 min.	10
1 min.	50
30 sec.	100
10 sec.	300
1 sec.	3,000
0.5 sec.	6,000
0.1 sec.	30,000

4. Permissible exposure time in seconds for exposure to actinic ultraviolet radiation incident upon the unprotected skin or eye may be computed by dividing 0.003 J/cm² by E_{eff} in W/cm². The exposure time may also be determined using Table 12 which provides exposure times corresponding to effective irradiances in μW/cm².
5. All the preceding TLVs for ultraviolet energy apply to sources which subtend an angle less than 80°. Sources which subtend a greater angle need to be measured only over an angle of 80°.

Conditioned (tanned) individuals can tolerate skin exposure in excess of the TLV without erythematous effects. However, such conditioning may not protect persons against skin cancer.

Reference:

1. *Sunlight and Man*. Fitzpatrick et al, Eds. Univ. of Tokyo Press, Tokyo, Japan (1974).

NOTICE OF INTENDED CHANGES
(for 1984-85)

These physical agents, with their corresponding values, comprise those for which either a limit has been proposed for the first time, or for which a change in the "Adopted" listing has been proposed. In both cases, the proposed limits should be considered trial limits that will remain in the listing for a period of at least one year. If after one year no evidence comes to light that questions the appropriateness of the values herein the values will be reconsidered for the "Adopted" list.

NOTICE OF INTENT TO ESTABLISH
THRESHOLD LIMIT VALUES
LASERS

It is proposed that the following footnote be added to Table 6 (Threshold Limit Value for Skin Exposure from a Laser Beam).

The IR-B and IR-C exposures to skin surface areas A(cm²) exceeding 1000 cm², the TLV is

$$(100,000/A) \cdot (mW/cm^2);$$

for areas greater than 10,000 cm², the TLV is 10 mW/cm².

LIGHT AND NEAR-INFRARED RADIATION

These Threshold Limit Values refer to visible and near-infrared radiation in the wavelength range of 400

$$\sum_{400}^{1400} E_{\lambda} \cdot t \cdot B_{\lambda} \cdot \Delta\lambda \leq 10 \text{ mJ} \cdot \text{cm}^{-2} \quad (t \leq 10^4 \text{ s}) \quad (5a)$$

$$\sum_{400}^{1400} E_{\lambda} \cdot B_{\lambda} \cdot \Delta\lambda \leq 1 \mu\text{W} \cdot \text{cm}^2 \quad (t \geq 10^4 \text{ s}) \quad (5b)$$

For a source where the blue light weighted irradiance E (blue) exceeds $1 \mu\text{W} \cdot \text{cm}^{-2}$ is the maximum permissible exposure duration t_{max} in seconds is:

$$t_{max} = 10 \text{ mJ} \cdot \text{cm}^{-2} \cdot E \text{ (blue)} \quad (6)$$

3. *Infrared Radiation:* To avoid possible delayed effects upon the lens of the eye (cataractogenesis), the infrared radiation ($\lambda > 770 \text{ nm}$) should be limited to 10 mWcm^{-2} . For an infrared heat lamp or any near-infrared source where a strong visual stimulus is absent, the near infrared (770-1400 nm) radiance as viewed by the eye should be limited to:

$$\sum_{770}^{1400} L_{\lambda} \Delta\lambda \leq 0.6/\alpha \quad (7)^*$$

for extended duration viewing conditions. This limit is based upon a 7 mm pupil diameter.

AIRBORNE UPPER SONIC AND ULTRASONIC ACOUSTIC RADIATION

These threshold limit values refer to sound pressure levels that represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. The values listed in Table 14 should be used as guides in the control of noise exposure and, due to individual susceptibility, should not be regarded as fine lines between safe and dangerous levels. The levels for the third octave bands centered below 20 kHz are below those which cause subjective effects. Those levels for 1/3 octaves above 20 kHz are for prevention of possible hearing losses from subharmonics of these frequencies.

*Formulae (1) and (7) are empirical and are not, strictly speaking, dimensionally correct. To make the formulae dimensionally correct, one would have to insert a dimensional correction factor k in the right hand numerator in each formula. For formula (1) this would be $k_1 = 1 \text{ W} \cdot \text{rad} \cdot \text{s}^2/(\text{cm}^2 \cdot \text{sr})$, and for formula (7) $k_2 = 1 \text{ W} \cdot \text{rad}/(\text{cm}^2 \cdot \text{sr})$.

TABLE 14

Permissible Ultrasound Exposure Levels

Mid-Frequency of Third-Octave Band kHz	One-Third Octave — Band Level in dB re 20 μPa
10	80
12.5	80
16	80
20	105
25	110
31.5	115
40	115
50	115

COLD STRESS

These Threshold Limit Values (TLVs) are intended to protect workers from the severest effects of cold stress (hypothermia) and cold injury and to describe exposures to cold working conditions under which it is believed that nearly all workers can be repeatedly exposed without adverse health effects. The TLV objective is to prevent the deep body core temperature from falling below 36°C and to prevent cold injury to body extremities. Deep body temperature is the core temperature of the body as determined by rectal temperature measurements. For a single, occasional exposure to a cold environment a drop in core temperature of no lower than 35°C should be permitted. In addition to provisions for total body protection, the TLV objective is to protect all parts of the body with emphasis on hands, feet and head from cold injury.

Introduction to Cold Stress

Fatal exposures to cold among workmen have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is the fall in the deep core temperature of the body. The clinical presentations of victims of hypothermia are shown in Table 15 (taken from Dembert in AFP, January 1982). Workmen should be protected from exposure to cold so that the deep core temperature does not fall below 36°C .

TABLE 18
Wind Chill Cooling Rate Effects*

Wind Chill Rates (Watts/m ² /hr)	Comments/Effects
700	Conditions considered comfortable when dressed for skiing.
1200	Conditions no longer pleasant for outdoor activities on overcast days.
1400	Conditions no longer pleasant for outdoor activities on sunny days.
1600	Freezing of exposed skin begins for most people depending on the degree of activity and the amount of sunshine.
2300	Conditions for outdoor travel such as walking become dangerous. Exposed areas of the face freeze in less than 1 minute for the average person.
2700	Exposed flesh will freeze within half a minute for the average person.

*From Canadian Department of the Environment, Atmospheric Environment Service.

Work-Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below -7°C (20°F) heated warming shelters (tents, cabins, rest rooms, etc.) shall be made available nearby and the workers should be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria, are indications for immediate return to the shelter. When entering the heated shelter the outerlayer of clothing shall be removed and the remainder of the clothing loosened to permit sweat evaporation or a change of dry work clothing provided. A change of dry work clothing shall be provided as necessary to prevent workers from returning to their work with wet clothing. Dehydration, or the loss of body fluids occurs insidiously in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at

the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of a diuretic and circulatory effect.

For work practices at or below -12°C (10°F) ECT the following shall apply:

1. The worker shall be under constant protective observation (buddy system or supervision).
2. The work rate should not be so high as to cause heavy sweating that will result in wet clothing; if heavy work must be done, rest periods must be taken in heated shelters and opportunity for changing into dry clothing shall be provided.
3. New employees shall not be required to work full-time in cold in the first days until they become accustomed to the working conditions and required protective clothing.
4. The weight and bulkiness of clothing shall be included in estimating the required work performance and weights to be lifted by the worker.
5. The work shall be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats shall not be used. The worker should be protected from drafts to the greatest extent possible.
6. The workers shall be instructed in safety and health procedures. The training program shall include as a minimum instruction in:
 - a. Proper rewarming procedures and appropriate first aid treatment.
 - b. Proper clothing practices.
 - c. Proper eating and drinking habits.
 - d. Recognition of impending frostbite.
 - e. Recognition signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur.
 - f. Safe work practices.

Special Workplace Recommendations

Special design requirements for refrigerator rooms include the following:

1. In refrigerator rooms, the air velocity should be minimized as much as possible and should not exceed 1 meter/sec (200 fpm) at the job site. This can be achieved by properly designed air distribution systems.

2. Special wind protective clothing shall be provided based upon existing air velocities to which workers are exposed.

Special caution shall be exercised when working with toxic substances and when workers are exposed to vibration. Cold exposure may require reduced exposure limits.

Eye protection for workers employed out-of-doors in a snow and/or ice-covered terrain shall be supplied. Special safety goggles to protect against ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) and blowing ice crystals are required when there is an expanse of snow coverage causing a potential eye exposure hazard.

Workplace monitoring is required as follows:

1. Suitable thermometry should be arranged at any workplace where the environmental temperature is below 16°C (60°F) to enable overall compliance with the requirements of the TLV to be maintained.
2. Whenever the air temperature at a workplace falls below -1°C (30°F), the dry bulb temperature should be measured and recorded at least every 4 hours.
3. In indoor workplaces, the wind speed should also be recorded at least every 4 hours whenever the rate of air movement exceeds 2 meters per second (5 mph).
4. In outdoor work situations, the windspeed should be measured and recorded together with the air temperature whenever the air temperature is below -1°C (30°F).
5. The equivalent chill temperature shall be obtained from Table 16 in all cases where air movement measurements are required, and shall be recorded with the other data whenever the equivalent chill temperature is below -7°C (20°F).

Employees shall be excluded from work in cold at -1°C (30°F) or below if they are suffering from diseases or taking medication which interferes with normal body temperature regulation or reduces tolerance to work in cold environments. Workers who are routinely exposed to temperatures below -24°C (-10°F) with wind speeds less than five miles per hour, or air temperatures below -18°C (0°F) with wind speeds above five miles per hour should be medically certified as suitable for such exposures.

Trauma sustained in freezing or subzero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment.

HAND-ARM (SEGMENTAL) VIBRATION

These threshold limit values (Table 19) refer to component accelerations levels and durations of exposure that represent conditions under which it is believed that most workers may be exposed repeatedly without progressing beyond Stage 3 of the Taylor-Pelmar Classification System for Vibration-induced White Finger (VWF, also known as Raynaud's Phenomenon of Occupational Origin). Since there is a paucity of dose-response relationships for VWF, these recommendations have been derived from epidemiological data from forestry, mining, and metal working. These values should be used as guides in the control of hand-arm vibration exposure and because of individual susceptibility, should not be regarded as defining a boundary between safe and dangerous levels.

It should be recognized that the application of the TLV alone for hand-arm vibration will not protect all workers from the adverse effects of hand-arm vibration exposure. The use of: 1) antivibration tools, 2) antivibration gloves, 3) proper work practices which keep the worker's hands and remaining body warm and also minimize the vibration coupling between the worker and the vibration tool are necessary to minimize vibration exposure, and 4) a conscientiously applied medical surveillance program are ALL necessary to rid VWF from the workplace.

Continuous, Intermittent, Impulsive, or Impact Hand-arm Vibration

The measurement of vibration should be performed in accordance with the procedures and instrumentation specified by the Second Draft International Standard ISO/DIS 5349 (1984), *Guide for the Measurement and the Assessment of Human Exposure to Vibration Transmitted to the Hand*, and summarized below:

The acceleration of a vibration handle or work piece should be determined in three mutually orthogonal directions at a point close to where vibration enters the hand. The directions shall preferably be

8. International Organization for Standardization: *Guide for the Measurement and the Assessment of Human Exposure to Vibration Transmitted to the Hand*. Second DIS 5349. International Organization for Standardization, Geneva (in press, 1983).
9. International Organization for Standardization: *Human-Response Vibration Measuring Instrumentation*. Second Draft Proposal DP 8041. ISO/TC 108/SC 3 n 99. International Organization for Standardization, Geneva (unpublished, 1982).

PHYSICAL AGENTS UNDER STUDY

The Physical Agents Committee of ACGIH has examined the current literature and has not found sufficient information to propose a TLV. However, these agents will remain under study during the coming year to examine new evidence indicating the need and feasibility for establishing a proposed TLV. Comments and suggestions, accompanied by substantive documentation are solicited and should be forwarded to the Executive Secretary, ACGIH. Documentation summarizing the current status of the biological effects literature is available on those agents preceded by an asterisk (*).

1. **Extremely Low Frequency (ELF) Radiation*. Specifically, that portion of the spectrum from 0 to 300 Hz.
2. *Magnetic Fields*. Both pulsed and *continuous.
3. *Laser Radiation*. Specifically laser exposures of less than one (1) nanosecond.
4. *Vibration*. Whole-body.
5. *Pressure Variations*.

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WEISS

Occupational Injury and Illness Information Alaska 1982



State of Alaska, Bill Sheffield, Governor

Occupational Illnesses

1982 Survey Findings

Results from the 1982 survey produced an estimated 235 cases of occupational illnesses. Work related illnesses usually account for under 5% of the total cases. For 1982, the number of illness cases was 2% of all cases, as it was in the prior year. The total number of work illnesses estimated for 1982 was 25% less than the preceding year. This is largely a result of the decline in manufacturing activity, although the estimated cases went down in most industry divisions. Table 1-3 compares the number of cases estimated for 1979 to 1982 by type of illness. The only category to show an increase over 1981 was "Poisoning". This rise is due largely to a single instance in which 15 employees were working in a processing building with very poor ventilation; they became ill, losing consciousness in some cases.

Industry Distribution

As expected, manufacturing had the majority of illness cases with 40% of the total. This is smaller than the total portion from prior years (52% in 1981, 76% in 1980). As manufacturing activity declined during 1981 and 1982, so did the total estimated illnesses; as a result other industries appear to have a larger share of the total. This can be misleading if one attempts to compare the annual distributions because in many industries, the number of cases has declined over prior years. For 1982, transportation was third in estimated illnesses, due to the incident mentioned before. One company classified in transportation was also operating the processing facility at which the 15 employees became ill from poor ventilation. Therefore, transportation's higher ranking in 1982 is quite unusual. Figure 1-6 illustrates the percent distribution by type of illness case and industry for 1982.

Lost Workday Cases

In 1982, 44% of the total estimated illness cases (103 cases) resulted in lost workdays. Roughly one third of the time loss cases (37 cases) were in seafood processing. The total estimated number of lost workdays due to work related diseases was 2,290. Less than one fourth of the lost days occurred in the public sector, mainly in local government. The average number of days lost for each time loss illness case was 21 days in the private sector and 28 days in government. All of the lost workdays from occupational diseases in 1982 equal approximately one full year of work for nine employees.

Use and Weakness of Survey Data

As previously mentioned, the primary purpose of the annual survey is to measure the relationship between exposure (in hours worked) and the occurrence of recordable injuries and illnesses in different industries. The second major product of the annual survey is an estimate of the total number of recordable injury and illness cases. In a survey sample based estimation procedure, events which are frequently occurring can be estimated more accurately than those which are relatively rare in occurrence. For example, the annual survey data led to an estimated 14 fatality cases in 1982, whereas there were 31 actual reported work related deaths, 121% more than estimated. Occupational illness cases, which have historically comprised 5% or less of total cases, are also cases estimated from the annual survey data may differ considerably from other sources such as reported Workers' Compensation cases. The main value of the survey based estimate of illness cases is not how close these estimates approach the "actual" experience. Rather, the value lies in the relationships which exist among the industries and types of illnesses (as expressed in Figure 1-6) and how these relationships change from year to year.

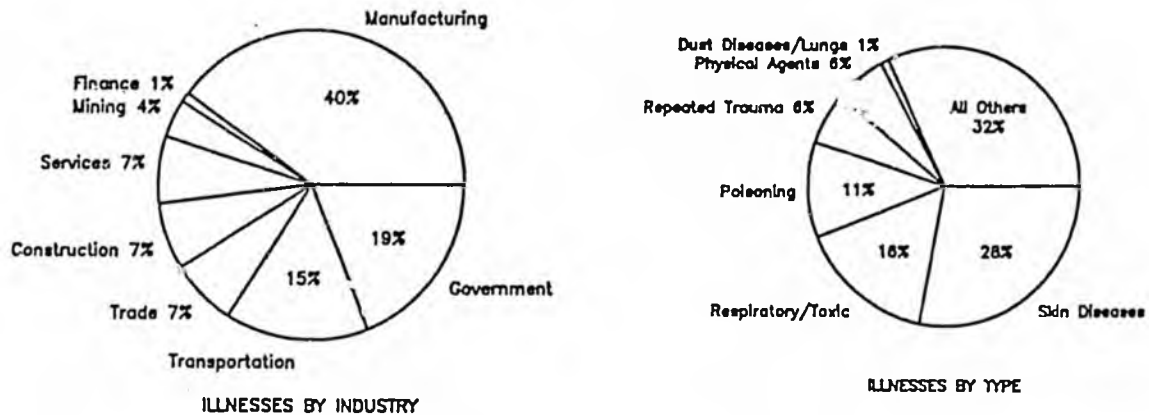
Table 1-3
Estimated Number of Recordable Occupational Illnesses
By Type of Illness
Alaska
1979-1982

Type of Illness	1979	1980	1981	1982
Total All Illnesses	413	614	313	235
Occupational Skin Diseases	195	140	108	66
Dust Diseases of the Lungs	4	3	3	2
Respiratory Conditions Due to Toxic Agents	105	111	53	37
Poisoning (Systemic Effects of Toxic Material)	22	14	4	26
Disorders Due to Physical Agents	24	53	18	14
Disorders Associated with Repeated Trauma	17	74	24	15
All Other Occupational Illnesses	46	219	103	75

Some figures in this table were adjusted after rounding so the sum of the detail equals the total.

reflects national trends

Figure 1-6
Percent Distribution of Occupational Illnesses by Type and by Industry
Alaska
1982



Public Sector

The annual survey of occupational injuries and illnesses includes state and local government operations. Federal government is excluded from the scope of the survey because it does not fall under the federal or state Occupational Safety and Health legislation. An estimated 2,258 recordable work related injury and illness cases occurred in Alaska's public sector in 1982. This represents a 9% increase over 1981 (2,066 cases). Sixty-seven percent of the public sector cases were in local government, similar to the prior year (66%). The number of cases estimated for local government in 1982 (1,524 cases) is the largest to date and is 12% higher than the prior year. The incidence rate for total cases rose in local government to reach the second highest rate recorded since 1975. In state government, the total case rate declined slightly.

The lost workday case rate for the public sector was identical to the record low recorded in 1981, 2.6 cases per 100 workers. This is because the state government rate declined slightly to match the 1980 low (1.3) while local government increased a similar amount over the record low of the prior year (Table 1-9). The estimated number of time loss cases in the public sector increased 5% over the 1981 level (830 to 869) while non-time loss cases gained by 12%. In state government, estimated time loss cases actually went down (230 to 209) from 1981 to 1982 while local government saw their time loss cases increase from 600 to 667. The total estimated number of lost workdays in government in 1982 was 12,471, a 17% decline from the record number in 1981. The estimated total lost workdays declined in state government by 53% and increased in local government by 9%.

The total estimated lost workdays in the public sector amounted to the equivalent of 52 employee years. The cost for this lost worktime in terms of salary would amount to nearly \$1.5 million (approximately \$308,000 for state government and \$1,156,000 for local government).*

* Note: Cost estimates based on average monthly salary figures for 1982 which appear in the Fourth Quarter 1982 issue of the *Statistical Quarterly*.

Long Term Trends

Completion of the survey of 1982 occupational injuries and illnesses provides eleven years of statistical data that allow examination of long term trends. The incidence rate for occupational injuries and illnesses in private industry has declined appreciably both nationally and in Alaska since 1972 (Figure 7). The U.S. rate of 7.7 cases per 100 workers recorded in 1982 represents a drop of 29.4% from the rate of 10.9 in 1972. However, from 1976 to 1979 the national rate showed a slight but steady increase each year. This trend was reversed during 1980, 1981, and 1982 when the U.S. rate dropped to a new low each year. Over the period 1972 to 1982, Alaska's private sector rate fell from 14.4 to 10.3, a decrease of 28.5%. Alaska's rate declined steadily from 1973 to 1978 and fluctuated between 10.0 and 10.4 in the last 4 years.

United States

The private sector injury and illness rate described above is the sum of the rates for time loss and non-time loss cases. The decline in the national injury and illness rate from 1972 to 1982 is the result of a 44.7% decrease in the rate for cases without lost worktime. The rate for lost workday cases is 6% higher after eleven years (Table 1-11). The trend of a slow but steady rise in national time loss case rates was reversed from 1980 to 1982 when a 19% drop occurred. Over the period 1972 to 1981 the manufacturing industries experienced the greatest rate of increase in the lost workday case rate. This ceased to be true in 1982 when manufacturing's time loss case rate fell 14% to a ten year low. In general, accident rates can be expected to rise as industry employment levels increase. The only time the U.S. lost workday case rate showed declines were in 1975, 1980, 1981, and 1982 when higher risk industries experienced significant losses in employment levels.

The average number of days of work lost due to a time loss injury has changed slightly since 1972 (Figure 1-5). For the U.S. as a whole the average number of days lost has risen only slightly since 1972. An average of 14 days was recorded in 1972 compared to 17 days in 1982. For the last nine years, the average has been either 16 or 17 days. This fairly stable average has been maintained during a period in which the lost time accident rate has risen.

Alaska

In Alaska the overall decline in the private sector incidence rate has also been greatly determined by the drop in the rate for cases without lost workdays. The rate for non-time loss cases in 1982 was 5.4, a decline of 40.7% from the 1972 rate of 9.1. Unlike the U.S., however, the lost workday case rate has not increased over the eleven year period. From 1977 to 1979 the lost workday case rate held at its lowest recorded level. Following a rise in 1980, the rate dropped to a new all time low in 1981 and recorded its second lowest level in 1982 (Figure 1-5). During the eleven year period in which the time loss case rate has been basically stable, employment in Alaska's private industries more than doubled (125%). Safety program managers would point out that holding down the time loss case rate during a period of significant growth is as much an achievement as decreasing the overall injury and illness rate.

In Alaska, the rise in average number of days lost has been somewhat greater than nationally. The state's private sector average increased from 12 days in 1972 to a level of 17 days where it held for four years. Then in 1982 the average dropped to a six year low of 15 days. The general rise in Alaska's average number of days lost has occurred even though the lost workday case rate has remained stable.

