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Project Chariot
Cape Thompson, Alaska

History

Project Chariot moved off the drawing board in July 1958 when a scientific field party chose Ogotoruk Creek near Cape Thompson in northwestern Alaska as the Project site.

Chariot was part of the U.S. Atomic Energy Commission's Plowshare Program. Plowshare was initiated to study peaceful uses for nuclear explosives. For example, scientists wanted to know if nuclear explosives could be used to move huge quantities of soil and excavate a harbor. The primary purpose of Project Chariot was to investigate the technical problems and to begin development of nuclear excavation technology. Similar studies were underway in Colorado, New Mexico, and Nevada. However, no nuclear detonations were performed at the Chariot site.

Because of the harsh arctic climate, work at Ogotoruk Creek was limited to the summer months. n July 1959, scientists began geological, hydrological and environmental studies. Two exploratory holes were drilled in the valley floor bedrock to determine the depth of the permafrost. Scientists conducted environmental studies on land and sea mammals, fish, birds, vegetation, oceanography, marine biology, limnology, human geography, ecology, archeology, and climatology. The scientists started experiments to determine the natural background levels of radiation in the land and sea ecosystems. These studies continued until the camp closed for the winter.

When the camp re-opened in April 1960, the experimental studies on Project Chariot continued. Scientists drilled two more holes in the valley floor bedrock. Using refrigerated drilling fluid, cores were taken in their original frozen condition. These were preserved, and frozen-state physical properties were established. Scientists installed temperature measuring cables in each hole to collect information on the permafrost.

In November the scientists conducted a small high-xplosive cratering experiment at the Project site. A 256-pound sphere of TNT was detonated about nine feet below the surface of a rock outcropping on the valley floor. This test was done to obtain information on the size of particles resulting from the blast, how far the particles were thrown, and the dimensions of the crater produced by the explosion in the frozen bedrock. The camp was then closed for the winter.

The camp re-opened in May 1961 and the environmental and geological research continued. Scientists wanted to complete studies of the ecological features and the area's background radiation levels. Three 10-inch, 22-foot deep holes were drilled for another cratering experiment. However, these tests, scheduled for 1962, were not conducted.

In September, as the camp was being deactivated for the winter, the scientists set up radiation monitoring stations at the Project site and in nearby villages. The Soviet Union had resumed nuclear weapons testing following a three-year moratorium, and the United States had followed suit. The monitoring stations would measure the radioactive fallout that came from the renewed testing activity.

When the scientists returned in April 1962 they focused on collecting environmental samples (animals, vegetation, soils, water) to measure changes in the levels of radiation as a result of the latest series of atmospheric tests.

The U.S. Geological Survey (USGS) carried out a limited five-day radioactive tracer experiment on the soils at the Chariot site. Since the planned Chariot test would release some radioactive materials into the atmosphere, the researchers needed to know what effects this radiation might have on the local environment, and how fast it would migrate through the soils and water.

Small quantities of radioactive material and about 15 pounds of soil containing radioactive fallout from the Sedan test (a Plowshare experiment in Nevada) were used as the tracers. Measurements were taken on 10 plots adjacent to the headwater forks of Snowbank Creek, about 1.6 miles north-northwest from the Chariot site. (Test plots were small, from 2' x 2' to 5' x 7'.) The following types and quantities of radioisotopes were used: six millicuries of Cesium-137, five millicuries of Iodine-131, five millicuries of Strontium-85, and ten millicuries of Project Sedan soil.

Following completion of the tracer study, the soil was removed and transported to a disposal area in Ogotoruk Creek Valley in four to six half-filled 55-gallon drums. At the disposal area, the soil was poured from the drums and mixed with local soils. This mixing process generated about 15,000 pounds of soil, six inches thick and six meters by six meters. The soil was then covered with four feet of clean soil to form a mound that is about 40 feet by 40 feet.

In November 1962 the Atomic Energy Commission permanently closed the camp without completing the experiments. After reviewing the Project Chariot plans, progress, and objectives, the Commission canceled the program. Much of the information they had hoped to obtain from Chariot already was available from earlier tests or would be developed from other experiments.

On April 28, 1963, the site was transferred to the Naval Arctic Research Laboratory. The laboratory ceased operations at the site in 1970, and most of the site was transferred by the Bureau of Land Management to the U.S. Fish and Wildlife Service in 1980.

Current Status

The Project Chariot mound still contains Cesium-137, which has a half-life of 30 years, as well as the products from the Sedan test dirt which has a half-life of 30 years or less. Both Iodine-131