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Figure 1-7
Occupational Injuries and Illnesses
Incidence Rate Trends
Private Sector
Alaska and United States

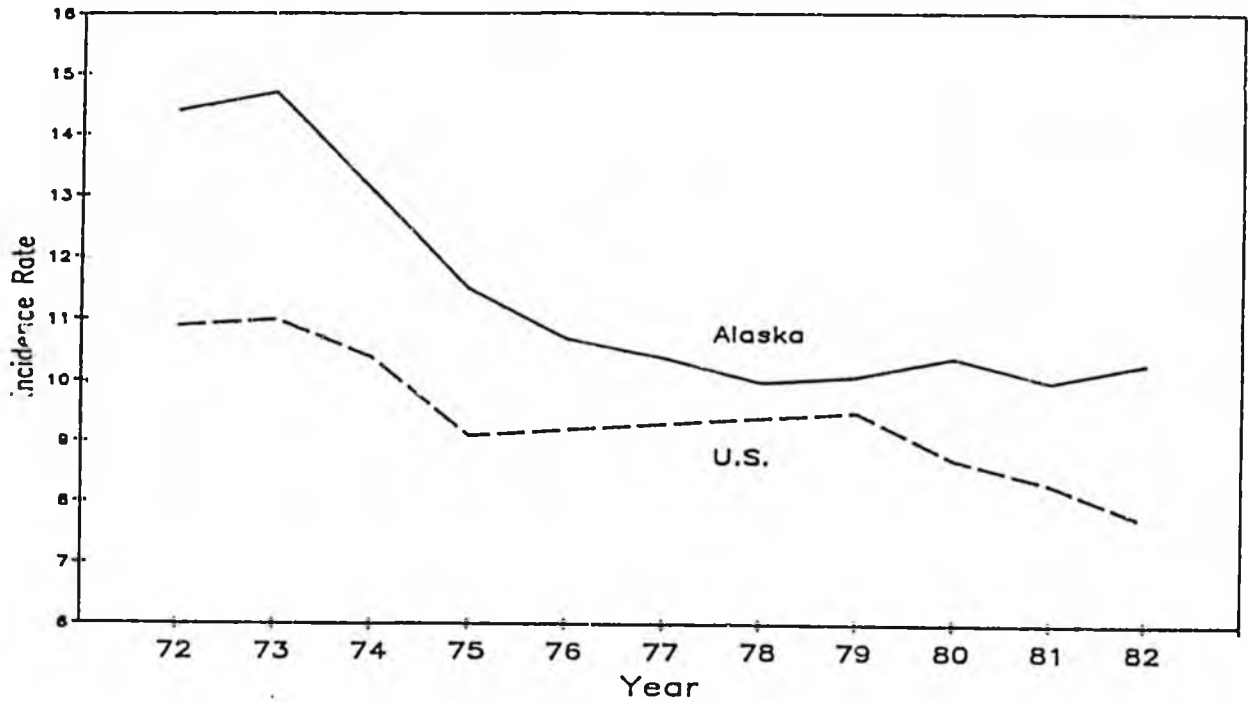
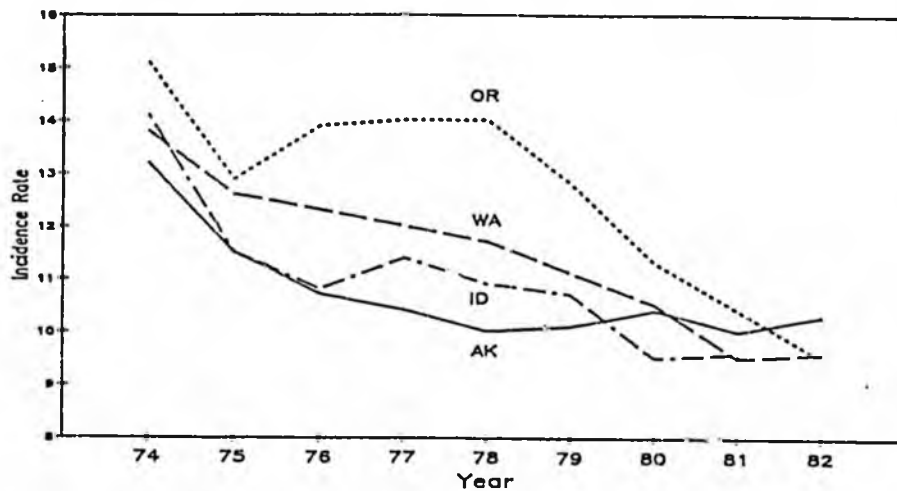


Figure 1-8
Occupational Injury and Illness Incidence Rates
Private Sector
Region X States



Methodology

Scope of Survey

The Annual Occupational Injury and Illness Survey covers employers in Alaska having one or more employees during a given year (self-employed individuals and federal government are excluded)

In 1982, a sample of 1,667 firms representing a universe of about 10,000 firms were mailed survey forms. Two follow-up mailings and many telephone calls were made to obtain as many usable responses as possible. Unusable responses were generally a result of the surveyed firm being out of business, outside the scope of the survey, included in the report of another location, in receipt of duplicate forms, or without an adequate mailing address.

It should be noted that this survey, under the Occupational Safety and Health Act, is a mandatory survey. This means that all those firms receiving questionnaires are required by law to respond. The response rate for the 1982 survey was 98.8%.

Note: Data conforming to OSHA definitions for coal and lignite mining (SIC 12), metal and nonmetal mining (SIC 10 and 14), and for railroad transportation (SIC 40) were provided by the Mine Safety and Health Administration, U.S. Department of Labor, and by the Federal Railroad Administration, U.S. Department of Transportation. Data for independent contractors who perform services or construction on mining sites are also included.

Survey Form

The survey form conveyed information concerning average annual employment, total employee hours worked, nature of business activity, and month of federal or state OSHA compliance inspection. The Occupational Injury and Illness information that employers provided on the form included data on fatalities, lost workday cases, cases without lost workdays, and seven categories of occupational illnesses. See the "Recording and Reporting" section of this publication for a sample of the survey form and instructions.

Industrial Classification

Firms were classified into industries on the basis of their principal product or activity, as determined by information entered in Section V, Nature of Business, of the survey form. Data for firms making more than one product or engaging in more than one activity were included under the industry indicated by the principal product or activity. Industries were classified according to the 1972 edition of the *Standard Industrial Classification (SIC) Manual*.

Sample Selection

The majority of the sample was selected using the Department of Labor's employment and earnings report which includes all employers in the state covered by Alaska's unemployment insurance program. Other sources were used to select a sample of banks, schools, agricultural firms, multi-establishment firms, and government agencies.

Industries with higher incidence rates tend to have rates which vary from year to year and were more heavily sampled than industries with lower rates. Since the number of injuries and illnesses also varies with an establishment's employment, the sample was stratified by size of firm.

Publication Criteria

In order to protect the privacy of individual employers, the publication of some data was suppressed. Also, statistical integrity of detailed industry level information required a minimum employment criteria for publication. Individual industry (2, 3, and 4 digit SIC levels) injury and illness information was presented in this report if the following publication criteria were met:

- a) Annual average industry employment was at or near the level of 1,000 or more and,
- b) There were more than three employers in the industry in which one firm did not account for 50% or more of the industry employment or two firms did not account for 75% or more of the industry employment.

Estimating Procedures

Occupational injury and illness data from sampled firms are used to produce industry wide information. It would be a time consuming and costly to gather data from each firm in Alaska. It is also unnecessary since a statistically valid sample is a much more cost effective means of generating reliable industry information. In a sample, surveyed firms represent their respective industries. Data obtained from the representative firms for each industry are then expanded or "blown up" to produce industry wide information.

During survey design, individual firms are selected to represent each industry. The portion of the total industry that each firm represents is called the sampling ratio. More specifically, the sampling ratio for a given firm is that portion of the total industry employment the firm represents. The reciprocal of the sampling ratio is called the weighting factor. During sample selection each sample firm is assigned a weighting factor. When data from each sampled firm in an industry are multiplied by its weighting factor, total industry estimates are produced.

Due to time constraints, the survey sample is designed and selected prior to the end of the reference period (calendar year) for which data will pertain. Because of this, industry growth or decline can occur after the time of survey sample selection. Industry estimates (weighted data) will, therefore, represent the industry at the time of sample selection and will not reflect the actual experience of the industry. To adjust for this, industry data are benchmarked against the actual average employment for the year. Benchmark factors are derived by dividing the actual average annual employment by the weighted estimated employment obtained from the sample. The benchmark factor for each industry is applied to the weighted industry data, adjusting for growth or decline in an industry which occurred after sample selection.

The occupational injury and illness information presented in many parts of this report is expressed in terms of incidence rates. The definition of incidence rate is the number of injuries and/or illnesses or lost workdays experienced by the equivalent of 100 full-time employees during one year.

Table 2-1
 Work Injuries and Illnesses
 By Nature of Injury or Illness
 Alaska 1982

SOS Code	Nature of Injury or Illness	Number of Cases	Percent
	Total	10125	100.0
100	Amputation or Enucleation	44	.4
110	Asphyxia, Strangulation, Drowning Suffocation	11	.1
120	Burn (Heat)	203	2.0
130	Burn (Chemical)	60	.6
140	Concussion	55	.5
	Infective or Parasitic Disease	15	.1
150	Infective or Parasitic Disease, UNS	1	.0
154	Conjunctivitis and Ophthalmia	10	.1
157	Tuberculosis	1	.1
159	Other Infective or Parasitic Disease	3	.0
160	Contusion, Crushing, Bruise	1459	14.4
170	Cut, Laceration, Puncture	938	9.3
	Dermatitis	42	.4
180	Dermatitis, UNS	12	.1
181	Contact Dermatitis	10	.1
182	Allergic Dermatitis	10	.1
183	Primary Infections of the Skin	8	.1
184	Skin Conditions	1	.0
189	Skin Condition, not Specified	1	.0
190	Dislocation	110	1.1
200	Electric Shock, Electrocutation	5	.0
210	Fracture	755	7.5
220	Effects of Exposure to Low Temp	25	.3
230	Hearing Loss, or Impairment	13	.1
250	Hernia, Rupture	164	1.6
260	Inflammation or Irritation of Joints, Tendons, or Muscles	166	1.6
	Poisoning, Systemic	75	.7
270	Poisoning, Systemic, UNS	7	.1
271	Due to Toxic Materials	48	.5
273	Upper Respiratory Conditions	3	.0
274	Influenza, Pneumonia, Etc.	14	.1
276	Other Diseases of the Gastrointestinal Tract	3	.0
	Radiation Effects	35	.3
290	Radiation Effects Uns.	1	.0
291	Non-Ionizing Radiation	4	.0
295	Welders Flash	30	.3
300	Scratches, Abrasions	290	2.9
310	Sprains, Strains	4677	46.2
320	Hemorrhoids	5	.1
330	Hepatitis (Serum and Infective)	17	.2
400	Multiple Injuries	655	6.5
500	Effects of Change in Atmospheric Pressure	6	.1
510	Cerebrovascular and Other Conditions of the Circulatory System	5	.0
530	Eye, Other Diseases of the Eye	4	.1
540	Mental Disorders	13	.1
	Nervous System, Conditions of	7	.1
560	Nervous System, Conditions of, Uns.	5	.0
562	Diseases of the Nerves and Peripheral Ganglia	2	.0
	Respiratory System, Conditions of	10	.1
570	Respiratory System, Conditions of, UNS	4	.0
571	Upper Respiratory	3	.0
572	Influenza, Pneumonia, Bronchitis, Asthma	9	.2
* 580	Symptoms and Ill-Defined Conditions	45	.4
900	No Injury or Illness	2	.0
950	Damage to Prosthetic Devices	10	.1
991	Heart Conditions (Includes Heart Attack)	41	.4
995	Other Injury, Nec	12	.1
999	Nonclassifiable	116	1.1

NOTE: Uns = Unspecified, Information not available to classify at a more detailed level.

Nec = Not elsewhere classified.

NOTE: Data includes only those reported cases which occurred during 1982 involving death or one or more lost workdays beyond the day of injury.

SOURCE: Alaska SOS Table IUI.

Table 2-3
Work Injuries and Illnesses
by Source of Injury or Illness
Alaska 1982

SUS Code	Source of Injury or Illness	Number of Cases	Percent
	Total	10125	100.0
	Air Pressure	8	.1
U100	Air Pressure, Uns.	2	.0
U120	Low Pressure	6	.1
	Animals, Insects, Etc.	19	.2
0200	Animals, Insects, Etc. Uns	1	0
0201	Animals	15	.1
0250	Insects	3	.0
	Animal Products	2	.0
0320	Fur, Hair, Etc.	1	.0
0330	Hides, Leather	1	.0
0400	Bodily Motion	683	6.7
	Boilers, Pressure Vessels	81	.8
0501	Boilers	5	.0
0510	Pressurized Containers	38	.4
0530	Pressure Lines	35	.3
0599	Pressure Vessels, Nec	3	.0
	Boxes, Barrels, Containers	1103	10.9
0600	Boxes, Barrels, Containers, Uns	5	.0
0601	Barrels, Kegs, Drums	66	.7
0630	Boxes, Crates, Cartons	493	4.9
0650	Bottles, Jugs, Flasks	11	.1
0660	Bundles, Bales	25	.2
0665	Keels, Rolls	46	.5
0670	Tanks, Bins	24	.2
0699	Containers, Nec	433	4.3
	Buildings and Structures	309	3.1
0700	Buildings and Structures, Uns	2	.0
0701	Buildings	9	.1
0705	Doors, Gates	138	1.4
0708	Windows	15	.1
0730	Grandstands, Stadia	2	.0
0740	Scaffolds, Staging	26	.3
0750	Towers, Poles	18	.2
0755	Walls, Fences	55	.5
0760	Wharfs, Docks	2	.0
0799	Buildings and Structures, Nec	42	.4
	Ceramic Items	4	.0
0801	Brick	2	.0
0810	China	1	.0
0899	Ceramic Items, Nec.	1	.0
	Chemicals, Chemical Compounds	91	.9
0900	Chemicals, Chemical Compounds, Uns	16	.2
0901	Acids	8	.1
0910	Alkalies	16	.2
0915	Aromatic Compounds	1	.0
0930	Carbon Dioxide	1	.0
0935	Carbon Monoxide	7	.1
0950	Halogenated Compounds, Nec	5	.0
0955	Metallic Compounds, Nec	2	.0
0960	Oxides of Nitrogen	2	.0
0965	Paint	5	.0
0999	Chemicals and Compounds, Nec	28	.3
	Clothing	18	.2
1000	Clothing, Uns.	1	.0
1001	Boots, Shoes	8	.1
1010	Gloves	1	.0
1030	Outer Coats	1	.0
1050	Suits, Dresses, Etc.	1	.0
1070	Underwear	1	.0
1099	Apparel, Nec.	5	.0
	Coal and Petroleum Products	33	.3
1100	Coal and Petroleum Products, Uns	1	.0
1120	Crude, Fuel Oil	4	.0
1130	Gasoline, Liquid Hydrocarbon Compounds	1	.0
1140	Hydrocarbon Gas	3	.0
1160	Lubricating Oils, Greases	6	.1
1180	Naptha Solvents	1	.0
1190	Petroleum Asphalts	12	.1
1199	Coal and Petroleum Products, Nec	5	.0

Table 2-3
Work Injuries and Illnesses
By Source of Injury or Illness
Alaska 1982
(continued)

SOS Code	Source of Injury or Illness	Number of Cases	Percent
1200	Cold (Atmospheric, Environmental)	54	.5
	Conveyors	31	.3
1300	Conveyors, Uns.	4	.0
1301	Gravity	2	.1
1350	Powered	25	.2
	Drugs & Medicine	1	.0
1490	Other Medicines	1	.0
	Electric Apparatus	94	.9
1500	Electric Apparatus, Uns.	2	.0
1501	Motors	15	.1
1505	Generators	19	.2
1510	Transformers, Converters	8	.1
1515	Conductors	4	.0
1520	Switches, Fuses, etc.	8	.1
1530	Rheostats, Starters, Etc.	15	.1
1540	Magnetic Apparatus	1	.0
1599	Electrical Apparatus, Nec	22	.2
1700	Flame, Fire, Smoke	41	.4
	Food Products	166	1.6
1800	Food Products, Uns.	6	.1
1810	Fruits	2	.0
1820	Grains	6	.1
1840	Meats	115	1.1
1870	Vegetables	28	.3
1890	Food Products, Nec	9	.1
	Furniture, Fixtures, Etc.	326	3.2
1900	Furniture, etc., Uns.	4	.0
1901	Cabinets, Etc.	36	.4
1910	Chairs, Etc.	31	.3
1920	Counters, Etc.	7	.1
1930	Desks	26	.3
1950	Floor Coverings	14	.1
1960	Lighting Equipment	6	.1
1970	Tables	42	.4
1999	Furniture, Nec	160	1.6
2000	Glass Items, Nec	74	.7
	Hand Tools, Not PWD	578	5.7
2200	Hand Tools, Not Pwd. Uns.	9	.1
2201	Axe	5	.0
2205	Blow Torch	1	.0
2210	Chisel	1	.0
2215	Crowbar	36	.4
2220	File	2	.2
2230	Hammer	83	.8
2235	Maschet	1	.0
2240	Hoe	1	.0
2245	Knife	154	1.5
2250	Pick	5	.0
2260	Pliers, Tongs	5	.0
2270	Hope, Chain	86	.8
2280	Scissors	3	.0
2285	Screwdriver	5	.0
2290	Shovel	50	.5
2295	Wrench	50	.5
2299	Hand Tools, Not Pwd, Nec	81	.8
	Hand Tools, PWD	214	2.1
2301	Grinder	10	.1
2305	Buffer, Etc.	5	.0
2315	Drill	28	.3
2320	Hammer	13	.1
2335	Powder Actuated	2	.0
2345	Riveter	2	.0
2355	Saw	120	1.2
2370	Welding Tools	4	.0
2399	Hand Tools, PWD, Nec	30	.3
2400	Heat, (Atmospheric, Environmental)	1	.0

Table 2-3
Work Injuries and Illnesses
By Source of Injury or Illness
Alaska 1982
(continued)

SDS Code	Source of Injury or Illness	Number of Cases	Percent
2500	Hoisting Equipment, Nec	42	.4
	Hoisting Apparatus	121	1.2
2600	Hoisting Apparatus, Uns.	5	.0
2610	Cranes, Derricks	22	.2
2620	Elevators	12	.1
	Other Hoisting Apparatus	55	.5
2641	Air Hoist	2	.0
2642	Chain Hoist	4	.0
2645	Jacks	49	.5
2699	Hoisting Apparatus, Nec	27	.3
2700	Infectious, Parasitic Agents, Nec	28	.3
	Ladders	45	.4
2800	Ladders, Uns	21	.2
2810	Fixed	2	.0
	Movable	21	.2
2830	Movable, Uns	7	.1
2831	Extension	11	.1
2833	Step Ladders	3	.0
2899	Ladders, Nec	1	.0
	Liquids, Nec	84	.8
2910	Water	61	.6
2999	Other Liquids, Nec	23	.2
	Machines	414	4.1
3000	Machines, Uns.	7	.1
3001	Agitators, Mixers	20	.2
3050	Agricultural Machines, Nec	1	.0
3100	Buffers, Polishers, Etc.	17	.2
3150	Casting, Forging, Welding	4	.0
3200	Crushing, Pulverizing	10	.1
3250	Drilling, Boring	34	.3
3300	Highway Construction	105	1.0
3400	Office	29	.3
3400	Packaging, Wrapping	6	.1
3550	Planers, Shapers, Molders	2	.0
3600	Presses, (Not Printing)	8	.1
3650	Printing	3	.0
3700	Rolls	2	.0
3750	Saws	47	.5
3850	Shears, Slitters, Slicers	39	.4
3999	Machines, Nec	80	.8
	Mechanical Power Transmission Apparatus	18	.2
4020	Chains, Ropes, Cables	14	.1
4030	Drums, Pulleys, Sheaves	2	.0
4059	Mechanical Power Transmission Apparatus, Nec	2	.0
	Metal Items	971	9.6
4100	Metal Items, Uns	21	.2
4110	Automobile Parts	67	.7
4115	Beams, Bars	79	.8
4120	Bullets	8	.1
4135	Nails, Spikes, Etc.	62	.6
4140	Pipe	215	2.1
4145	Screws, Nuts, Bolts	9	.1
4199	Metal Items, Nec.	510	5.0
4200	Mineral Items, Metallic, Nec	2	.0
4300	Mineral Items, Nonmetallic, Nec	135	1.3
4400	Noise	3	.0
4500	Paper and Pulp	62	.6
4600	Particles (Unidentified)	62	.6
4700	Plants, Trees, Vegetation	30	.4
4800	Plastic Items, Nec	7	.1
	Pumps and Prime Movers	60	.6
4900	Pumps and Prime Movers, Uns	1	.0
4910	Engines	26	.3
4930	Pumps	32	.3
4950	Turbines	1	.0

Table 2-3
Work Injuries and Illnesses
By Source of Injury or Illness
Alaska 1982
(continued)

SUS Code	Source of Injury or Illness	Number of Cases	Percent
5000	Radiating Substances and Equipment	35	.3
5050	Radiating Substances and Equipment, Uns	1	.0
5060	Sun	2	.0
5070	Ultraviolet Equipment	1	.0
5070	Welding Equipment	31	.3
5100	Soaps, Detergents, Etc., Nec	29	.3
5300	Scrap, Debris, Waste Materials, Nec	10	.1
5400	Steam	22	.2
5500	Textile Items, Nec	8	.1
	Vehicles	778	7.7
5600	Vehicles, Uns	2	.0
5610	Aircraft	56	.6
5620	Highway Vehicles, Powered	426	4.2
	Plant or Industrial Vehicles	215	2.1
5630	Plant or Industrial Vehicles, Uns	7	.1
5631	Nonpowered Vehicles	122	1.2
5635	Powered Carriers	81	.8
5638	Power Towing Vehicles	5	.0
5640	Rail Vehicles	8	.1
5650	Sleds, Snow, Ice Vehicles	22	.2
5660	Water Vehicles	20	.2
5699	Vehicles, Nec	29	.3
	Wood Items	416	4.1
5700	Wood Items, Uns	8	.1
5710	Logs	66	.7
5720	Lumber	213	2.1
5730	Skids, Pellets	61	.6
5749	Wood Items, Nec	68	.7
	Working Surfaces	2066	20.4
5800	Working Surfaces, Uns	281	2.8
5801	Floor	601	5.9
5810	Ground	817	8.1
5815	Ramps	28	.3
5820	Roofs	11	.1
5825	Runways, Platforms	17	.2
5830	Sidewalks, Paths, Etc.	38	.4
5840	Stairs, Steps	191	1.9
5845	Street, Road	15	.1
5899	Working Surfaces, Nec	67	.7
	Person	334	3.3
5010	Person Injured	114	1.1
6020	Person, Other than Injured	220	2.2
6100	Recreation and Athletic Equipment	23	.2
	Rubber Products	51	.5
6210	Tires	48	.5
6299	Rubber Products, Nec	3	.0
6500	Ice, Snow	8	.1
8800	Miscellaneous, Nec	92	.9
9800	Nonclassifiable	229	2.3

Note: Uns = Unspecified. Information not available to classify at a more detailed level.

Nec = Not elsewhere classified

Note: Data includes only those reported cases which occurred during 1982 involving death, or one or more lost workdays beyond the day of injury.

Source: Alaska SUS Table 103.

Table 2-4
Work Injuries and Illnesses
By Type of Accident or Exposure
Alaska 1982

SUS Code	Type of Accident or Exposure	Number of Cases	Percent
	Total	10125	100.0
	Struck Against	679	6.7
010	Struck Against, Uns	59	.6
011	Stationary Object	539	5.3
012	Moving Object	81	.8
	Struck By	1584	15.6
020	Struck by, Uns	48	.5
021	Falling Object	699	6.9
022	Flying Object	167	1.6
029	Struck By, Nec	670	6.6
	Fall From Elevation	1034	10.2
030	Fall from Elevation, Uns	10	.1
031	From Scaffolds, Etc	187	1.8
032	From Ladders	132	1.3
033	From Piled Materials	10	.1
034	From Vehicles	256	2.5
035	On Stairs	171	1.7
036	Into Shafts, Etc	68	.7
039	Fall to Lower Level, Nec	200	2.0
	Fall on Same Level	1157	11.4
050	Fall on Same Level, Uns	24	.2
051	Fall to the Walkway, Etc	823	8.1
052	Fall Onto or Against Objects	307	3.0
059	Fall on Same Level, Nec	3	.0
	Caught In, Under, Between	673	6.6
060	Caught, In, Under, Between, Uns	87	.9
061	Inrunning or Meshing Objects	50	.5
062	Moving and Stationary Object	421	4.2
063	Two or More Moving Objects	22	.2
064	Collapsing Materials	20	.2
069	Caught In, Under, Between, Nec	73	.7
	Rubbed or Abraded	336	3.3
080	Rubbed or Abraded, Uns	1	.0
081	Leaning, Kneeling, Etc	32	.3
082	Objects Handled	61	.6
083	Vibrating Objects	3	.0
084	Foreign Matter in Eyes	224	2.2
085	Repetition of Pressure	9	.1
089	Rubbed or Abraded, Nec	6	.1
100	Bodily Reaction	683	6.7
	Overexertion	2818	27.8
120	Overexertion, Uns	154	1.5
121	Lifting Objects	1330	13.1
122	Pulling or Pushing Objects	359	3.5
123	Welding, Throwing, Holding, or Carrying	683	6.7
124	Overexertion, Nec	292	2.9
130	Contact with Electric Current	14	.1
	Contact with Temp. Extremes	251	2.5
150	Contact with Temp. Extremes, Uns	1	.0
151	General Heat	1	.0
152	General Cold	53	.5
153	Hot Objects	188	1.9
154	Cold Objects	8	.1
	Contact with Radiations, Caustics, Etc	254	2.5
180	Contact with Radiations, Caustics, Etc, Uns	71	.7
181	By Inhalation	65	.6
182	By Ingestion	9	.1
183	By Absorption	87	.9
189	Contact with Radiations, Caustics, Etc, Nec	22	.2
	Transportation Accidents, Other Than Motor Vehicle	40	.4
201	Aircraft	36	.4
205	Ship or Boat	3	.0
298	Transportation Accidents, Other than Motor Vehicles, Nec	1	.0

Table 2-4
Work Injuries and Illnesses
by Type of Accident or Exposure
Alaska 1982
(continued)

SOS Code	Type of Accident or Exposure	Number of Cases	Percent
	Motor Vehicle Accidents	344	3.4
300	Motor Vehicle, Uns	21	.2
	Both Vehicles in Motion	81	.8
310	Both Vehicles in Motion, Uns	6	.1
311	Oncoming Vehicle	24	.2
312	Vehicles Moving in Same Direction	12	.1
313	Vehicles Moving in Intersection	39	.4
	Standing Vehicle (r Stationary Object	62	.6
320	Standing Vehicle or Stationary Object, Uns	1	.0
321	Standing Vehicle or Object in Roadway	12	.1
322	Standing Vehicle on Side of Road	12	.1
323	Struck by While Standing in Roadway	34	.3
324	Struck by While Standing off Roadway	3	.0
	Noncollision Accidents	180	1.8
330	Noncollision, Uns	1	.0
331	Overtaken	49	.5
332	Ran off Roadway	43	.4
333	Sudden Stop or Start	25	.2
338	Other Noncollision Accidents	62	.6
	Exposure to Noise	3	.0
402	Sudden or Single Exposure	1	.0
405	Repeated Noise	2	.0
500	Explosions	29	.3
899	Accident Type, Nec	118	1.2
999	Nonclassifiable	108	1.1

NOTE: Uns = Unspecified. Information not available to classify at a more detailed level.

Nec = Not elsewhere classified.

NOTE: Data includes only those reported cases which occurred during 1982 involving death, or one or more lost workdays beyond the day of injury.

Source: Alaska SOS Table 104.

how much noise exposure was underreported here?

TABLE 2-13
Work Injuries and Illnesses
Nature of Injury or Illness By Type of Accident or Exposure
Alaska 1982

Nature of Injury or Illness	TOTAL	STRUCK BY OR STRUCK AGAINST	FALL	CAUGHT IN OR BETWEEN	PUBBED OR A-BRADED	BODILY REACTION	OVER EXERTION	CONTACT WITH TEMP. EXTRM.	CONTACT W/RADIA-TIONS, CAUSTICS	MOTOR VEHICLE ACCT.	ALL OTHER CLASSIFIABLE	NON-CLASSIFIABLE
TOTAL	10125	2263	2191	673	336	683	2818	251	254	344	204	108
Amputation or Enucleation	44	20	-	23	-	-	-	-	-	1	-	-
Asphyxia, Strangulation, Etc.	11	-	-	2	-	-	-	-	10	-	1	-
Burn (Heat)	203	-	-	-	-	-	-	184	-	-	19	2
Burn (Chemical)	60	-	-	-	-	-	-	-	56	-	4	-
Concussion	55	27	22	1	-	-	-	-	-	3	2	-
Infective or Parasitic Diseases	15	-	-	-	-	-	-	-	13	-	1	1
Contusion, Crushing, Bruise	1459	712	433	276	6	-	1	-	-	26	3	2
Cut, Laceration, Puncture	938	707	51	107	57	-	-	-	-	6	3	7
Dermatitis	42	-	-	-	-	-	-	2	38	-	-	2
Dislocation	110	4	34	-	2	12	51	-	-	4	-	3
Electric Shock, Electrocution	5	-	-	-	-	-	-	-	-	-	5	-
Fracture	755	277	303	103	8	8	17	-	-	27	7	5
Effects of Exposure to Low Temp	35	-	-	-	-	-	-	35	-	-	-	-
Hearing Loss, or Impairment	13	3	1	-	1	-	-	2	-	-	6	-
Hernia, Rupture	164	3	8	-	-	5	145	-	-	-	-	3
Inflammation of Joints, Etc.	166	10	14	1	10	3	114	2	1	1	1	9
Poisoning, Systemic	75	-	-	-	-	-	-	-	73	-	2	-
Radiation Effects	35	-	-	-	-	-	-	-	35	-	-	-
Scratches, Abrasions	290	54	7	1	226	-	-	-	-	1	-	1
Sprains, Strains	4677	221	1016	87	19	652	2474	-	-	155	11	42
Hemorrhoids	6	-	-	-	-	-	4	-	-	-	2	-
Hepatitis	17	-	-	-	-	-	-	-	17	-	-	-
Multiple Injuries	655	184	250	63	1	1	8	3	1	113	30	1
Effects of Changes in Atmospheric Pres.	6	-	-	-	4	-	-	-	-	-	2	-
Cerebrovascular and Other Cond. of the Circulatory System	5	-	-	-	-	-	1	-	-	-	5	-
Complications Peculiar To Medical Care	2	-	-	-	-	-	-	-	1	-	1	-
Eye, Other Diseases of the Eye	4	2	-	-	2	-	-	-	2	-	-	-
Mental Disorders	13	-	-	-	-	-	-	-	-	-	13	-
Nervous System, Conditions of	7	-	-	-	-	-	-	2	-	-	4	1
Respiratory System, Conditions of	32	-	-	-	-	-	-	20	4	-	6	2
Symptoms and Ill-Defined Conditions	45	1	2	-	1	-	3	-	3	1	30	4
No Injury or Illness	2	-	-	-	-	-	-	-	-	-	-	2
Damage to Prosthetic Devices	10	6	1	1	-	-	-	-	-	-	-	2
Heart Conditions (Incl. Heart Attack)	41	-	-	-	-	-	-	-	-	-	41	-
Other Injury, Nec	12	3	2	-	1	1	-	1	-	-	4	-
Nonclassifiable	116	29	47	10	-	1	1	-	-	6	1	21

NOTE: Uns = Unspecified. Information not available to classify at a more detailed level.
Nec = not elsewhere classified.

NOTE: Data includes only those reported cases which occurred during 1982 involving death, or one or more lost workdays beyond the day of injury.

SOURCE: Alaska SDS Table 5.1

TABLE 2-14
Work Injuries and Illnesses
Source of Injury or Illness By Type of Accident or Exposure
Alaska 1982

Source of Injury or Illness	TOTAL	STRUCK BY OR STRUCK AGAINST	FALL	CAUGHT IN OR BETWEEN	RUBBED OR A-BRADED	BOOZLY REAC-TION	OVER EXER-TION	CONTACT WITH TEMP. EXTRM.	CONTACT W/HAZAR-IOUS, CAUSTICS	MOTION VEH-ICLE ACCT.	ALL OTHER CLASSI-FIABLE	NON-CLASSI-FIABLE
TOTAL	10125	2263	2191	673	336	633	2818	251	254	344	204	108
Air Pressure	8	1	-	-	5	-	-	-	-	-	2	-
Animals, Insects	19	17	-	-	-	-	2	-	-	-	-	-
Animal Products	2	-	-	-	1	-	1	-	-	-	-	-
Bodily Motion	683	-	3	-	-	683	-	-	-	-	-	-
Boilers, Pressure Vessels	81	22	-	4	1	-	50	-	-	-	4	-
Boxes, Barrels, Containers	1103	163	13	41	3	-	874	4	-	-	5	-
Buildings & Structures	309	121	24	56	4	-	104	-	-	-	-	-
Ceramic Items	4	1	-	-	1	-	2	-	-	-	-	-
Chemicals & Chem. Compounds	91	-	-	-	3	-	-	2	84	-	2	-
Clothing	18	2	1	2	6	-	3	-	3	-	-	1
Coal & Petroleum Products	33	5	-	-	3	-	-	14	11	-	-	-
Cold (Atmospheric, Environmental)	54	-	-	-	-	-	-	54	-	-	-	-
Conveyors	31	3	9	18	-	-	1	-	-	-	-	-
Drugs and Medicines	1	-	-	-	-	-	-	-	1	-	-	-
Electric Apparatus	94	17	1	4	-	-	54	2	-	-	16	-
Flame, Fire, Smoke	41	-	-	-	-	-	-	26	13	-	2	-
Food Products	166	23	-	-	4	-	79	35	23	-	1	-
Furniture, Fixtures, Etc.	326	110	26	-	7	-	163	-	-	-	1	-
Glass Items, Nec	74	36	2	-	33	-	2	-	-	-	-	1
Hand Tools, Not PWD	478	323	-	34	8	-	210	2	-	-	-	1
Hand Tools, PWD	214	126	1	14	2	-	71	-	-	-	-	-
Heat (Atmospheric, Environmental)	1	-	-	-	-	-	-	1	-	-	-	-
Heating Equipment, Nec	42	5	1	5	-	-	20	7	-	-	4	-
Hoisting Apparatus	121	45	3	40	-	-	29	-	-	4	-	-
Infectious, Parasitic Agents, Nec	38	-	-	-	-	-	-	-	28	-	-	-
Ladders	45	13	6	4	-	-	22	-	-	-	-	-
Liquids, NEC	84	1	1	-	3	-	1	65	12	-	1	-
Machines	414	150	19	116	3	-	81	1	-	39	3	2
Mechanical Power Trans Apparatus	18	8	-	2	-	-	8	-	-	-	-	-
Metal Items	971	462	18	81	96	-	294	17	-	-	2	1
Mineral Items, Metallic, Nec	2	2	-	-	-	-	-	-	-	-	-	-
Mineral Items, Nonmetallic, Nec	135	64	3	24	30	-	12	-	1	-	1	-
Noise	3	-	-	-	-	-	-	-	-	-	3	-
Paper & Pulp	62	18	-	1	-	-	43	-	-	-	-	-
Particles (Unidentified)	62	1	-	-	61	-	-	-	-	-	-	-
Plants, Trees, Vegetation	39	33	2	-	-	-	4	-	-	-	-	-
Plastic Items, NEC	7	4	-	-	-	-	3	-	-	-	-	-
Pumps & Prime Movers	60	15	3	6	-	-	35	-	-	-	1	-
Radiating Substances & Equip.	35	-	-	-	-	-	-	-	35	-	-	-
Soaps, Detergents Etc. Nec	29	-	-	-	1	-	-	-	28	-	-	-
Scrap, Debris, Waste Materials	10	-	-	1	1	-	6	-	1	-	1	-
Steam	22	-	-	-	-	-	-	21	1	-	-	-
Textile Items, Nec	8	-	-	-	-	-	7	-	1	-	-	-
Vehicles	778	153	41	123	4	-	115	-	-	301	40	1
Wood Items	416	148	31	32	27	-	178	-	-	-	-	-
Working Surfaces	2066	19	1984	32	22	-	8	-	-	-	1	-
Person	334	79	-	2	3	-	137	-	-	-	110	3
Recreation & Athletic Equip.	23	12	1	1	-	-	9	-	-	-	-	-
Rubber Products	51	12	1	2	-	-	35	-	-	-	1	-
Ice, Snow	8	6	-	1	-	-	1	-	-	-	-	-
Miscellaneous, Nec	92	25	-	4	2	-	58	-	-	-	2	1
Non-Classifiable	229	18	-	3	2	-	96	-	12	-	1	97

NOTE: Uns = Unspecified. Information not available to classify at a more detailed level.

Nec = Not elsewhere classified.

NOTE: Data includes only those reported cases which occurred during 1982 involving death, or one or more lost workdays beyond the day of injury.

Source: Alaska SDS Table 514.



A Recommended Standard for Occupational Exposure to.....

Hot Environments

Section 20(a)(3) of the Occupational Safety and Health Act directs that the Secretary of Health, Education, and Welfare, on the basis of such research, demonstrations, and experiments, and any other information available to him, shall develop criteria dealing with toxic materials and harmful physical agents and substances which will describe exposure levels that are safe for various periods of employment, including, but not limited to, the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience.

The criteria document contains much of the supplemental information required by Section 6(b)(7) of the Act to be in the final standard.

The recommendations for an occupational exposure standard for heat take into consideration available information on health effects and limited data on technical feasibility of achieving various levels of exposure.

The criteria document was reviewed by six knowledgeable consultants, government agencies with interest and responsibility in occupational safety and health, and input resulting from the *Federal Register* request for information.

Reviewers were of the opinion that the recommended heat stress standard was appropriate and that it is a positive approach to the medical and environmental facts and to the controls necessary to prevent excessive harm to a worker.

The document is a result of substantial changes incorporated into the original draft subsequent to extensive review by qualified experts. The incorporated changes are reflected in the simplification of the approach used to control heat exposure of workers and of the recommendations involving medical requirements for examinations. Other substantial changes involved recommendations regarding work practices.

Comments by official agencies with interest and responsibilities in occupational health and HEW consultants will be made available to the Ad Hoc Committee to be appointed by the Department of Labor.

The following is the first chapter of the criteria document. It contains the NIOSH recommendations for controlling worker exposure to Hot Environments.

I. RECOMMENDATIONS FOR A STANDARD FOR WORK IN HOT ENVIRONMENTS

The National Institute for Occupational Safety and Health (NIOSH) recommends that employee exposure to heat in the workplace be controlled by requiring compliance with the work practice standard set forth in the following sections. Adherence to the precautionary procedures prescribed will prevent acute or chronic heat disorders and illnesses and heat induced unsafe acts, and will reduce the risk of harmful effects due to the interactions between excessive heat and toxic chemicals and physical agents. The standard is amenable to techniques that are valid, reproducible, and presently available. It will be reviewed and revised as necessary.

Section 1 — Definitions

(a) Acclimatization to heat means a series of physiological and psychological adjustments that occur in an individual during his first week of exposure to a hot environment so that thereafter the individual is capable of working in a hot environment without excessive strain.

(b) Unimpaired mental performance means the ability of an employee to cope with conditions where safety and health depend on constant alertness because he has to make critical decisions, fine discriminations, or fast and skillful actions.

(c) Intermittent heat exposure means exposure to hot environmental conditions which continues no longer than fifteen minutes without an interrupting interval spent either spontaneously or according to a prescribed schedule in a cooler environment.

(d) Continuous heat exposure means any exposure to hot environmental conditions which is not an intermittent exposure.

(e) Hot environmental condition means any combination of air temperature, humidity, radiation and wind speed that exceeds a Wet Bulb Globe Temperature (WBGT) of 79°F.

Section 2 — Applicability

The provisions of this standard are applicable to all places of employment, indoors and outdoors, and to all employees except those who are required to wear impermeable protective clothing.

Section 3 — Work Practices

(a) For sedentary jobs where continuous unimpaired mental performance is required, no employee shall be exposed to conditions which exceed the limits set forth in Figure I-1.

(b) No employee should be permitted to work without protective observation at high heat stress levels.

(c) When exposure of an employee is continuous for one hour or intermittent for a period of two hours and the time-weighted average WBGT exceeds 79°F for men or 76°F for women, then any one or combination of the following practices shall be initiated to insure that the employee's body core temperature does not exceed 100.4°F:

(i) Acclimatization

(1) Unacclimatized employees shall be acclimatized over a period of 6 days. The acclimatization schedule shall begin with 50 percent of the anticipated total work load and time exposure on the first day, followed by daily 10 percent increments building up 100 percent total exposure on the sixth day.

(2) Regular acclimatized employees who return from nine or more consecutive calendar days of leave, shall undergo a four day acclimatization period. The acclimatization schedule shall begin with 50 percent of the anticipated total exposure on the first day, followed by daily 20 percent increments building up to 100 percent total exposure on the fourth day.

(3) Regular acclimatized employees who return from four consecutive days of illness should have medical permission to return to the job, and should undergo a four day re-acclimatization period as defined in (2) above.

(ii) A work and rest regimen shall be implemented to reduce the peaks of physiological strain and to improve recovery during rest periods.

(iii) The total work load shall be evenly distributed over the entire work day when possible.

(iv) When possible hot jobs shall be scheduled for the coolest part of the work shift.

(v) Regular breaks, consisting as a minimum of one every hour, shall be prescribed for employees to get water and replacement salt. The employer shall provide a minimum of 8 quarts of cool potable 0.1 percent salted drinking water or a minimum of 8 quarts of cool potable water and salt tablets per man per shift. The water supply shall be located as near as possible to the position where the employee is regularly engaged in work, but never further than 200 feet* therefrom.

(vi) Appropriate protective clothing and equipment shall be provided and used.

(vii) Engineering controls to reduce the environmental heat load shall be utilized.

* Except where a variance had been granted.

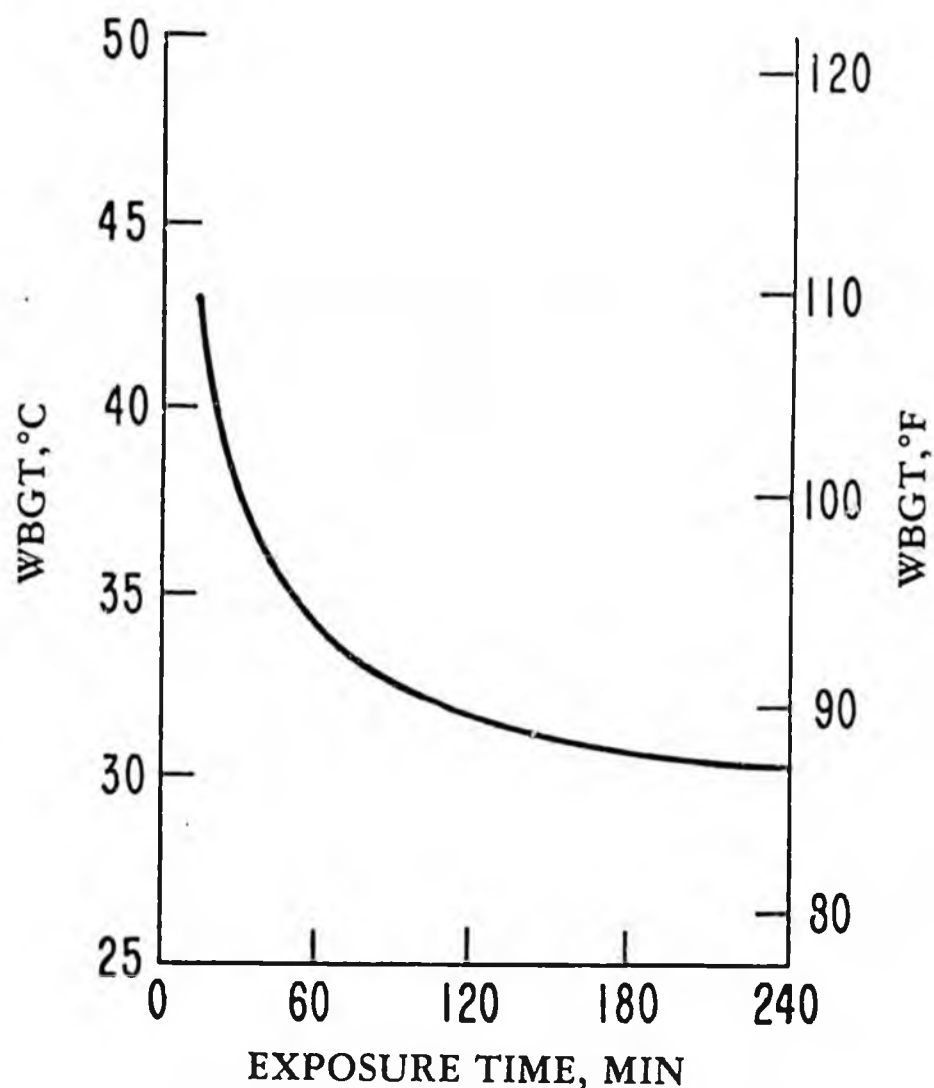


FIGURE I-1. UPPER LIMITS OF EXPOSURE FOR UNIMPAIRED MENTAL PERFORMANCE

Section 4 — Environmental Measurements

(a) The WBGT index used as the parameter in determining the environmental conditions for implementation of work practices shall be calculated by the following equations:

For indoor exposure, or outdoor exposure with no solar load:

$$WBGT = 0.7 WB + 0.3 GT$$

For outdoor sunlit exposure:

$WBGT = 0.7 WB + 0.2 GT + 0.1 DB$, where WB = the natural wet-bulb temperature obtained with a wetted sensor exposed to the natural air movement (unaspirated)

GT = globe thermometer temperature

DB = dry-bulb temperature

(b) The time-weighted average WBGT shall be determined by the equation:

$$Av. WBGT = \frac{(WBGT_1) \times (t_1) + (WBGT_2) \times (t_2) + \dots + (WBGT_n) \times (t_n)}{(t_1) + (t_2) + \dots + (t_n)}$$

where $WBGT_1$, $WBGT_2$, $WBGT_n$, are calculated values of WBGT for the various work and rest areas occupied during total time period; t_1 , t_2 , t_n are the elapsed times in minutes spent in the corresponding areas which are determined by a time study.

(i) Where exposure to environmental conditions is continuous for several hours or the entire work day, the WBGT shall be calculated as an hourly time-weighted-average.

(ii) Where exposure is intermittent, the WBGT shall be calculated as a two-hour time-weighted average.

Section 5 — Medical

(a) All employees who are 45 years of age and older and who have not had previous occupational exposure to heat shall not be assigned to jobs where the environmental conditions equal or exceed 79°F WBGT for men and 76°F WBGT for women, until they are acclimatized.

(b) All personnel who are to be assigned to hot jobs for the first time shall be evaluated by a physician prior to assignment to assure that the individual can cope with the hot environment. In the examination special emphasis should be on the cardiovascular, renal, hepatic, endocrine, and respiratory system and the skin. The examination should also include a complete medical history of the worker with specific emphasis on previous heat-related disorders or illnesses.

(c) All employees exposed to hot environmental conditions should be given a periodic physical examination every 2 years for employees under age 45, and every year for employees 45 years of age or older, that should include all components of the preplacement examination.

(d) There shall be a person available during working hours, who shall have had first aid training in recognizing the signs and symptoms of any heat disorder or illness.

Section 6 — Appraisal of Employees of Hazards from Exposure to Excessive Heat

Each employee who may be exposed to environmental conditions that exceed the prescribed limits shall be given training in health and safety procedures through a program that shall include the following as a minimum:

(a) Information as to water intake for replacement purposes.

(b) Information as to salt replacement.

(c) Importance of weighing; each day before and after the day's work.

(d) Instruction on how to recognize the symptoms of heat disorders and illnesses, including dehydration, exhaustion, heat syncope, heat cramps, salt deficiency exhaustion, prickly heat, and heat stroke.

(e) Information as to special caution that shall be exercised in situations where employees are exposed to toxic agents and/or other stressful physical agents which may be present in addition to and simultaneously with heat.

(f) Information concerning heat acclimatization. The information shall be kept on file and readily accessible to the worker at all places of employment where he may be exposed to excessive heat.

Section 7 — Warning Sign

The following warning sign shall be appropriately located at one or more places to be noticed by any one entering an area where environmental conditions are 86°F WBGT or above.

WARNING HEAT STRESS AREA

Section 8 — Monitoring

(a) A WBGT profile shall be established for each work place for winter and summer seasons to serve as a guide for deciding when work practices shall be initiated to conform with the requirements of the standard. The first profile shall be established within 3 months of the effective date of this standard.

(b) After the WBGT profiles have been established, monitoring shall be conducted once during July and August of each year.

Section 9 — Recordkeeping

(a) The following records shall be maintained:

(i) Medical records for each employee.

(ii) Records of acclimatization as required by Section 3(c)(i).

(iii) Records of the WBGT for each work area as specified in Section 8.

(b) Records required by provisions (i) and (ii) above shall be maintained for a period of the employee's employment and for one year thereafter.

(c) Records of the WBGT as specified in (iii) above shall be maintained for a period determined by the Secretary of Labor with consultation with the Secretary of Health, Education, and Welfare.

HEAT/COLD

HEAT

A worker's ability to do the job is affected by working in a hot environment: strength declines and the onset of fatigue comes sooner than it would otherwise. Constant heat can also impair a worker's mental alertness, often increasing the possibility of an accident.

Moreover, constant heat can lead to serious health effects such as heat rash, heat cramps, heat exhaustion, and heat stroke.

Health Effects

- o Heat Rash (prickly heat). Excessive sweating can plug up sweat ducts and cause an inflammation or rash. This rash sometimes affects the body's ability to sweat and to cool itself, and therefore can lead to more serious problems, such as heat cramps or heat stroke (see below).
- o Heat Cramps. Prolonged sweating with inadequate replacement of salt can lead to muscle spasms--usually in arms, legs, and abdomen.
- o Heat Exhaustion (heat fainting), due to dehydration or low blood pressure from physical exertion. Results in headache, tiredness, nausea, dizziness, clammy skin, heavy sweating and, sometimes, fainting.
- o Heat Stroke. Sometimes sweat suppression and increased storage of body heat lead to high body temperature (106° F) which causes extreme stress. Symptoms include hot, dry skin, mental confusion, and, if serious enough, convulsions, and eventually coma.

Measuring Heat Stress

There are four basic factors affecting the amount of heat stress we receive from working in a hot area:

Air temperature is not the only factor contributing to the amount of heat stress we receive. The three other factors are:

- o Humidity
- o Radiant Heat (direct heat radiating from an object such as an oven or even the sun)
- o Air Velocity

There is a way to evaluate the contributing effects of these four factors and determine the amount of heat stress you receive. The measurement is called the Wet Bulb Globe Temperature (WBGT). If you think heat is a problem in your workplace, you may want to measure the WBGT. Finding out what the WBGT is can give you ways to control heat exposure (See How to Beat the Heat).

Reuter-Stokes Inc. manufactures a miniaturized instrument that quickly gives you the WBGT in a digital read-out after three minutes in the hot environment. Their address is: 18530 South Miles Parkway, Cleveland, Ohio 44128. Write for the literature and get your company to purchase one.

Another alternative is having the union call NIOSH (National Institute for Occupational Safety and Health). Also the employer can contact the OSHA consultation service to come in and do a free evaluation.

How to Beat the Heat

There are essentially two ways to reduce heat stress: through engineering controls and/or good work practices.

Engineering controls are the best way to go because they actually reduce or eliminate the factors responsible for the heat stress (e.g. hot air temperature, high humidity, radiant heat, lack of air velocity). Examples of ways to deal with each factor are listed below:

- o Air Temperature:
 - Use air conditioning.
- o Humidity:
 - Use local exhaust ventilation at the sources in the process where humidity is generated.
 - Enclose processes that give off humidity.
 - Use dehumidifiers.
- o Radiant Heat:
 - Use insulation to contain the heat of hot machinery (ovens, dryers, etc.). Some types of insulation include fiberglass, polished metal reflectors and metal screens.
- o Air Velocity:
 - Use portable fans or roof fans that move air through the work area.
 - Use local exhaust ventilation at the sources where heat is generated.

Good Work Practices

1. Acclimatization. No matter how hot the surrounding air becomes, the human body must always maintain its internal temperature of 98.6° F. If the workplace air temperature increases, workers should be given time to get used to the new environment before being asked to work in it full-time. This is called acclimatization.

It takes roughly one week for the body to adjust its internal temperature controls, such as sweating to increased heat. On the first day of work in a hotter environment body temperature, pulse rate and general discomfort are high. With each succeeding day, the body becomes acclimatized to the heat. Gradual exposures, over a period of one week, reduce the likelihood of serious heat disorders among workers exposed to increased heat.

2. **Providing Isotonic Beverages.** A person may sweat away as much as three gallons of fluid that is essential for normal body functioning without feeling thirsty. Isotonic beverages should be provided at all times -- free of charge -- to replace vital salts and fluids lost through perspiration. Gatorade is one brand name. Another brand which is claimed to taste better is Squincher. Their address is: P. O. Box 192, Columbus, Mississippi 39701. Write for information and get your company to buy some.
3. **A Work-Rest Regimen** has been developed by the American Conference of Governmental Industrial Hygienists (ACGIH). Based on many workplace studies conducted by industrial hygienists, ACGIH states that these guidelines should be followed to reduce the incidence of the serious health effects caused by heat stress.

Work-Rest Regimen	Work Load		
	Lt.	Mod.	Hvy.
Continuous Work	86°F*	80°F	77°F
75% work/25% rest each hour	87°	82°	79°
50% work/50% rest each hour	89°	85°	82°
25% work/75% rest each hour	90°	88°	86°

* All temperatures are WBGT

During these rest periods, cool places should be provided. Rest is important because it gives the body an opportunity to get rid of excess heat, slows down the production of internal heat and provides greater blood flow to the skin (a natural cooling mechanism).

NOTE:

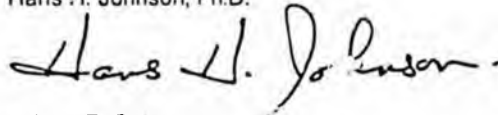
Although temperature extremes, such as heat, present serious health problems for workers, there is no OSHA standard at this time. The best chance for success in prevention is through a strong union health and safety committee.

Construction Health Hazards Prevention

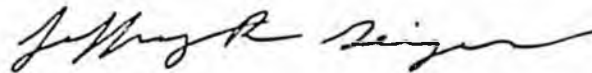
Action Tips

Construction Health Hazards Education Program
Institute of Rural Environmental Health
Occupational Health and Safety Section
110 Veterinary Science Building
Colorado State University
Fort Collins, Colorado 80523
303/491-6151

Hans A. Johnson, Ph.D.



Jeffrey R. Geiger
Industrial Hygienist



HEAT STRESS

Anyone in charge of a group of workers should be aware of the signs of heat stress. Physical activity at high temperatures can directly affect health and indirectly be the cause of accidents.

WHAT IS HEAT STRESS? It is a signal that says the body is having difficulty maintaining its narrow temperature range. The heart pumps faster, blood is diverted from internal organs to the skin, breathing rate increases, sweating increases — all in an attempt to transfer more heat to the outside air and to cool the skin by evaporation of sweat. If the body can't keep up then the person suffers effects ranging from cramps to heat stroke.

DRY CLOTHES AND SKIN DON'T MEAN YOU'RE NOT SWEATING! In dry climates you might not feel wet or sticky, but you are still sweating. On a very warm day as much as two liters of fluid may be lost due to sweating.

ACTION TIPS — BEATING THE HEAT The following steps will help to prevent the ill effects of heat stress.

- drink water frequently and moderately (every 15-30 minutes about a glassful). Due to the fact that most of us already consume excessive salt in our diets, salt tablets are not recommended for general use.

"This material has been funded in whole or in part with Federal funds from the Occupational Safety and Health Administration, U.S. Department of Labor, under grant number E1F00 101. Individuals undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment. Therefore, these materials do not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government."

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TYPES OF HEAT STRESS How to detect workers suffering from heat stress, and some things to help. (Why not copy this section, cut it out and post it for quick reference!)

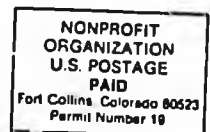
HEAT CRAMPS	pain and spasm of muscles used during work	- give water - alternate tasks between easy and strenuous jobs
HEAT EXHAUSTION	fatigue, nausea, headache, giddiness, <u>clammy skin</u> , red complexion, <u>rapid heart rate</u> , fainting while standing	- remove to cool area - give water - keep at rest
HEAT STROKE	hot and <u>dry skin</u> , red and blotchy appearance, mental confusion, convulsions, loss of consciousness	- immediate and rapid cooling by immersing in water or wrapping in wet cloth - GET MEDICAL ATTENTION IMMEDIATELY - can cause irreversible damage

.....

BEATING THE HEAT -- more Action Tips

- rest frequently
- eat a light lunch
- consider a summer schedule with starting and ending times a few hours earlier. Do the strenuous jobs during the cooler morning hours, rotating workers through strenuous jobs during the hotter times of the day.
- ventilate or use a fan in enclosed areas
- Break in new workers gradually. The body will adjust in 1-2 weeks. This adaptation to heat is quickly lost so workers just back from vacation will need an adjustment period too.
- instead of soft drinks, try a non-carbonated thirst quencher such as Gatorade.
- reduce alcohol consumption. Many cases of heat stroke have occurred the day after a "night on the town."
- wear light colored, cotton clothes and keep your shirt on -- desert nomads don't wear all of those clothes for nothing!

Occupational Health and Safety Section
Institute of Rural Environmental Health
110 Veterinary Science Building
Colorado State University
Fort Collins, Colorado 80523



DC 37 Safety & Health Factsheet

HEAT STRESS

Safety and Health Unit, District Council 37, AFSCME, AFL-CIO, 140 Park Place, New York, NY 10007



Beat The Heat!

It's hot, it's muggy, and you feel miserable. Nobody has to tell you that working in hot environments is uncomfortable. But what about the safety and health hazards? And what can be done to minimize them? This factsheet explores these questions and tells you how to beat the heat.

Q. Who has trouble with heat?

A. Nearly anyone can, but heat is more of a problem for certain groups of City workers especially:

- people who work out of doors—such as highway repairers, traffic device maintainers, arterial workers, parks laborers, lifeguards and MVOs.
- people who work near hot equipment—stationary firemen, highway repairers, hospital laundry workers, custodians, hospital dietary workers, and school lunch aides.
- people who work in confined spaces—sewer laborers, water supply, gas and electricity laborers, sewage treatment workers.

Q. Why do you get hot?

A. Your body constantly produces heat. Hard work and physical exertion produces even more heat. The body must maintain a constant temperature, so it has to shed the extra heat.

Q. How does the body keep cool?

A. In two ways: first, by varying the rate of blood circulation; and second, by evaporation, or sweating. Blood circulates close to the skin so that heat can be expelled into the environment. However, blood pumped to the body's surface cannot give off its heat if air temperatures are as warm or warmer than the skin's temperature. Therefore, when environmental temperatures reach normal body temperature (98.6 degrees F.), cooling the body becomes more difficult. Sweating then becomes the only effective way to keep your body cool.

Q. What does humidity do to the body's ability to cool itself?

A. High humidity makes it even more difficult to cool off. Your body continues to sweat, but high humidity slows the evaporation process—and it is evaporation that does the cooling.

Q. How does heat affect working ability?

A. When blood is being pumped to the skin surface to keep you cool, less blood is in the muscles and in-

ner organs. This has an effect on working ability. People working in hot environments tire easily, have difficulty concentrating, work less efficiently, make more mistakes, and suffer more accidents.

Q. Does extra heat make work less safe?

A. Because overall physical performance and mental alertness are lowered, workers in hot environments tend to experience higher accident rates. And, as temperatures rise, tempers shorten, sometimes causing people to act rashly or carelessly. Also, sweaty, slippery hands, dizziness, and fogged-up safety glasses contribute to accidents.

Common Heat Hazards

	Symptoms	Treatment
Heat Cramps	Muscle spasms and pain — usually in the arms, legs or abdomen.	Drink lightly salted water (one half teaspoon per gallon). CAUTION: People with high blood pressure, heart condition, or on a low sodium diet must consult a physician.
Heat Stroke	Blotchy, hot, dry skin; body temperature is 105° and rising; mental confusion. Severe symptoms are loss of consciousness, delirium, and convulsions leading to death.	Get medical attention immediately. This is a serious medical emergency. Move to a cool area, soak clothes with water and fan the body vigorously to increase cooling.
Heat Exhaustion	Clammy skin, headache, giddiness, fatigue, nausea, dizziness, heavy sweating.	Rest in a cool place, drink lightly salted liquids. CAUTION: People with high blood pressure, heart condition, or on a low sodium diet must consult a physician.
Heat Rash (Prickly heat)	Inflammation of the skin and sweat glands.	Rest, at regular intervals, in a cool place. Shower after each work shift.

Q. What is the effect of heat on health?

A. It depends. If you are not used to working in high temperatures, or if intense prolonged heat overwhelms your body's ability to cool itself, you can suffer several unhealthy, and sometimes dangerous, reactions to heat. Learn to recognize the signs and treatment of heat stress.

Q. Does long term heat exposure present any special health problems?

A. Though the research is skimpy, it suggests that some psychological conditions, digestive tract problems, and heart strain are more frequent among workers routinely exposed to high temperatures.

Q. Is it possible to adjust to high temperatures?

A. Yes. Through a process known as acclimatization, within one or two weeks people get used to working in hot environments. During the first few days of heat exposure, body temperatures rise to a feverish level, heart and pulse rates quicken, and general discomfort is increased. Gradually, with each day of exposure, the body acclimates and further heat exposure becomes more endurable.

Not everyone acclimates as well or as quickly. Young people acclimate better than older people. Leaving a hot environment for more than one week can cause a loss of from one quarter to two-thirds of the acclimatization. An absence of three weeks or more can cause a total loss. Take care to acclimatize slowly. Heat disorders are more likely to afflict workers who have not been given adequate time to adjust.

Q. Do any laws protect me from working in excessive heat?

A. The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) doesn't have an official standard for heat. However, OSHA has recommended a standard of 86 degrees F effective temperature. The effective temperature is obtained by use of a special thermometer (called Wet Globe Thermometer) which combines on a single dial reading air temperature, heat from machinery and processes (thermal radiation), humidity, and air movement. The combined effective temperature is supposed to simulate the way the human body reacts to heat. *Remember*, the recommended standard is just that—a recommendation. But it can be used as a guide.

The American Industrial Hygiene Association recommends the following temperatures for persons not in direct sunlight:

Q. What's the best way to keep cool?

A. Drink plenty of cool water. It should be available near your work area. When you feel hot or uncomfortable, drink more than satisfies your thirst, and drink it every 15 or 20 minutes. Don't drink alcohol to cool off—it dehydrates the body.

Q. What about salt?

A. When you sweat, particularly if you are not ac-

Maximum Exposure
(Based on Wet Globe Thermometer reading *only*)*

Exposure time	Desk Work	Moderate Work	Heavy Work
Continuous daily work	83.2	80.3	75.6
Intermittent work-rest			
3 hours	86.0	82.5	78.8
2 hours	87.3	83.9	80.3
1 hour	90.0	86.7	83.2
30 minutes	94.3	90.6	86.7
20 minutes	97.2	93.7	90.0

*Readings on a wet globe thermometer are lower than dry bulb readings.

climated, you lose some salt. The best way to replace it is to literally salt your food, or to drink a mild salt solution (0.1 percent). **CAUTION: PERSONS WITH HEART PROBLEMS OR ON A LOW SODIUM DIET MUST NOT BE GIVEN SALT.** Consult a doctor in such cases.

Q. What else helps?

A. Any method that increases air flow including fans, exhaust fans, or air blowers helps. Increasing air speed improves sweat evaporation as long as temperatures are below 95 degrees F. When temperatures are above 95, fans are less useful. And in dusty work areas, fans can be more trouble than they are worth.

Besides increasing air flow, other mechanical or physical methods can reduce heat. Very hot equipment can be isolated, for example, or reflective shields can be placed between a worker and the heat source.

Q. Can a change in work schedules make a difference?

A. When working in hot environments frequent short work periods alternating with short rest periods are better than long stretches of work and long breaks. Frequent rest periods give the body a chance to cool down. Work practices should be modified during an unusual rise in temperature or humidity. Non-essential jobs should be postponed; heavy work should be done in the coolest part of the day. Extra help or teams can reduce the amount of any individual worker's exposure.

Q. Is there anything else?

A. Rest areas that are air conditioned or cooler than the workplace go a long way in reducing the stress of work in a hot environment. Rest areas should be easily accessible. □

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Hot Environments

1980

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

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ABOUT THIS PAMPHLET

The purpose of this pamphlet is to give employers and employees an overview of the health hazards of work in hot environments, and to alert them to the precautions which should be taken to avoid excessive heat stress.

The following is general information only. It should not be considered as a substitute for any of the provisions of the Occupational Safety and Health Act of 1970 or for any regulations issued by the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA).

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NOISE CONTROL

A guide for
workers and employers

U.S. Department of Labor

Occupational Safety and
Health Administration



PHILAPOSH factsheet

NOISE

the most common industrial health hazard

typical decibel ratings		
Ordinary conversation	60	dB
Busy street traffic	75	dB
Office tabulating machines	80	dB
Linotype machines	88 to 91	dB
20 feet from subway train	90	dB
Folding machine, bindery	90	dB
Pneumatic diesel air compressor	90	dB
Rotogravure press, pressman's station	97	dB
Automatic screw machine	98 to 105	dB
Can manufacturing plant	100	dB
Newspaper printing press	102 to 108	dB
Wire rope stranding machine	102 to 108	dB
Caterpillar tractor, idling	104	dB
Weaving room	105	dB
Circular saw	105 to 116	dB
Drills, shovels & trucks operating	108	dB
Between two compressors	110	dB
Woodworking shop	110	dB
Drop hammer (depending on size)	110 to 135	dB
Punch press	112	dB
Sandblasting	112	dB

It is probably too noisy if

- 1) you must shout to be heard by someone standing within a few feet,
- 2) your ears ring or you have heard noises after being in a work area,
- 3) you have a temporary reduction in your hearing ability (your family may notice this first).

The unit that measures noise is the decibel (dB). An increase of 3 decibels means that the noise level is twice as loud. Decibels can be measured exactly with a sound level meter. It is easy to use and some unions are buying their own. After taking measurements you can figure out if your daily dose of noise is more than federal OSHA law allows.

what noise does to you

For 100 years it has been known that excessive noise causes temporary then permanent hearing loss due to damage of the "hair cells" inside the ear. Neither surgery or a hearing aid can remedy this damage. A victim will first notice that although he/she hears voices, he/she cannot understand the words: music sounds flat. Noise also causes blood vessels to contract, blood pressure to increase, pupils to dilate, and muscles become tense. Noise may contribute to diseases of the heart and nervous systems.



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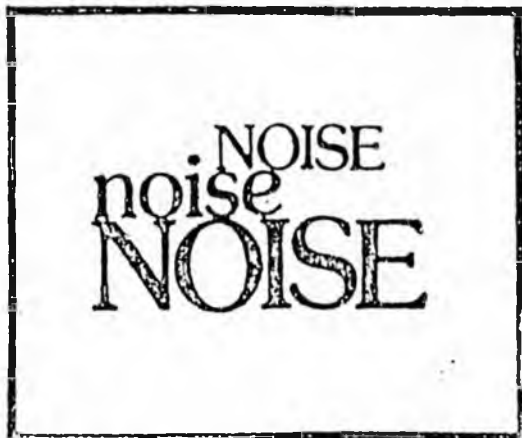
how to protect yourself

If your plant is too noisy, the company should give you a plan of how they will quiet the equipment and when. A guarantee could be written into the union contract. The company can run machines at lower speed, use plastic gears, erect baffles to deflect and absorb noise, isolate the noisy machines or enclose the noise producing parts.

Only while engineering solutions are being worked out are ear plugs or muffs acceptable. The company should provide a type that is both comfortable and effective. The protection offered by a good muff is generally greater and less variable between individuals than for earplugs. Earplugs can be worn only in healthy ear canals and even then discomfort or infection can result.

OSHA noise levels

DURATION OF EXPOSURE per day, in hours	SOUND LEVEL IN DECIBELS
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼ or less	115



Wearing plugs or muffs in noise levels above 90 dB should not interfere with and may improve speech communications. However, you are the best judge of whether the devices hinder communication and could be a safety hazard.

Remember--OSHA law states that engineering controls, not ear plugs or ear muffs, are required to reduce noise.

Although not yet legally required, the company should provide audiometric (hearing) tests yearly. You should request the test results and see for yourself that your hearing is not being harmed. If you suspect that your hearing loss has been caused by your job, you may be eligible for Worker's Compensation.

It's also important to remember that the 90 decibel limit set by OSHA as the legal standard has been found not to prevent hearing loss. Thus, we must fight for lower noise levels at work and for a strong noise standard.



For further information:
Noise Control, A Workers' Manual, Dan MacLeod, United Auto Workers. \$1.50
Available from PHILAPOSH

This factsheet was produced by the PHILAPOSH Health/Technical Committee.
For more information, contact the Philadelphia Area Project on
Occupational Safety and Health, Room 607, 1321 Arch Street, Phila, Pa.
19107 215-568-5189

DEPARTMENT OF LABOR

NEWS RELEASE

PO BOX 1149, JUNEAU, ALASKA 99802 (907) 465-2700
Sheffield, Governor, Jim Robison, Commissioner, J. Allan MacKinnon, Information Officer

NOISE EXPOSURE STANDARDS AMENDMENTS PROPOSED

The Alaska Department of Labor is proposing to amend its recently adopted occupational noise exposure standards. The department expects to have these standards in place before the end of this year.

Under the revised hearing protection program, an employer will be allowed flexibility to find the most cost-effective means to provide hearing protection for those workers exposed to an 8-hour time-weighted average (TWA) of 85 decibels. All workers except those employed in construction, agriculture, and oil and gas-well drilling and servicing operations will be covered.

The revised program covers the following points:

MONITORING. The performance-oriented provisions allow employers to choose the monitoring method best suited to their individual situation, but must include all levels of noise between TWAs of 80 to 130 decibels. Area monitoring is allowed, but where such monitoring is inappropriate, representative personal sampling is required.

AUDIOMETRIC. Includes baseline audiograms, annual audiograms, training and follow-up procedures.

Training must be provided at least annually for employees exposed at or above the action level.

RECORDKEEPING. Requirements state that noise-exposure-measurement records must be kept for two years and audiometric test results for the duration of a worker's employment.

HEARING PROTECTORS. The revised program requires employers to make hearing protectors available to all workers exposed at or above the action level by paying for the protectors and offering a choice of protectors from a variety of suitable types. Further, employers will ensure the proper use of hearing protectors by employees.

Anyone interested in receiving a copy of the standards should contact the Division of Labor Standards and Safety, Occupational Safety and Health Section, P.O. Box 1149, Juneau, Alaska 99802.

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FOR IMMEDIATE RELEASE

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building specifications for new industrial plants, construction noise levels can be reduced. The same technique can be applied to apartment, office and other construction. Designers and specification writers can use less-noise-producing construction equipment and methods.

Another controllable factor in reducing construction noise is operation of the equipment itself. Just as motorcycle and sports car engines do not have to be "revved up" for efficient street use, big trucks, loaders, etc. do not have to be run at full power or at highest speed. They need not be banged around either; operators can and should control the noise output of their equipment.

Despite the anticipated manufacture of quieter products, most of the nation's urban centers will remain noisier than they need be until residents, like you, recognize that there is no such thing as "temporary" construction and you actively support the enactment and enforcement of effective noise control regulations in your community.

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August, 1972



U.S. Environmental Protection Agency
Washington, D.C. 20460

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All over America, in large cities and small, new office buildings and apartment houses are going up, new highways are under construction, streets are being repaired, new homes are being built—construction activity envelops us and so does one of its by-products—noise.

Construction noise, especially in urban areas, today is a major environmental problem. Few of us recognize it as such, however.

Why? Because we look upon construction as something temporary, although it has become a permanent part of our modern world. No sooner are individual projects completed, than new ones begin; construction is never-ending and so is its noise.

Noise generated in construction and from other sources is certainly an annoyance, but, more important, it can impair our health. Continuous noise at high levels, is not only irritating, but it can damage our hearing and cause other ailments. More and more, people who work in construction or live in constantly noisy environments are experiencing gradual, but permanent hearing loss.

In the construction cycle, noise is usually the loudest in the ground-clearing and excavation phases. The intermediate foundation placement and erection operations generally are somewhat quieter, but again the finishing work tends to produce considerable noise.

The equipment used for heavy construction—earth movers which have high horsepower gasoline or diesel engines, large capacity air compressors, powerful rock drills and demolition tools, pile drivers, cement trucks—was designed to do as much work as possible, with little or no thought given to sound control.

Large portable compressors, for example, produce some of the most objectionable noise. Often as many as eight or nine are lined up along the curb, beside the sidewalk where people pass, and close to apartments, stores and offices, where people live and work. Sometimes the compressors, which produce about twice as much noise as a subway roaring into a station, remain in the vicinity for many months. These devices have become a target for noise control.

In open areas such equipment is not too objectionable because noise levels drop six decibels as the distance from the source doubles. But in large cities with narrow streets, noise bounces back

and forth between buildings so the sound decreases little with distance.

Noise Can Be Lessened

At the present time, the most practical method of absorbing or containing noise within a compressor unit is to enclose it in a structure containing sound-insulation material, stiffeners and baffles. Using these techniques, noise levels have been reduced from approximately 105 decibels when measured at 3 feet to less than 90 (or about as loud as a heavy truck passing by, 50 feet away). Further reductions are possible.

In other construction equipment such as tractors, loaders, graders, etc., the major noise sources are the engines, engine exhausts, cooling fans, engine air inlets, transmission and drive chains, pumps, motors and valves and tires.

To reduce these noises, manufacturers are using modifications such as new muffler designs, engine enclosures, slower speed fans, hydraulic tank covers, fuel tank isolation, engine mounts, special floor mats, etc. Manufacturers estimate that these types of modifications will add 1-3 percent to the present costs.

Trucks also add to construction noise, large diesels are the biggest "contributors." In spite of problems in silencing this equipment, most manufacturers agree that they will be able to meet the operating noise level standards of 86 dbA required by the State of California for heavy trucks manufactured after January 1, 1973.

Quieter, new construction equipment, however, will not result in a dramatic, immediate noise reduction. An estimated 90 percent of the 519,000 units sold in the United States from 1960 through 1971 are still in use and an additional 100,000 units manufactured between 1955 and 1960 are still working. Attention, therefore, must be given to changing some construction activities.

One method is to regulate hours of operation; another is to consider the construction site rather

The decibel is the most commonly used measurement of sound. Some scientific opinion holds that continuous 8-hour-exposure to levels of 85 decibels as measured on the "A" scale of a standard noise meter can cause permanent hearing loss. There is individual variation, however, and this time/level combination cannot be considered inflexible. Moreover, annoyance which is really what bothers people most, sets in at levels much lower than 85 decibels and in a time frame of seconds.

than the specific equipment. For example, new, quieter equipment can be used in the cities and the older equipment in suburban or rural areas. To further reduce noise, sound-absorbing barriers also can be used on urban projects. Needed to speed the application of such control techniques, however, is community action to establish and enforce local ordinances and codes to reduce construction noise.

Control Technology Exists

Draglines and pile drivers used in excavation and foundation work; portable steam boilers; jackhammers and other demolition equipment; welding machines; power saws; pneumatic wrenches; drills; reamers; concrete mixers and dump trucks all add to the din of the environment.

Again, adequate basic technology already exists to effectively reduce noise from most of this equipment. Some examples are:

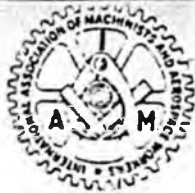
Pile Drivers. Some noise can be eliminated by replacing valves and using silencers on vents. Design changes in boilers, compressors and diesel drives are also possible. The traditional pounding, however, is eliminated in vibrator equipment, a relatively recent development, which is normally operated at resonant frequency and is unusually quiet since the only noises come from the motors and the hum of the vibrators. In addition, ground vibrations extend only a few feet away from the driver. An additional benefit is that pile driving with this new type of equipment is many times faster.

Hammers. Noise is generated by the impacting force and by the exhaust air vents. Pneumatic silencers, comparatively simple and cheap, can reduce noise levels; some air hammers already have silencers.

Riveting. Riveting sounds are in the high noise category and travel for long distances through massive steel structures. Dampening such noise is difficult, if not impossible. However, squeeze-riveting, welding or the use of high-strength bolts are possible alternatives.

Concrete Mixers. This equipment can be made less noisy by using a heavier mixing bucket or by using a sound-absorbing coating. Quieter operation can also be achieved by using plastic gears.

It has been demonstrated that when specific attention is given to noise during development of



International Association of Machinists and Aerospace Workers

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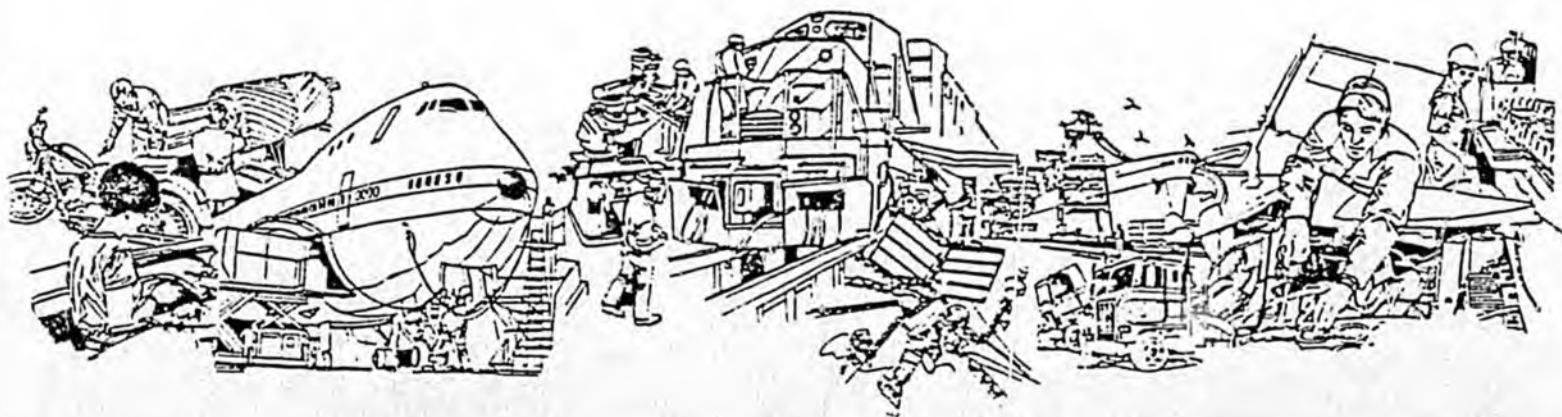
SAFETY & HEALTH

1300 Connecticut Avenue, NW

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NOISE



NOISE

I. Introduction

Hearing loss due to noise is America's number one nonfatal health problem. Noise can be a very subjective topic since it involves so many factors. Its most basic definition is unwanted sound or sound that is irritating to the ears. Sound is a result of a pressure oscillation (increases and decreases in atmospheric pressure due to a rapidly vibrating object). When referring to noise, we must be concerned with wavelength, frequency, sound speed, and amplitude:

1. Wavelength - This is the distance sound waves travel during a period of time.
2. Frequency - The number of variations in sound pressure per second. It is expressed in units called Hertz (Hz). A healthy young ear can detect sounds in the 20 - 20,000 Hz range. Speech occurs in the 250 - 3000 Hz range.
3. Sound speed - Dependent on temperature of air
4. Amplitude - Dependent on temperature and density of air.

There are three basic types of noise:

1. Wide band - Noise distributed across a broad range of frequencies. (Example: airplane noise)
2. Narrow band - Noise distributed across a narrow range of frequencies. (Example: circular saws)
3. Impulse - Noise that is present for short periods of time. (Example: firing of a gun)

The most common unit used for describing noise is the decibel. Since there are a wide range of sound pressures, a logarithmic scale was devised to simplify the expression of noise levels. On the decibel scale, 1 represents the faintest audible sound and 120 to 140 is generally considered to be the threshold of pain.

II. Effects of Noise

General Effects - May cause loss of hearing, disrupt speech communication and hearing, cause annoyance, and impair performance to some extent. Some definitions have been developed to assess type of hearing impairment.

1. Temporary Threshold Shift - Hearing loss, also called auditory fatigue, represents hearing loss which is recoverable after a period of time away from the noise source.
2. Permanent Threshold Shift Hearing Loss - Prolonged exposure to noise results in permanent hearing loss or impairment.
3. Speech Communication Interference - Noise not intensive enough to cause hearing damage, but may disrupt speech communication. While communication is necessary, the levels of acceptability may vary with the nature of work involved.
4. Annoyance - Different levels of noise and frequency may prove to be annoying while performing work tasks.
5. Noise can cause changes in heart beat and respiration, electrical activity of the brain, irritability, and nausea. As a result of this type effect, a stressful type of situation may be experienced by workers. Increased blood pressure has also been noted in workers exposed to excessive levels of noise.

III. Factors Influencing Noise-Induced Hearing Loss

1. Overall decibel level of noise exposure - If a noise exposure does not cause auditory fatigue, then such an exposure is not considered harmful to one's hearing sensitivity.
2. Another consideration is the frequency of the noise - High frequency noise is more harmful to a worker's hearing sensitivity.
3. The time distribution of the exposure is important - In general, intermittent noise exposure is less harmful than steady state noise. The ear is allowed to recover when exposed to intermittent noise.
4. Individual's own susceptibility to noise must be considered - Each individual will react differently to the same noise levels encountered.

IV. Measurement of Noise

The basic instrument for the measurement of noise is type Type II Sound Level Meter (see diagram). The meter is a portable survey type instrument and consists of a microphone, an amplifier with calibrated volume control, and an indicating meter. Because of its design, noise can be expressed in decibels. There are three weighting networks (A,B,C) provided which are an attempt to duplicate the response of the human ear to various sounds. The weighting network used for most measurements is the A scale.

For personnel exposure, noise dosimeters are used to indicate the amount of exposure the worker may encounter during the shift. The dosimeters contain specialized electronic memory cells that present the exposure in percentages. This percentage can be related to the noise exposure to which the employee was subjected.

V. Control of Noise Sources

Noise control can be achieved with engineering controls, administrative controls, or personal protective equipment. The most desired choice would be that of engineering controls, or the design or installation of new equipment to minimize exposure. This eliminates any discomfort of the worker, and allows for normal and efficient operation of duties. There are various types of engineering controls with different degrees of complexities. The following is just a partial list of types of engineering controls:

1. Substitution of machines
2. Substitution of processes
3. Maintenance of existing machines
4. Isolation of operation
5. Isolation of noise sources
6. Enclosures

The second most desirable method of noise control is by administrative means. These types of controls can be implemented by management in order to reduce the duration workers are exposed to noise. The following are examples of administrative controls:

1. Arrange work schedule to limit operator exposure
2. Increase workforce
3. Perform work around high noise levels when a minimum number of employees will be exposed.

The main disadvantage to administrative controls is that many industrial settings do not lend themselves to flexible work shifts or the operation is not a process which can be stopped or started easily.

The third and least desirable means of control is personal protective equipment. In most cases, this type of control is the one usually encountered due to economic appeal (least expensive control method). Control by personal protective equipment is in the form of ear plugs or ear muffs. Both type of devices have advantages and disadvantages. The application and length of exposure to noise will determine which protection is most suitable. Each employee has his own personal preference, and as long as there is proper attenuation of noise, each can be used effectively. The main disadvantage of ear protectors is the discomfort

that the wearer must endure. There also may be interference in communications with other employees in the area as a result of using ear protection.

If hearing protection is utilized, the type and style should be carefully considered in order that employees will receive the maximum protection afforded by them. All employees should be trained in the proper manner of wearing and maintaining the devices used. A great deal of caution must be used when ear protection is needed on a job requiring communication.

VI. Hearing Conservation Program

If workers are being exposed to excessive levels of noise, a hearing conservation program should be implemented. This type of program will ensure that employees will not suffer continuing deterioration of hearing. The program consists of noise surveys, provision of personal protective equipment, audiometric testing (process of testing for hearing ability or detecting deafness), documentation of results, and education of employees and management about the need of hearing conservation. For a program such as this to be effective, continuous monitoring by qualified individuals is required.

VII. Federal Regulations Concerning Noise

OSHA has a Federal standard concerning noise which can be found in Section 1910.95 of the General Industry Standards. It is not a very comprehensive standard, but does provide a table for permissible noise exposures. A reprint of Table 6-16 is as follows:

<u>Duration per day, hours</u>	<u>Sound Level (dBA)</u>
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼ or less	115

Exposure to impulse noise should not exceed 140 dBA.

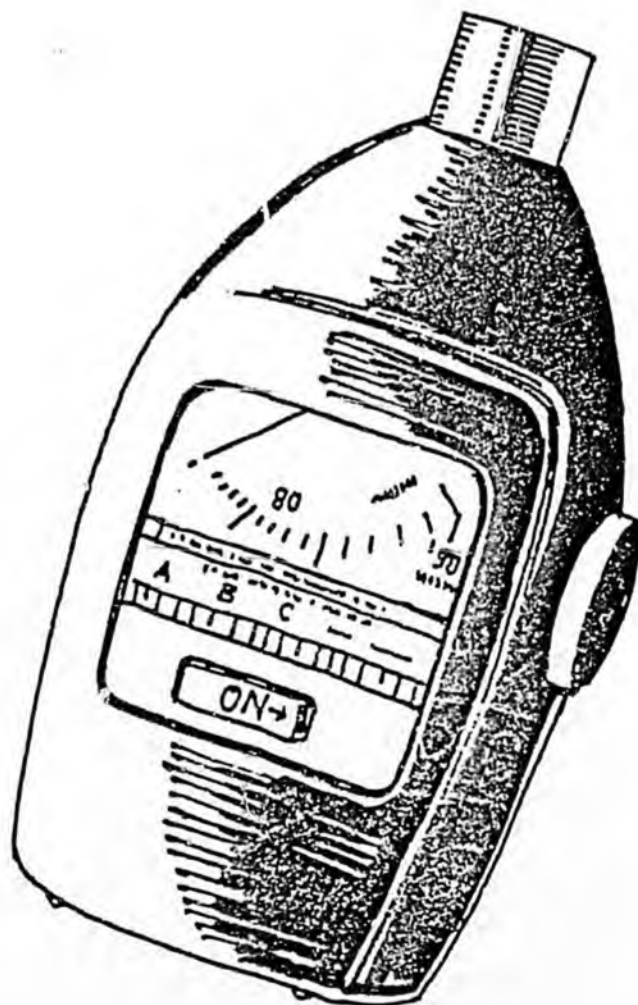
Recently, OSHA promulgated a hearing conservation amendment to Sec. 1910.95 similar to what is mentioned in VI. The amendment applies to establishments which have noise that exceeds 85 dBA for an 8-hour time-weighted average. The amendment does not require engineering controls or reduce the acceptable exposure level but does provide for extensive monitoring. Copies of the standard should be available at the workplace, and are available at the area OSHA office.

VIII. Conclusion

Everyone is aware of the problem that noise presents to the population. There is evidence available that the present standard may not be stringent enough to prevent hearing loss in the exposed populations. If noise is a problem at the workplace, a survey should be done by qualified personnel to locate the noise sources and recommendations made to alleviate the noise.

All employees should have annual audiometric tests to determine if there has been any change in hearing ability during the past year. With the proper education and protection, hearing loss due to noise should be reduced significantly.

One other concern associated with noise is the exposure to vibration. The effects of vibration on the body is not documented as well as the effects caused by noise. There can be a whole body type of an effect where the whole body mass is subjected to vibration, or segmental vibration can occur. This refers to vibration of a portion of the body. Certain physiological and psychological effects can also result from vibration. Vibration can be measured and controls implemented for its control. The subject of vibration is much more complex, but this brief introduction should make employees aware that noise and vibration are frequently associated with each other. If further information concerning vibration is required, inquiries may be made to the Safety and Health Department.



SAFETY RULES FOR LASER OPERATION ENUMERATED

Guidelines for the safe operation of lasers were outlined by Charles L. Cheever, Industrial Hygienist, Argonne National Laboratories (9700 Cass Ave., Argonne, Ill.) at a meeting of the Chicago Section of the American Industrial Hygiene Association on January 8, 1964. The recommendations he made are summarized as follows:

1. Limit the area in which a laser is used to those whose work requires access to the room, and indicate controlled area by use of signs on each door.
2. Provide an intense and distinctive audible signal to alert all personnel in the area of the imminent firing of the laser.
3. Equip all lasers with key-lock switches which permit removal of the key only when the circuit is open. Assign keys only to authorized personnel.
4. Remove all unnecessary shiny surfaces in the general direction of the beam to minimize the potential for specular reflections which may arise not only from mirrors and the front surfaces of lenses, but even from doorknobs, polished table tops or walls, and metal or glass containers. Provide laser safety glasses for reducing the intensity of reflections, but test the glasses periodically since some deteriorate with time and exposure.
5. Forbid personnel to look directly into a laser beam even while wearing optical absorbing lenses, or from a distance calculated to be safe.
6. Contain all lasers in a suitable shield; also shield the light source (pumping light) of the solid state laser to protect operating personnel from the brilliant flashes and the fragments from lamps which may explode.
7. Maintain cables, connectors, cabinets, and switches in proper working order to prevent electric shock and burns. Discharge capacitors before cleaning or repairing. Do not permit operators to leave equipment until all voltage is removed from the capacitors as indicated by a zero voltage reading on the meter. Provide interlocking covers over high voltage circuits to prevent access to energized components, and a tagout or lockout system to prevent connections from being made unless power supplies are disconnected. Ground all noncurrent carrying components.

8. When possible, operate the laser in a well-lighted room to avoid enlarging the pupils of the eyes of personnel and thus minimizing access to the retina.
9. Provide impervious, quick-removal type gloves, face shields and safety glasses as minimum protection for personnel who handle the liquid gases used as coolants for the crystals of pulsed lasers.
10. Remove all unshielded combustible material from the area in which the laser is employed since a laser beam can ignite paper at distances up to 20 feet.
11. Immediately report any incident involving persisting after-images of any light source to the Health Division or Medical Department.

NIOSH

Current Intelligence Bulletin 38

MARCH 29, 1983

VIBRATION SYNDROME



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

CURRENT INTELLIGENCE BULLETIN #38

VIBRATION SYNDROME

March 29, 1983

In light of a recently completed, comprehensive study, conducted by the National Institute for Occupational Safety and Health (NIOSH), the Institute concludes that vibrating handtools can cause vibration syndrome, a condition also known as vibration white finger and as Raynaud's phenomenon of occupational origin. Vibration syndrome has adverse circulatory and neural effects in the fingers; the signs and symptoms include numbness, pain, and blanching (turning pale and ashen). Of particular concern is evidence of advanced stages of vibration syndrome after exposures as short as one year. NIOSH recommends that jobs be redesigned to minimize the use of vibrating handtools and that powered handtools be redesigned to minimize vibration. Where jobs cannot be redesigned to eliminate vibrating tools, such as pneumatic hammers, gasoline chain saws, and other powered handtools, engineering controls, work practices, and administrative controls should be employed to minimize exposure.

PURPOSE OF BULLETIN

Occupational health and safety professionals, employers, and workers should be alerted to recent information on the potential hazards of vibrating handtools. A comprehensive study recently completed by NIOSH demonstrates the seriousness of vibration syndrome in workers and provides an accurate measure of the prevalence of vibration syndrome. The study suggests that vibration syndrome is severely underreported by workers and health professionals. Workers tend to underreport the syndrome because symptoms are intermittent and occur most frequently under conditions not

present in a doctor's office (e.g., early in the morning or when the hands are cold or wet). In addition, many workers are unfamiliar with the potential seriousness of vibration syndrome. Cases tend to be underreported by physicians because most have not been informed of how to distinguish the symptoms of Raynaud's phenomenon from other medical conditions where blanching or sensory loss occurs. Consequently, many doctors do not perform the appropriate clinical examination and interview to test for vibration syndrome.

Implementation of NIOSH's recommendations should reduce the incidence and severity of vibration syndrome. However, existing data are insufficient to recommend a safe duration and intensity of exposure or specific work practices that will prevent the occurrence of vibration syndrome. Through research, NIOSH is seeking additional information about the relationship between exposure duration and vibration syndrome, as well as effective control technologies to prevent vibration syndrome.

BACKGROUND

Raynaud's phenomenon was first described as "a condition, a local syncope [loss of blood circulation], where persons see one or more fingers becoming white and cold all at once" [1]. In 1 to 3% of the cases, these blanching attacks become progressively more severe over the years, leading to blue and cold fingers; even though the skin may become atrophic, ulcerated, or gangrenous. "Primary" Raynaud's phenomenon, originally described by Dr. Maurice Raynaud, occurs spontaneously in less than 15% of the general population [2]. The ratio of female to male patients is five to one [3]. "Secondary" Raynaud's phenomenon has the same signs and symptoms and progresses through the same stages of severity but may be correlated with a specific cause (i.e., other medical conditions, vinyl chloride, or vibrating handtools). Some medical conditions, particularly fractures, lacerations, costoclavicular syndrome, connective tissue diseases, vascular disorders such as Buerger's disease, generalized atherosclerosis, or a long history of high blood pressure, may result in the same signs and symptoms as primary Raynaud's phenomenon. This CIB is limited to a discussion of Secondary Raynaud's phenomenon resulting from the use of vibrating handtools, referred to as vibration syndrome.

Early stages of vibration syndrome are characterized by tingling or numbness in the fingers. Temporary tingling or numbness during or soon after use of a vibrating handtool is not considered vibration syndrome. To be diagnosed as vibration syndrome, these neurologic symptoms must be more persistent and occur without provocation by immediate exposure to vibration. Other symptoms of vibration syndrome include blanching, pain, and flushing. The symptoms usually appear suddenly, and are precipitated by exposure to cold. With continuing exposure to vibration, the signs and symptoms become more severe and the pathology may become irreversible.

The severity of vibration syndrome can be measured using a grading system developed by Taylor [4]. After a clinical observation and an interview, a worker can be placed into one of the categories in Table 1. Clinical aspects of vibration syndrome are discussed in the Appendix.

Table 1. Stages of Vibration Syndrome

Stage	Condition of Fingers	Work and Social Interference
00	No tingling, numbness, or blanching of fingers	No complaints
0T	Intermittent tingling	No interference with activities
0N	Intermittent numbness	"
TN	Intermittent tingling and numbness	"
01	Blanching of a fingertip with or without tingling and/or numbness	"
02	Blanching of one or more fingers beyond tips, usually during winter	Possible interference with nonwork activities; no interference at work
03	Extensive blanching of fingers; during summer and winter	Definite interference at work, at home, and with social activities; restriction of hobbies
04	Extensive blanching of most fingers; during summer and winter	Occupation usually changed because of severity of signs and symptoms

EXTENT OF EXPOSURE

Based on a 1974 study of occupational exposures to vibration, NIOSH estimates that 1.2 million workers in the United States are potentially exposed to hand-arm vibration (Table 2) [5]. These workers are potentially at risk of developing vibration syndrome.

Table 2. Workers Potentially Exposed to Hand-Arm Vibration

No. of Workers	Industry	Type of Tool
500,000	Construction	Handtools
200,000	Farming	Gasoline chain saws
14,000	Metal working	Handtools
54,000	Steel	Furnace cleaning using powered handtools
30,000	Lumber and wood	Gasoline chain saws
34,000	Furniture manufacturing	Handtools
100,000	Mining	Pneumatic drills
250,000	Truck and auto manufacturing	Handtools
64,000	Foundries	Handtools
Total	1,246,000	

Adapted from reference [5]

EVIDENCE OF HEALTH EFFECTS

Although individual workers reported symptoms of Raynaud's phenomenon and many published studies indicated that occupational exposure to vibration does cause vibration syndrome, there are few medical records of vibration syndrome. In 1979, the Bureau of Labor Statistic's Supplementary Data System contained fewer than 39 cases that might have been vibration syndrome [6]. To resolve the question of whether vibration syndrome is a rare disease or whether the small number of recorded cases is, in fact, due to underreporting NIOSH conducted a recently completed, comprehensive study designed to avoid problems noted in previously published studies [7].

NIOSH studied 385 workers exposed to hand-arm vibration from pneumatic chipping hammers and grinders at two foundries and a shipyard. Workers in the foundries and the shipyard who had never used vibrating handtools comprised the control group. Workers in the exposed groups were in the same work locations as the control workers, and were exposed to vibrating handtools while on the job.

A physician on the research team who had extensive experience in the diagnosis of vibration syndrome examined each worker in the double blind study. Based on clinical observation and interview, each worker was placed in one of the stages shown in Table 1. Neither the worker nor the physician was told if a worker was classified as exposed or control.

In the foundries, 47% of the exposed workers had advanced vibration syndrome (stage 1 or more severe); 19% of the exposed workers in the shipyard were similarly affected. Although no workers in the control group were found to have vibration syndrome, 83% of the exposed workers in the foundries and 64% of the exposed shipyard workers had discernable symptoms. Table 3 displays prevalence of vibration syndrome by stage among the workers.

Table 3. Prevalence of Vibration Syndrome by Stage in Foundry and Shipyard Populations

Vibration Syndrome Stages	Controls Foundries and Shipyard N=63*	Exposed Workers		
		Foundries N=147*	Shipyard N=58*	
Circulatory Symptoms (or combined symptoms)	03 02 01	0% 0% 0%	5% 22% 20%	5% 5% 9%
	Subtotal	47%	Subtotal 19%	
Neurological Symptoms Alone	TN ON OT	0% 0% 0%	20% 7% 9%	17% 17% 11%
	Subtotal	36%	Subtotal 45%	
No Symptoms	00	100%	17%	36%
Total		100%	100%	100%

*N = Number of workers

Adapted from Vibration White Finger Disease in U.S. Workers [7]

Workers with medical conditions that might produce signs and symptoms similar to Raynaud's phenomenon were excluded from both the control and exposed groups. Of studies performed in the United States, these prevalence rates are the best available evidence that link Raynaud's phenomenon with exposure to vibration. These data demonstrate the potential seriousness of vibration syndrome in foundries and shipyards and by implication in other workplaces where there are similar tools and operations.

There is a direct relationship between years exposed and severity of vibration syndrome. This relationship in foundry workers is demonstrated in Table 4. Vibration syndrome of stage 1 or greater severity was found in 31% of the workers exposed 1.5 years or less, 41% of the workers exposed 1.5 to 3 years, and 71% of the workers exposed more than 3 years. A similar relationship was observed among shipyard workers (Table 5).

Table 4. Exposure Duration and Severity of Health Effect for Foundry Workers Using Chipping Hammers*

Vibration Syndrome Stage	Exposure Duration (Years) and Prevalence of Symptoms			Percent of Total Workers at a Stage N=147**
	Less Than 1.5 N=56**	1.5-3.0 N=29**	More Than 3.0 N=52**	
02 and 03	11%	24%	50%	27%
01	20%	17%	21%	20%
0T, 0N, and 0TN	48%	48%	14%	36%
00	21%	11%	15%	17%
Total	100%	100%	100%	100%

*Chi square value 29.8 with p less than .00001

**N = Number of workers

Adapted from Vibration White Finger Disease in U.S. Workers [7]

Table 5. Exposure Duration and Severity of Health Effect
for Shipyard Workers Using Chipping Hammers*

Vibration Syndrome Stage	Exposure Duration (Years) and Percent of Workers at a Stage			Percent of Total Workers at a Stage N=58**
	Less Than 5.0 N=22**	5.0-15.0 N=17**	More Than 15.0 N=19**	
TN, O1, O2, and O3	23%	29%	58%	35%
OT and ON	32%	18%	32%	28%
OO	45%	53%	10%	36%
Total	100%	100%	100%	100%

*Chi square value of 9.9 with $p=.041$

**N = Number of workers

Adapted from Vibration White Finger Disease in U.S. Workers [7]

NIOSH also analyzed the length of time between initial occupational exposure and the onset of symptoms. This is given for each stage in Table 6. The average time for the appearance of blanching, advanced vibration syndrome of stage 1 or greater severity, for foundry workers was 2 years, and for shipyard workers it was 17 years. There is no definitive explanation for this difference. One theory attributes the difference to variations in work practices.

Table 6. Latency Period of Vibration Syndrome for Workers
in Foundries and Shipyards

	Foundries		Shipyards	
	Number of Workers	Average Latency (Years)	Number of Workers	Average Latency (Years)
Latency of Tingling for Workers with Stages OT, TN, 01, 02, 03 (excludes ON)	94	2	21	9
Latency of Numbness for Workers with Stages ON, TN, 01, 02, 03 (excludes OT)	80	2	26	12
Latency of Blanching for Workers with Stages 01, 02, 03	69	2	11	17

Adapted from Vibration Syndrome White Finger Disease in U.S. Workers [7]

Although the symptoms of vibration syndrome have also been associated with smoking and age, these associations were not seen in the study.

The results of the NIOSH study corroborate those of many published studies of Raynaud's phenomenon and vibration. In 1918, Hamilton studied workers who used pneumatic chipping hammers and drills in the limestone quarries of Indiana, and described "spastic anemia of the hands" [8]. Vibration syndrome was described in the 1930's and 1940's by Seyring, who studied workers in iron foundries [9]; by Hunt, who studied riveters who used pneumatic handtools [10]; by Telford et al., who studied workers who used electrically driven high-speed rotating handtools [11]; and by Agate and Druett, who examined casting workers who used grinding wheels [12]. Dart [13] reported vibration syndrome among 112 workers who used pneumatic and electric tools in the U.S. aircraft industry.

In 1960 Pecora et al. concluded that vibration syndrome "may have become an uncommon occupational disease approaching extinction in this country [the United States]" [14]. This finding is inconsistent, however, with those of researchers from many countries that have been published before

and since that report [15,16,17,18,19,20]. This may be due to the fact that Pecora et al. based their conclusions on the results of a questionnaire survey of occupational health physicians, a review of existing occupational health information and the results of an examination of some workers.

Ashe and coworkers reported on a small number of drillers from the hard rock mines of Saskatchewan, Canada, seven of whom were examined in the hospital [15,16]. In these clinical investigations, arteriography and biopsies were performed on the digital arteries of the fingers. In the worst cases, there was extensive damage to the digital artery with narrowing of the blood vessels. This investigation demonstrated that prolonged exposure to vibration could lead to extensive pathological damage to the digital arteries of the fingers.

In the 1960's and 1970's, vibration syndrome was also associated with gasoline-powered chain saws used in forestry work. For example, in Finland, Pyykko [17] found that the vibration of the two-stroke internal combustion engine (transmitted through the handles to the hands) was associated with vibration syndrome in 40% of the lumberjacks studied.

Other studies have been undertaken since the NIOSH study was initiated. In the United States, Taylor et al. [18] examined foundry workers who used pneumatic handtools; in Italy, Bovenzi et al. [19] studied shipyard workers; Kasamatsu et al. [20] studied Japanese chain saw operators; and Harada and Matsumoto [21] examined three groups of workers exposed to different kinds of vibration (rock drillers in a zinc mine, chipping-hammer operators in an iron foundry, and motorcycle mailmen). All studies found significant evidence of vibration syndrome.

The exact point at which vibration syndrome becomes irreversible has not been firmly established. Recently Taylor et al. reported the effect of reduced vibration levels on severity and prevalence of vibration syndrome [22]. After anti-vibration chain saws had been introduced in England, Taylor et al. found that the overall prevalence of vibration syndrome decreased. Vibration syndrome was less prevalent in workers who used only anti-vibration saws than among workers who used other types of saws. In addition, users of anti-vibration saws had an overall decrease in severity of the syndrome. The results of studies such as this have led to the redesign of other tools to reduce the degree of vibration. For example, the ARO 8316^o pneumatic scaling hammer and the Vast Hardill VHB-30^o pneumatic pavement breaker were specifically designed to reduce both vibration and noise levels.

Despite considerable research, little is known about the physiological basis of vibration syndrome or which specific vibration parameters, such as acceleration, frequency spectrum, or energy transferred to the hand, are the most necessary to control. The progressive stages of vibration syndrome arise from the cumulative effect of vibration-induced trauma to the hands from the regular, prolonged use of vibrating handtools in certain occupations.

Only recently have methods been developed to perform reproducible vibration measurements [23]. In the NIOSH study, acceleration levels were measured in three orthogonal directions [7]. To minimize distortion during measurement of acceleration, the lightest available accelerometers were selected and were tightly mounted to the vibrating tool. For tools with high acceleration rates, such as chippers, the accelerometer was mounted in a fixture which was welded to the chisel. Measuring devices were calibrated before and after each measurement.

Exposure Standards and Guides

The Occupational Safety and Health Administration (OSHA) has not promulgated any standards, nor has NIOSH published recommendations that addressed occupational vibration. Other countries have proposed such standards [24,25]; and the International Organization for Standardization (ISO) has proposed a draft standard for hand-arm vibration (ISO/DIS 5349-1982) [26]. The draft standard specifies methods for measuring and reporting hand-transmitted vibration exposure and attempts to relate these measurements to a limited amount of epidemiological data. The reader is referred to that document. However, due to the difficulty of measuring vibration exposure and the lack of a quantitative relationship between vibration levels and health effects, the ISO draft standard has yet to be accepted in the United States and several other countries. ISO has not yet proposed a final standard to replace the draft standard.

RECOMMENDATIONS

Based on the recent NIOSH study and other published studies, NIOSH concludes that occupational health professionals, workers, and employers should consider the seriousness of vibration syndrome. NIOSH recommends that engineering controls, medical surveillance, work practices, and personal protective equipment be used to help reduce exposure to vibrating handtools and to help identify vibration syndrome in its early stages among workers likely to be at risk.

Engineering Controls

The amount of exposure to vibration in many jobs can be reduced by proper job and production design. Where job redesign is not feasible, direct intervention by means of reducing tool vibration should be attempted.

Recommendation 1 Production lines should be engineered to minimize the need to use vibrating handtools. For example, quality controls on casting could be increased to reduce the average refinishing needed.

Recommendation 2 Tool manufacturers should modify and redesign tools to reduce hand-arm vibration. Tools with reduced vibration levels should be furnished to workers. Purchasers are encouraged to request suppliers to provide evidence that their equipment reduces vibration. More research is needed before a specific standard can be recommended for vibrating handtools. In the meantime, purchasers are encouraged to select tools that minimize vibration. Such information can be obtained from manufacturers' product or technical brochures.

Medical Surveillance and Worker Education

The number of vibration syndrome cases reported is small. Physicians have failed to diagnose the syndrome and workers tend not to report it. All workers who use vibrating handtools are at risk and should be examined for signs and symptoms of vibration syndrome. An examination is recommended because the severity of vibration syndrome appears to be directly related to the cumulative duration of exposure and because health effects can become irreversible.

Recommendation 3 More research is needed in order to specify an optimum surveillance program, but for the present, NIOSH recommends that a medical surveillance program be implemented and that it should be tailored to the degree that workers use vibrating handtools. It should include preplacement examination of all new workers and an initial examination of all present workers who use vibrating handtools. Work histories should be included in all examinations. Work histories should include any prior exposure to vibrating handtools. Medical records, including health and work histories, should be maintained throughout employment and for an extended period after termination of employment.

Recommendation 4 Workers using vibrating handtools and their employers should be informed of the symptoms of vibration syndrome.

Recommendation 5 Workers should see a physician promptly if they experience prolonged symptoms of tingling, numbness, or signs of blanched or blue fingers.

Recommendation 6 Health professionals, particularly occupational health physicians, should be trained in the appropriate clinical examination and interview necessary to diagnose vibration syndrome. (A special NIOSH VWF videotape has been prepared to aid in the diagnosis of vibration syndrome [31]).

Work Practices

Some tools, such as grinders, can cause greater vibration levels to impinge on the hand when wear is uneven or their alignment slips. While insufficient information is available to recommend a safe exposure duration, it is known that the severity of vibration syndrome is related to the extent and duration of continuous exposure to vibration.

Recommendation 7 Vibrating handtools should be carefully maintained according to manufacturers' recommendations.

Recommendation 8 Work schedules with a 10-minute break after each hour of continuous exposure may help reduce the severity of vibration syndrome. Research is needed to determine, however, whether another schedule of rest breaks on job rotation is more appropriate.

Recommendation 9 Workers are advised to:

- a. Wear adequate clothing to keep the body temperature stable and normal, since a low body temperature reduces blood flow to the extremities and therefore may trigger an attack of vibration syndrome. Workers are also advised to keep hands warm and dry while on the job. When their hands become wet and chilled, workers should dry them and put on dry warm gloves before additional exposure to vibration. More than one pair of gloves may be required on the job.
- b. Let the tool do the work, grasping it as lightly as possible while working safely and maintaining tool control. The tool should rest on the workpiece or support as much as possible. The tighter the tool is held, the greater the vibration transmitted to the worker.
- c. Substitute a manual tool or other processes where practical.

Personal Protective Equipment

Many types of gloves help maintain body warmth, and, in addition, some designs may attenuate vibration; however, this may be limited to only some of the higher frequencies found in vibrating handtools. Although gloves alone are not recommended as a method of reducing vibration transferred to the hands, they will help keep hands warm, and thus help reduce the severity of vibration syndrome.

for Elliott Harris
J. Donald Millar, M.D.
Assistant Surgeon General
Director



LAWS OF ALASKA

1983

Source

CSSB 79(Res)

Chapter No.

93

AN ACT

Relating to toxic and hazardous substances in the workplace;
and providing for an effective date.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

THE ACT FOLLOWS ON PAGE 1, LINE 9

Approved by the Governor: July 25, 1983
Actual Effective Date: Sections 1, 3, and 4 take effect
July 26, 1983; and Section 2 takes effect July 1, 1984

AN ACT

Relating to toxic and hazardous substances in the work-
place; and providing for an effective date.

* Section 1. AS 18.60.030 is amended by adding new paragraphs to read:

(12) annually publish a list of toxic and hazardous
substances;

(13) maintain a current set of OSHA form 20's or equivalent
information for toxic and hazardous substances, and other information
relevant to toxic and hazardous substances;

(14) assist employers, upon request, to identify and obtain
information on toxic and hazardous substances and develop employee
safety education programs.

* Sec. 2. AS 18.60 is amended by adding new sections to read:

Sec. 18.60.065. IMPORTATION OF TOXIC AND HAZARDOUS SUBSTANCES.
Toxic and hazardous substances imported into the state shall be accom-
panied by a federal Occupational Safety and Health Administration
(OSHA) form 20 or equivalent information. This requirement does not
apply to a substance for which the in-state purchaser has already
received the most current information.

Sec. 18.60.066. EMPLOYEE SAFETY EDUCATION PROGRAMS. (a) An
employer shall conduct a safety education program for an employee
before the employee performs a new work assignment that may result in
the employee being exposed to a toxic or hazardous substance for which
the employee has not received safety instruction as provided under (b)

of this section.

(b) An employee safety instruction program shall inform the employee of

(A) the location, properties, and known or suspected acute and chronic health effects of the hazardous or toxic substances to which the employee is exposed in the workplace;

(B) the nature of the operations that could result in exposure to hazardous or toxic substances, as well as any necessary handling or hygienic practices or precautions; and

(C) the location, purpose, proper use, and limitations of personal protective equipment used in the workplace.

Sec. 18.60.067. INFORMATION PROVIDED ON EMPLOYEE'S REQUEST. (a)

An employer shall make available to an employee on request a copy of the most recent OSHA form 20 or equivalent written information for a toxic or hazardous substance to which the employee may be exposed. If the employer does not have the copy or information requested, the employer shall request a copy from the department or the manufacturer of the substance within three state government working days after receiving the request.

(b) If the copy or information requested under (a) of this section is not made available to the employee within 15 calendar days after the request is received, the employer shall take measures to assure that employees are not exposed to the substance to which the copy or information pertains until the copy or information is made available to the employee who made the request. This subsection applies only to substances for which an OSHA form 20 or equivalent information is required under OSHA regulations. This subsection does not alter, deny, or abrogate any right an employee may have under law to refuse to work under hazardous circumstances.

Sec. 18.60.068. POSTING OF INFORMATION IN WORKPLACE. (a) The department shall print and make available to employers posters that contain notice of the provisions of this chapter relating to toxic and hazardous substances.

(b) An employer whose employees are or may be exposed in the workplace to a toxic or hazardous substance shall display the following information in a manner designed to notify the employees:

(1) a poster printed by the department under (a) of this section; and

(2) an OSHA form 20 or equivalent information for each toxic or hazardous substance to which an employee may be exposed in the workplace

(A) under normal conditions of work; or

(B) during a reasonably foreseeable emergency, including equipment failure and rupture of containers.

(c) Instead of posting the information required under (b)(2) of this section, an employer may post a list of the chemical name and product name of each toxic or hazardous substance to which an employee may be exposed in the workplace, together with an identification of a location, in or near the workplace and accessible to employees, where an employee may inspect the information listed under (b)(2) of this section.

* Sec. 3. AS 18.60.105 is amended by adding new paragraphs to read:

(6) "be exposed" means to ingest, inhale, or absorb through the skin or eyes a substance, or fumes or other potentially harmful aspect of a substance;

(7) "OSHA" means the federal Occupational Safety and Health Administration;

(8) "toxic or hazardous substance" includes

1 (A) a chemical listed in 29 CFR Part 1910, Subpart Z,
2 Toxic and Hazardous Substances, "General Industry Standards",
3 Occupational Safety and Health Administration;

4 (B) a chemical listed in "Threshold Limit Values for
5 Chemical Substances and Physical Agents in the Work Environment",
6 American Conference of Governmental Industrial Hygienists (Latest
7 Edition);

8 (C) a substance for which an OSHA form 20 or
9 equivalent information is required under OSHA regulations; and

10 (D) a substance determined by the department, in
11 accordance with the Administrative Procedure Act (AS 44.62), to
12 be a health hazard to an employee who is exposed to the
13 substance, including a carcinogen, reproductive toxin, irritant,
14 corrosive, sensitizer, hepatotoxin, nephrotoxin, neurotoxin,
15 agent that acts on the hematopoietic system, agent that damages
16 the lungs, a cutaneous hazard and an eye hazard;

17 (9) "toxic or hazardous substance" does not include

18 (A) substances that because of their physical state,
19 volume, or concentration do not pose a health hazard upon expo-
20 sure;

21 (B) substances that are goods, food, drugs, cosmetics,
22 or tobacco products intended for personal consumption; or

23 (C) substances in transit;

24 (10) "transit" means conveyed in a sealed or unopened con-
25 tainer by a mode of transportation.

26 * Sec. 4. AS 18.60.105 is amended by adding a new subsection to read:

27 (b) In AS 18.60.030(14), 18.60.065 - 18.60.068, and 18.60.105-

28 (a)(9)

29 (1) "employee" means a person who works for an employer,

1 but not in a place used primarily as a personal residence;

2 (2) "employer" means a person, including the state and a
3 political subdivision of the state, who has one or more employees
4 working in a place not used primarily as a personal residence.

5 (3) "health hazard" means a substance capable of causing
6 acute or chronic adverse effects to health;

7 (4) "workplace" means a place of employment other than a
8 place used primarily as a personal residence.

9 * Sec. 5. Sections 1, 3, and 4 of this Act take effect immediately in
10 accordance with AS 01.10.070(c).

11 * Sec. 6. Section 2 of this Act takes effect July 1, 1984.
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Table 13-1. Categories of Workers Potentially Exposed to Radiation

Aircraft workers	Nurses
Atomic energy plant workers	Oil well loggers
Biologists	Ore assayers
Cathode ray tube makers	Pathologists
Ceramic workers	Petroleum refinery workers
Chemists	Physicians
Dental assistants	Physicists
Dentists	Pipeline oil flow testers
Dermatologists	Pipeline weld radiographers
Drug makers	Plasma torch operators
Drug sterilizers	Plastic technicians
Electron microscope makers	Prospectors
Electron microscopists	Radar tube makers
Electrostatic eliminator operators	Radiologists
Embalmers	Radium laboratory workers
Fire alarm makers	Radium refinery workers
Food preservers	Research workers
Food sterilizers	Television tube makers
Gas mantle makers	Thickness gage operators
High voltage television repairmen	Thorium-aluminum alloy workers
High voltage vacuum tube makers	Thorium-magnesium alloy workers
High voltage vacuum tube users	Thorium ore producers
Industrial fluoroscope operators	Tile glazers
Industrial radiographers	Uranium dye workers
Inspectors using and workers located near sealed gamma ray sources (cesium ¹³⁷ , cobalt ⁶⁰ , and iridium ¹⁹²)	Uranium mill workers
Klystron tube operators	Uranium miners
Liquid level gage operators	Veterinarians
Luminous dial painters	X-ray aides
Machinists, fabricated metal product	X-ray diffraction apparatus operators
Maintenance workers	X-ray technicians
Military personnel	X-ray tube makers

Source: M. M. Key et al. (Eds.). *Occupational Diseases: A Guide to Their Recognition*. Washington, D.C.: NIOSH, 1977. P. 471-472.

Ionizing Radiation

cient to drive molecular orbital electrons emitted from atoms that are equivalent to two protons with two protons are particles emitted from a stable atom that have a net charge, making them ionizing. X-rays are electromagnetic radiation (no net charge) spontaneously emitted from nuclei. X-rays are ionizing radiations (no net charge) spontaneously emitted from nuclei.

Ionizing radiation ionizes atoms as a result of ion pairs as a result of ionization in tissue. It can be measured by the average number of ion pairs per unit length of irradiation. The unit of measurement is *Linear Energy Transfer (LET)* has a biologic response. The average ionization (release of energy) per unit length. The unit of measurement is energy released per unit length.

Alpha particles have their large mass (4 atomic mass units) ion pairs produced by their passage through amounts of energy per unit length.

Beta particles have a small amount of energy but beta particles travel at high speeds because of their small atomic mass units) over a longer track length of beta radiation because of the ionization over a longer track length. An equivalent amount of x-radiation will travel a longer track length.

Uranium, thorium, and plutonium—all of which have atomic numbers greater than 84—are alpha emitters. They are exposed during the



International Association of Machinists and Aerospace Workers

Department of

SAFETY & HEALTH

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NONIONIZING RADIATION

March 15-16
May 3



NONIONIZING RADIATION

I. Introduction

Interest in the public health aspects of nonionizing radiation has increased due to the expanded production of electronic equipment which use or produce this type of radiation. Examples are microwave ovens, lasers, radar, radiofrequency sealers and infrared equipment.

Nonionizing radiation is designated as such due to the fact that it does not produce ionization of cells present in the body. More simply stated, nonionizing radiation does not possess enough energy to produce severe effects similar to ionizing radiation (x-rays, gamma radiation).

II. Types of nonionizing radiation and general mechanism of action on the body

There are several types of nonionizing radiation, each with their own wavelength and frequency to differentiate them:

1. Ultra violet radiation (UV)
2. Infrared radiation (IR)
3. Visible
4. Laser
5. Radiofrequency radiation (RF)
6. Microwave radiation

The general effect exerted on the body by nonionizing radiation is either whole body or localized heating of tissue. The body will absorb the energy produced and it in turn will be converted to heat. This heat in turn will cause the denaturation of protein within the cells and tissue. The eye is the primary organ at risk to nonionizing radiation with the skin also being affected. There is great concern at the present time over effects that are less noticeable. Many of these effects, usually resulting from exposure to RF or microwave exposure, range from immunological and behavioral changes to physiological and central nervous system effects. There is considerable discussion over the importance of these effects but many of the reports have not been substantiated. At the present time, the scientific community is doing research to determine and validate the above mentioned effects in regard to nonionizing radiation.

III. Nonionizing Radiation and Effects

The following table will provide information regarding the six types of radiation listed. The table is by no means intended to be comprehensive. Its main

function is to compile information in a form so as to allow for quick reference. Wavelengths are expressed in micrometers or microns which corresponds to 0.0000394 inches and frequency is expressed in megahertz which is one million cycles per second or hertz. These two properties of radiation expresses the length of the wave and the frequency the waves are being produced. There is some variation as to the exact frequency and wavelength exhibited by these types of radiation, but the ones listed are generally accepted.

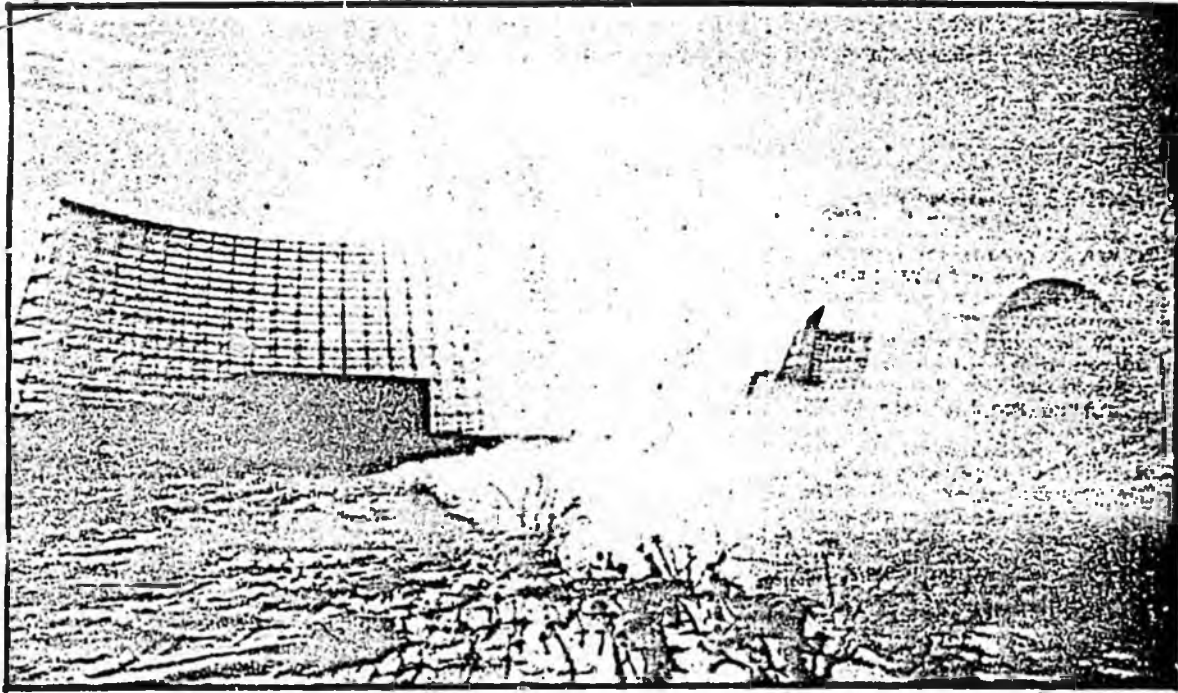
IV. Standards concerning Nonionizing Radiation

The Occupational Safety and Health Administration does have a standard regulating exposure to nonionizing radiation. It can be found in Section 1910.97 in the General Industry Standards. The standard only applies to radiofrequency and microwave radiation with no attention given to ultraviolet, infrared, visible, or lasers. Private agencies have listed recommended exposure limits to these different forms of radiation but none have been implemented into legal standards. There is a Radiation Control for Health and Safety Act which was enacted to set performance standards and control emissions from electronic products using this radiation. The Act ensures that products have been thoroughly tested before being marketed. Presently, there is some concern over the present OSHA standard as being too high, and as of now, action is being taken on the development of a new standard concerning radiofrequency waves and microwaves. In relation to other forms of nonionizing radiation, no definite action has been taken on the promulgation of new standards.

V. Summary

As can be seen from the information presented, exposure to nonionizing radiation is quite common. Of course, some exposure is dependent on the individual (exposure to UV via the sun), but in many cases excessive exposures in the workplace can be prevented. If employees are subjected to this type of radiation due to the work activity, it would be advisable to determine the extent of the exposure. Measurement of this radiation requires different types of instrumentation and should only be done by qualified personnel that are familiar with the devices. It would be advisable that each work location that uses nonionizing radiation have a surveillance program that is conducted in accordance to OSHA guidelines or some other consensus standard. This will ensure that employees are not subjected to hazardous levels of the radiation.

The range of health effects resulting from exposure to nonionizing radiation is still not completely understood. Employees should be aware of the problem if nonionizing radiation is used in their workplace, and inquiries as to the extent of their exposure should be initiated.



U.S. Air Force photo

Clear Air Force Station, part of the United States' ballistic missile early warning system.

After their exposure to microwaves at Clear, workers are looking for help

By RICHARD MAUER

Daily News reporter

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CLEAR — On a normal day, the giant aluminum web dish of the Clear tracking radar is pointed at the heavens, casting two powerful microwave beams skyward. The invisible, 5 million watt searchlight probes space for operating satellites, orbiting junk or ballistic missiles aimed at North America.

But on Sept. 14, the tracker beams were cut off and its motor drives stilled. The only noise within the dome sheltering the tracker dish came from eight men at work.

Richard Eldridge and John Jessop were welding a cracked aluminum tube. Carl Keppler and William Emmons, civil service inspectors from California, inspected the work and checked the alignment of critical parts. Ronald Foster and Ed Forsling, two radar technicians, helped the others. Two electri-

cians were installing floodlights beneath the dish.

Sometime after 3 that afternoon, strange things began to happen.

Eldridge, Jessop and Emmons couldn't understand why it was becoming so uncomfortably warm. The radome temperature had been about 60 when they walked in that morning.

Their scalps were especially annoying, as if they had worn hats all day in the summer sun.

Even odder were the stinging metal filings. The welders prepared the aluminum for welding with a grinding wheel, which threw off hot and biting bits of metal.

As Foster crawled around the tracker radar looking for a hole where a fallen bolt belonged, he also felt the strange warmth.

Keppler left his spot on top of the dish and came over to the others. His flashlight was hot to the touch. The bulb had burned out.

See Page A-10, WORKERS

Who suffered radiation at Clear look for answers and someone they can trust

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Anchorage Daily News/Paul Brown

Ron Foster gets an eye test.

"You give me the price of a coffin for a seven-year-old girl?" She couldn't figure out what the caller was talking about and hung up. The next night, the same person called, this time asking, "Could you give me the price of a coffin for a nine-year-old boy?"

Those were the ages and sexes of two of her children. Mrs. Jessop said she went to the FBI and alerted her children's teachers and school bus driver. She didn't tell her husband at first. He had enough on his mind, she said.

Neither William Emmons nor Carl Keppler, the two technical specialists from Sacramento, could be reached for comment.

Forsling has also been suffering pain, faint spells and numbness to his left side. Both Foster and Jessop said that in addition to headaches, they have trouble seeing backlighted objects like television.

Forsling, who never wore

ing Felec and its workmans' compensation insurance company to send them to non-Air Force physicians who specialize in their injuries.

But the workers got another setback. In a letter dated Feb. 1, the insurance company said that a recommended specialist, Dr. Charles Becker of San Francisco University, "chooses not to become involved in this particular case due to the particular nature of the claim."

Dr. Herbert Pollack, a physician who led Project Pandora, a federal government study in the 1960s and 1970s into the effects of the Moscow Signal, displayed the severity of the Clear accident in a telephone interview at his office in Palm Beach, Fla.

"The amount of damage one can expect in this particular situation is minimum, if any at all," he said.

Others are not so sure. Dr. Hans Arne Hansson, a clinical and laboratory researcher at the university in Gothenburg, Sweden and a leading expert in microwave radiation, said in a telephone interview that it would be hard to assess the damage to the men because so little is known about microwave exposure. Accidents like the one at Clear "are only rarely known," Hansson said.

But research is slowly catching up, Hansson said. Technical improvements in equipment and methods have enabled researchers to detect minute changes in body chemistry caused by microwaves — changes that could have significant impact on a person as time goes on.

Hansson is now doing clinical studies for the Swedish

plete. "The eye is really a disabled eye from that point on. You can't focus anymore," Zaret said.

Because additional exposure could cause cumulative and irreversible damage to the workers at Clear, Zaret said, they might be wise to avoid microwave radiation sources, whether at Clear or from leaking microwave ovens, computer video display terminals or even citizen's band radios.

Zaret examined Richard Eldridge in December and found swelling of the eye lens. He said it was too early to predict whether Eldridge would develop cataracts.

The delays that the Clear workers went through before receiving treatment may have had more than medical effects, Zaret said.

"Part of the problem with these fellows now is that they're so suspicious that they wouldn't feel a good doctor-patient relationship with any of the physicians being put forward by the military establishment or some of the (military) sponsored research scientists," Zaret said.

The Clear case has caught the interest of Alaska's congressional delegation. On Jan. 16, Rep. Don Young called for a full-scale investigation of safety procedures at Clear in a letter he sent to Vene Orr, the Air Force secretary.

Young said the Air Force and Felec "did not cooperate in good faith with the affected employees in evaluating and treating any injuries or physical damage that may have incurred."

Young's aide, William Sharow was unhappy with the

actions in the case.

"In December, Sen. Stevens and Sen. Murkowski both wrote the Air Force and asked that the victims get proper medical attention," said an aide to Stevens. "We got a letter back that was not satisfactory to either office."

Young has also called for an independent evaluation to measure how much radiation the workers were exposed to. He is not alone.

According to state documents, the Alaska Department of Labor requested the U.S. Occupational Safety and Health Administration office in Seattle to provide assistance in a new survey three times since Nov. 1. The request was repeated to Jim Lake, OSHA regional administrator in Seattle, when he visited Juneau Thursday on other matters.

Ray Jorgensen, chief industrial hygienist for the state labor department, said state investigators lack the equipment and experience for a survey. Though OSHA is usually "more than conducive to provide assistance," Jorgensen said, in this case the answer from Lake has so far been negative.

In an internal memo to Lake, Robert Curtis, senior industrial hygienist for OSHA's special health response team in Salt Lake City, suggested Jan. 12 that a second survey be done to alleviate the doubts expressed by the workers. The memo was obtained under the Freedom of Information Act.

In his memo, Curtis reported that Col. Roger Graham of Brooks Air Force Base had said the official Air Force position is to "discourage additional measurements." Curtis said

made up our minds that the Air Force is competent to handle it. It wouldn't have made a difference what kind of exposure (the workers) had because the medical evaluation that was done would take care of any situation. I don't know what we would buy by going back in and doing a re-measurement."

But Foster said Lake was wrong. "It happens everybody is sick from this, and this is going to be with us for the rest of our lives. Every one of our doctors is telling us an accurate survey is important."

John Jessop, the welder, noticed something very strange while working in an underground utility corridor near the giant detection radar dishes at Clear. The discovery has him nervous.

"I'm no expert, but I know what I've seen," Jessop said. "I've seen some very disturbing, grossly deformed little critters, shrews and re-backed voles. I've seen them with crooked tails, crooked legs, humps on their backs, deformities in their heads, all some without even any eyes. They run around out here back of the screens."

Jessop said he talked about the rodents in the meeting with Air Force personnel following the accident. A doctor from Eielson Air Force Base seemed interested at the time but so far no one has gone to Clear to capture them.

After seeing what microwave radiation may have done to the mice and feeling what already has done to him, Jessop is wondering what the future holds.



OCCUPATIONAL SAFETY & HEALTH REPORTER

A weekly review of occupational safety and health developments

Volume 14, Number 16

THE BUREAU OF NATIONAL AFFAIRS, INC.

September 20, 1984

HIGHLIGHTS OF CURRENT REPORT

THE ARSENIC STANDARD is upheld by the U.S. Court of Appeals for the Ninth Circuit, which finds that the secretary of labor did not abuse his discretion in refusing to reopen the rulemaking record to reconsider the standard's feasibility. Criticism by the smelting industry of studies relied on by the Occupational Safety and Health Administration in setting a 10 microgram exposure limit was "unpersuasive," the court finds (p. 331).

WALTER F. MONDALE, the Democratic candidate for President, charges that OSHA under the Reagan Administration "is more interested in maintaining friendly relations with business than it is with protecting workers." Mondale says that, if he is elected President, his first priority for OSHA will be to appoint "dedicated professionals, who believe in the OSHA law" to direct the agency (p. 331).

THE HAZARD COMMUNICATION RULE issued by OSHA should cover all employees, Public Citizen asserts in a court brief filed in its challenge to the standard. OSHA's decision to apply the standard only to the manufacturing sector was "plainly motivated" by the desire to reduce the cost of compliance to employers, and "fails any test of rationality," the public interest organization contends (p. 332).

ORGANIZED LABOR'S MAIN PRIORITY for workplace safety and health is "turning Ronald Reagan out of office in 1984," United Steelworkers of America President Lynn R. Williams tells an AFL-CIO annual conference (p. 333) . . . Citing a cotton dust interim order given to Dan River, Inc., as a reflection of OSHA's policy of allowing "human experimentation," Rep. Bruce Vento (D-Minn) tells attendees at the conference to make this type of issue a part of the 1984 presidential campaign (p. 335).

A SHORT TERM EXPOSURE LIMIT for ethylene oxide is the subject of a request for infor-

mation by OSHA. The agency asks for comment on the need for such a limit, and on the mixed responses the agency has received from a scientific peer review group on the issue (p. 334).

CRANE AND DERRICK RULES that would limit the use of such equipment for hoisting personnel to elevated work areas would entail first-year costs of about \$5.8 million, but they also would result in savings that could range from \$8.4 million to \$12.5 million, according to data from an analysis presented at a hearing on the proposed standard (p. 334).

FISCAL 1985 FUNDING for OSHA would be provided under a continuing resolution approved by the House Appropriations Committee as a stopgap measure failing passage of a regular appropriations bill. The resolution would provide \$219.6 million for OSHA, the same amount specified in the pending House appropriations bill (p. 336).

WORKERS IN OFFICES face potential hazards from indoor air pollution, stress, and low-level radiation, according to an Office of Technology Assessment report released by Rep. Mary Rose Oakar (D-Ohio). The report calls for more research on such risks, saying that, although the hazards may not be life-threatening, they still may be potentially disabling, and can be costly in terms of lost work time. Oakar criticizes the Reagan Administration for inadequately funding such research (p. 336).

A FINDING OF CIVIL CONTEMPT is made by the U.S. District Court for the District of Nebraska in the case of a steel foundry which refused to permit entry by OSHA inspectors, despite the fact that the compliance officers presented valid search warrants. The court rejects an argument by the company that OSHA failed to show probable cause in seeking to conduct a safety and health inspection at the facility (p. 337).

A safety bulletin, prepared by the company in April 1983, observed that the threshold limit value for trichlorotrifluoroethane is 1,000 ppm, that concentrations above 2,500 ppm could cause central nervous system depression, and that concentrations above 5,000 ppm could cause cardiac sensitization. In addition, a safety bulletin setting forth specific rules as to the amount of trichlorotrifluoroethane that could be used in a tracked vehicle was never posted for employees or enforced by supervisors or safety personnel, the plaintiffs' statement emphasized. Despite these safety bulletins, management took no action regarding the use of Gensolv D at the Center Line plant.

A solvent distribution test conducted by General Dynamics following the accident indicated that substantial fluid remains trapped in the vehicle after flushing in the manner used. A simulation test designed to duplicate the events that occurred Nov. 14 and 15 indicated that the fluorocarbon vapor concentration at Lee's breathing zone probably increased to more than 30,000 ppm when the air filtering system was automatically activated, the plaintiffs contended.

Based on the facts in evidence there was prior knowledge by key supervisory personnel of incidents regarding employee exposure to trichlorotrifluoroethane as well as knowledge of a safety bulletin that contained specific rules limiting the amount of the trichlorotrifluoroethane that can be used in tracked vehicles, according to the plaintiffs. A failure to communicate the hazards of misuse of the solvent and failure to communicate the rules as to use of the solvent as contained in the safety bulletins resulted in the death of Lee, they asserted. For these reasons, the plaintiffs argued that General Dynamics should be bound over for trial on the charge of involuntary manslaughter and willful violation of the Michigan Occupational Safety and Health Act.

Theodore Klimaszewski, assistant attorney general for Michigan, told BNA that oral argument in the case is scheduled for Sept. 26. Judge Kennedy will decide at that point whether to bind the company over for trial.

Meetings

STRATEGIES FOR CANCER PREVENTION IN THE WORKPLACE SUBJECT OF SYMPOSIUM

Strategies for the prevention of cancer in the workplace will be the subject of the second annual Symposium on Recent Advances in Occupational Cancer, scheduled to be held Dec. 7-8 in San Francisco, Calif.

Among the topics to be discussed are workplace risk assessment, current legal and policy issues in cancer prevention, phenoxyherbicides and other pesticides in the etiology of cancer, occupational skin cancers, formaldehyde in insulation and pathology, and ethylene dibromide risks in farming and food products, according to the agenda for the meeting.

Sponsors for the symposium are the American Cancer Society, San Francisco unit, Region IX, National Institute for Occupational Safety and Health, Northern California Occupational Health Center, and Extended Programs in Medical Education, University of California School of Medicine, San Francisco.

For further information, contact Extended Programs in Medical Education, Registration Office, 1456 Ninth Ave., San Francisco, Calif. 94122; tel. (415) 666-5808.

Research

EVALUATION OF INDUSTRIAL LOW-BACK INJURY SUBJECT OF STUDY BY NIOSH SAFETY DIVISION

A procedure for the objective evaluation of industrial low-back injury is in the early stages of development at the National Institute for Occupational Safety and Health, BNA was told Sept. 12.

The "evaluation tool" would be used to more strictly classify various low-back disorders that now are combined into the general category of "sprains and strains," according to Roger Nelson, NIOSH Division of Safety Research, the project officer for the study.

NIOSH's ultimate intent is that, as these disorders are better defined, the task that led to a specific injury can be examined, and measures can be taken to prevent such an injury from occurring again, Nelson remarked.

A preliminary meeting on the protocol for the study was held last February, and a follow-up peer review session was scheduled for Sept. 20 in Morgantown, W.Va. The protocol will be examined by a 12-member peer review group providing a "broad representation" from industry, insurance, ergonomics, physical therapy, and other relevant fields, Nelson said.

"We want a valid, reliable tool for evaluating the patient," the NIOSH researcher commented. At present, the draft evaluation procedure is composed of "universal tests and measurements," but it could be changed later if any of these tests are found to be unreliable after further study, he told BNA.

Another goal in developing the evaluation procedure, he added, is to keep the tests "simple," so that the procedure can be used by small practitioners.

Further information on the project is available from Roger Nelson, Ph.D., NIOSH Division of Safety Research, 944 Chestnut Ridge Road, Morgantown, W.Va. 26505; tel. (304) 291-4454, or FTS 923-4454.

Research

PARAMETERS FOR REPRODUCTIVE STUDY TO BE SUBJECT OF OCT. 11 REVIEW SESSION

Details of a planned study of human semen characteristics will be reviewed at a meeting scheduled for Oct. 11 in Cincinnati, Ohio, the National Institute for Occupational Safety and Health announced (49 FR 36018).

Participants will discuss the semen characteristics that should be studied in a longitudinal study design, the Sept. 13 notice indicated. Comments and suggestions from industry, labor, academia, other government agencies, and the public are invited, NIOSH stated.

The meeting is scheduled to take place from 8 a.m. to 4:30 p.m. at the Auditorium, Robert A. Taft Laboratories, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

For further information, contact Steven M. Schrader, Ph.D., NIOSH Division of Biomedical and Behavioral Science, at the same address, tel. (513) 684-8357, or FTS 684-8357.

Radiation

URGENT NEED TO EXAMINE POTENTIAL RISKS FROM NON-IONIZING RADIATION SEEN BY ILO

GENEVA, Switzerland — (By a BNA Special Correspondent) — There is an urgent and growing need for a new look

to be taken at the potential health hazards of non-ionizing radiation, which has become both a blessing and a curse in modern society, the International Labor Office asserted.

The radiation is a blessing because the use of devices emitting electromagnetic rays promotes scientific progress, increases industrial productivity, facilitates communications, and, when used in medical treatment, helps save lives, a new ILO pamphlet, "Occupational Hazards from Non-Ionizing Electromagnetic Radiation," said.

However, as their use becomes more common, rays from such devices can have adverse effects on the skin, eyes, and in some cases the central nervous systems of workers who operate the equipment, the report stated.

One of the widest applications of microwave and radiofrequency technology is in communications and broadcasting, the pamphlet pointed out. Broadcast transmitters may constitute a health risk to maintenance crews servicing equipment on the towers while the transmitters are operating. In addition, personnel working inside broadcasting towers and near cables and waveguides that feed antennas also may be exposed to harmful levels of radiation, the report said.

Personal exposure to radiation from microwave ovens in the home normally is small, the pamphlet also noted, because of a rapid decrease of the power density with increasing distance from the source. But overexposure to radiation from industrial microwave ovens, which are more powerful, should be minimized to protect workers against excessive leakages which could cause eye lesions, it added.

Radiofrequency Heaters

Heaters using radiofrequency energy are used widely in industries producing cars, furniture, glass fiber, sealing rubber, and textiles. Devices that are poorly designed or have unshielded applicators can give off stray electromagnetic energy that could be a health hazard — an important one since most of the operators of heaters are women of childbearing age, the pamphlet contended. It said, however, that further clarification is needed regarding the effects this type of radiation has on the fetus.

Some video display terminals generate electromagnetic radiation which is strongest close to the screen and drops rapidly at a distance, the pamphlet continued. At 20 to 30 centimeters from the screen, the potentially harmful emission is either not detectable, or, at worst, is far below the most stringent exposure levels in force anywhere in the world, it said.

Serious and painful ultraviolet-induced eye and skin irritations sometimes are experienced by unprotected workers exposed to direct radiation from other types of non-ionizing radiation devices, germicidal and arc lamps, the ILO report remarked.

Ultraviolet or "quartz" lamps are used for germicidal control in hospital corridors, intensive care wards, operating rooms, and biological laboratory hoods. In an operating room with a quartz-memory discharge lamp mounted in open ceiling fixtures, protective rubber clothing is essential for all personnel, the report stated.

Regarding optic radiation from welding arcs, the report called for control measures to be adopted to limit this exposure, coupled with the mandatory use of personal protective equipment.

In printing plants and other graphic arts facilities, arc lamps and tungsten halogen lamps are used for making negatives and photo-offset plates. ILO said that large camera units should be located well away from work and traffic

areas, and employees should be warned against looking directly at exposed lamps.

Risk of Laser Damage

Increasing use of lasers in such areas as satellite communications, controlled fusion research, surveying, surgery, holography, and automatic supermarket checkout systems has brought increased risk of damage from laser beams, the report warned. Damage caused to the eye by laser radiation is often irreversible, and although skin irritation and its biological consequences are considered repairable, excessive exposure can cause depigmentation, severe burns, and possible injuries to underlying organs, the publication said.

Prevention of undue exposure requires the use of enclosures, shielding, and personal protective equipment such as eye protection with proper filters, and reliance on distance to reduce the intensity of radiation. However, the report cautioned that distance cannot be used as a means of controlling exposure to laser beams.

Workers should be made aware of potential hazards, and warning notices should be posted as a constant reminder that danger exists, the pamphlet suggested. Further, it said, sources of non-ionizing radiation may have secondary hazards against which safeguards also must be provided.

"Given the complexity of identifying and assessing the non-ionizing radiation hazards in order to effect control measures, an inter-disciplinary approach is called for to coordinate preventive action at the national level," the report concluded. "There is also need for international cooperation to set new standards and harmonize those which already exist."

For further information on the publication, contact the International Labor Office, Route des Morillons 4, Geneva 1202 Switzerland.

Publications

CASE CONTROL STUDY OF MELANOMA AMONG LIVERMORE WORKERS PUBLISHED

A follow-up report to a 1980 case control study of malignant melanoma among employees of Lawrence Livermore National Laboratory in Livermore, Calif., is available from the California Public Health Foundation.

The 1980 study found a higher than expected incidence of malignant melanoma among employees of the laboratory during the period 1972-77 (Current Report, May 1, 1980, p. 1112). The follow-up investigation was designed to search for "the reason or reasons for that previously established excess," the new report stated.

Seven factors were found to be "significantly associated" with the melanoma cases, and five of these further were determined to be independent of non-occupational factors, the report indicated. These included exposure to radioactive materials, work at a non-nuclear weapons testing site near the laboratory, exposure to volatile photographic chemicals, presence at a Pacific test site at the time of a nuclear explosion, and duties as a chemist.

The sixth factor, exposure to fumes from high explosives, appeared to be largely an indirect measure of two other risk factors, the report stated. The seventh, involving work location at a building constructed in 1969, appeared to exert its effect primarily among persons who, due to constitutional factors, were more susceptible to malignant melanoma than other persons.

Results of the investigation are presented in six sections in the report. The sections provide a description of the



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IONIZING RADIATION



IONIZING RADIATION

The potential for occupational illness arising from the use of radiant energy has become a more important problem with the increasing use of radiation and radioactive materials in laboratory investigation and in industry.

Properties (Ionizing Radiation)

Ionizing radiation has always been a part of our natural environment. Since the discovery of x-rays and radioactivity, it has become a part of the industrial environment of many workers.

Ionizing radiations are produced naturally by the decay of radioactive elements. They are artificially induced by such devices as x-ray machines and high energy motivators, or accelerators.

By general definition an ion is an atom or group of atoms carrying a positive or negative electric charge as a result of having lost or gained one or more electrons. An ion may also be considered a free electron or other charged subatomic particle. Radiation affects humans by ionizing--that is, altering the electrical charge of--the atoms and molecules comprising body cells.

Radioactivity, natural or artificial, is the emission of radiation resulting from spontaneous or induced disintegration of atomic nuclei. The radiations that result from these nuclear changes are basically alpha rays, beta rays, and gamma rays.

Different types of ionizing radiation i.e., alpha, beta, gamma, vary in their penetrative powers as well as the number of ions they produce in passing through matter. This is important because the biological effects of radiation vary with ion density produced in the body.

The electromagnetic (EM) waves of radiation consist of electromagnetic forces. When these forces are disturbed, EM radiation results. Known EM radiations are grouped into a spectrum according to their frequency and/or wavelength.

The radiation spectrum is a continuum of frequencies or wavelengths (non-ionized) ranging from below radio frequencies, to microwave, infrared, visible, ultraviolet, and above ionizing radiation. The amount of energy absorbed by workers varies considerably over this range.

The safety, health, and control problems associated with this range of magnitudes are great. No other area of human research has such a wide range of hazards which must be considered, classified, and regulated.

Occupational Exposures

Entry of radiation into the body during occupational exposures is principally through inhalation of particles or gases. Ingestion and skin absorption can be important exposure routes as well.

Implantation under the skin may occur as a result of accidental skin puncture or laceration. Once inside the body, the radioactive agents are absorbed, metabolized, and distributed through the tissues and organs depending on the chemical properties of the elements. Their effects on organs or tissues depend on the type and energy of the radiation and amount of time in the body.

The impact of external radiation depends on the penetrating ability of the particular type of radiation.

Penetrating radiation with x-rays and gamma-rays is widely used in industrial radiography for flaw detection (welding cracks, defects in reinforced concrete), for thickness gauging (production line control of paper, aluminum, copper, tinplate, plastics, glass, rubber), for density gauging (H/C ratios in analysis of hydrocarbons such as fuel oils, conduit pipe contents), and for liquid level gauges (measurement of height of molten metals).

Reflection of radiation is used for measurement of thickness of coatings over base metal. Self-luminescent markers are widely used for instrument panels and faces.

Ionization of the air by alpha particles to eliminate static electricity is one of the more recent industrial uses of radioactivity.

A number of radioisotope batteries have been developed for production of electric current. Radioisotopes have been used as tracers in detection of metal wear (such as piston rings).

The term "non-ionizing radiation" refers to regions of the electromagnetic (EM) spectrum where the energies of emitted photons, or units of radiant energy are insufficient to ionize other atomic matter. The transparent tissues of the eye,

the tastes, and the central nervous system display a very high sensitivity to the thermal effects of ultraviolet and visible portions of the spectrum. Similarly, organs which possess modulated electrical activity, such as the heart, brain, and nervous system may be influenced by radiofrequency radiation.

Occupational Hazards

Biological damage is related to the kind of radiation, the total dose received, and the rate of irradiation. The units used to express radiation dosages have been changed over the years. This has resulted as industry has come to appreciate the widely different degrees of adverse biological effect of various kinds of radiation.

The basic physical unit for dosage is the roentgen, or rem. It is the unit used to express human biological doses as a result of exposure to one or many types of ionizing radiation. The current annual permissible dose of body exposure in the United States is 5 rem per year with 3 rem permitted within a period of 13 weeks.

The effects from occupational exposure to ionizing radiation are usually localized, leading to burns and radiodermatitis (rashes, skin aberrations). Acute radiation syndrome (ARS) occurs rarely. This type (ARS) involves whole body exposure typically exceeding 100 rems given in a very short time. In this severe case, symptoms are nausea, vomiting, diarrhea, weakness and shock. Death may result from severe bone marrow depression with ARS exposure.

The mechanism by which radiation causes cancer is not completely understood. It is currently believed that it involves damage to the genes. In addition to controlling every aspect of an individual's hereditary characteristics, genes also control cellular activities and cellular rates of division.

Radiation can collide with the regulatory gene controlling the cell's rate of division, with possible cell destruction. Or the other hand, the cell may continue to function normally for a number of years. Later, however, instead of dividing to produce two new cells, the irradiated cell may produce many identically damaged cells uncontrollably. This growth is called cancer.

Accepted Levels of Exposure

National exposure limits have been set at 5 rems per year with a 3 rem permissible level over a 13 week period.

However, developing research led by the IAM's medical consultant, Dr. Thomas Mancuso and consultants Dr. Alice Stewart, doctor and epidemiologist from Birmingham, England, and George Kneale, statistician from Oxford, now

suggest that the permissible levels of low-level radiation should be reduced tenfold to .5 rems per year. The arguments are based on long-term research not yet completed.

Prevention of Radiation Poisoning

Protection against unnecessary exposure requires the use of shielding appropriate to the intensity and type of radiation, protective clothing, properly filtered eye protection, enclosed dry boxes (also known as glove boxes), appropriate ventilation with high-efficiency filters interposed in the duct work, and the presence of safety showers in case of external contamination.

Measurement of the amount of radiation a person may receive is done through use of a variety of film badges, pocket dosimeters, and other devices. This may include permanently installed radiation monitors with signaling devices when radiation levels exceed a critical point.

Further studies are continuing, but caution is our byword.

RA569

Fairbanks News Miner 17 Sept 71

Drop in radiation level at Anaktuvuk Pass

A 50 per cent decrease in radiation level among residents of Anaktuvuk Pass has been recorded this year, U.S. Sen. Ted Stevens said Thursday.

The decrease in radiation levels was reported by the Atomic Energy Commission whose scientists have been studying the effects of fallout on Alaskans since 1964. In a letter to Stevens, the AEC's director of biology and medicine reported that the 1971 summer measurements—made July 27-31—showed a level of 50 per cent lower than those of the previous summer.

In addition to testing 74 residents of Anaktuvuk Pass by age groups, the AEC scientists sampled caribou flesh, lichen and plants. The scientists said they expected the radiation level to be even lower when the next testing session is held in the

winter. The researchers who conducted the studies were from Pacific Northwest Laboratories.

They tested the residents in the following age groups: adults, minors 15-20 years old and children under 15. They reported that although able-bodied men of the village had been fire fighters and had eaten commercially processed foods which would account for a drop in the radiation levels, the lower levels were also found in women and children.

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Barrow File

Anaktuvuk Pass



NOTES ON EQUIPMENT

Choose rainclothes that are proof against *wind-driven* rain and cover head, neck, body, and legs. Polyurethane coated nylon is best. The coatings won't last forever. Inspect carefully and test under a cold shower before you leave home. Ponchos are poor protection in wind.

Take woolen clothing for hypothermia weather: 2-piece woolen underwear ... or ... long wool pants and sweater or shirt. Include a knit cap that can protect neck and chin. Cotton underwear is worse than useless when wet.

A stormproof tent gives best shelter. Take plastic sheeting and nylon twine for rigging additional foul-weather shelter.

Carry trail food...nuts, jerky, and candy...and keep nibbling during hypothermia weather.

Take a gas stove or a plumber's candle, flammable paste, or other reliable firestarter.

- **DON'T WAIT FOR AN EMERGENCY. USE THESE ITEMS TO AVOID OR MINIMIZE EXPOSURE.**



THINK HYPOTHERMIA

If you are outdoors for recreation, you presumably do not intend to jeopardize your life.

Hypothermia may be a new word to you, but it's the *only* word that describes the rapid, progressive mental and physical collapse accompanying the chilling of the inner core of the human body.

Hypothermia is caused by exposure to cold, aggravated by wet, wind, and exhaustion. It is the #1 killer of outdoor recreationists.

- **TAKE HEED OF "HYPOTHERMIA WEATHER"**
- **WATCH CAREFULLY FOR WARNING SYMPTOMS.**
- **CHOOSE EQUIPMENT WITH HYPOTHERMIA IN MIND.**
- **THINK HYPOTHERMIA.**

FOUR LINES OF DEFENSE AGAINST HYPOTHERMIA

From the motion picture
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OLD KILLS IN TWO DISTINCT STEPS

STEP ONE: EXPOSURE AND EXHAUSTION

The moment your body begins to *lose heat* faster than it produces it, you are under-going exposure. Two things happen:

1. You voluntarily *exercise to stay warm*.
2. Your body makes involuntary adjustments to preserve *normal temperature in the vital organs*.

Either response drains your energy reserves. The only way to stop the drain is to reduce the degree of exposure...

● THE TIME TO PREVENT HYPOTHERMIA IS DURING THE PERIOD OF EXPOSURE AND GRADUAL EXHAUSTION.

STEP TWO: HYPOTHERMIA

If exposure continues until your energy reserves are exhausted:

1. Cold reaches the brain depriving you of judgment and reasoning power. *You will not realize this is happening.*
2. You will lose control of your hands.

This is hypothermia. Your internal temperature is sliding downward. Without treatment, this slide leads to stupor, collapse, and death.



● DON'T ASK, "HOW COLD IS THE AIR?" ASK INSTEAD, "HOW COLD IS THE WATER AGAINST MY BODY?"

4. USE YOUR CLOTHES Put on raingear *before* you get wet. Put on wool clothes *before* you start shivering.

YOUR SECOND LINE OF DEFENSE: TERMINATE EXPOSURE

If you cannot stay dry and warm under existing weather conditions, using the clothes you have with you, *terminate exposure*.

1. BE BRAVE ENOUGH TO GIVE UP REACHING THE PEAK OR GETTING THE FISH OR WHATEVER YOU HAD IN MIND.
2. Get out of the *wind and rain*. Build a fire. Concentrate on making your camp or bivouac as secure and comfortable as possible.

NEVER IGNORE SHIVERING

Persistent or violent shivering is clear warning that you are on the verge of hypothermia. MAKE CAMP.

FORESTALL EXHAUSTION

Make camp while you still have a reserve of energy. Allow for the fact that exposure greatly reduces your normal endurance.

You may think you are doing fine when the fact that you are exercising is the only thing preventing your going into hypothermia. If exhaustion forces you to stop, however briefly:

1. Your rate of body heat production instantly drops by 50% or more.
2. Violent, incapacitating shivering may begin immediately.
3. You may slip into hypothermia in a matter of minutes.

APPOINT A FOUL-WEATHER LEADER

Make the best-protected member of your party responsible for calling a halt before the least protected member becomes exhausted or goes into violent shivering.

YOUR THIRD LINE OF DEFENSE: DETECT HYPOTHERMIA

If your party is exposed to wind, cold, and wet THINK HYPOTHERMIA. Watch yourself and others for symptoms

1. Uncontrollable fits of shivering.
2. Vague, slow, slurred speech
3. Memory lapses. Incoherence
4. Immobile, fumbling hands
5. Frequent stumbling. Lurching gait
6. Drowsiness (to sleep is to die)
7. Apparent exhaustion. Inability to get up after a rest

YOUR FIRST LINE OF DEFENSE: AVOID EXPOSURE

1. STAY DRY. When clothes get wet, they lose about 90% of their insulating value. Wool loses less; cotton, down, and synthetics lose more.
2. BEWARE THE WIND. A slight breeze carries heat away from bare skin much faster than still air. Wind drives cold air under and through clothing. *Wind refrigerates wet clothes* by evaporating moisture from the surface. WIND MULTIPLIES THE PROBLEMS OF STAYING DRY.
3. UNDERSTAND COLD. Most hypothermia cases develop in air temperatures between 30 and 50 degrees. Most outdoorsmen simply can't believe such temperatures can be dangerous. They fatally underestimate the danger of being wet at such temperatures.
● 50 degree *water* is unbearably cold. The cold that kills is *cold water* running down neck and legs, *cold water* held against the body by sopping clothes, *cold water* flushing body heat from the surface of the clothes.

YOUR FOURTH AND LAST LINE OF DEFENSE: TREATMENT

The victim may deny he's in trouble. Believe the symptoms, not the patient. Even mild symptoms demand immediate, drastic treatment

1. Get the victim out of the wind and rain.
2. Strip off *all* wet clothes.
3. If the patient is only mildly impaired:
 - a. Give him warm drinks.
 - b. Get him into dry clothes and a warm sleeping bag. Well-wrapped, warm (not hot) rocks or canteens will hasten recovery.
4. If the patient is semi-conscious or worse:
 - a. Try to keep him awake. Give warm drinks
 - b. Leave him stripped. Put him in a sleeping bag with another person (also stripped). If you have a double bag, put the victim between *two* warmth donors. *Skin to skin contact* is the most effective treatment.
5. Build a fire to warm the camp.



RECORDS CERTIFICATION

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James O. Smith
Signature of Camera Operator

9/5/89
Date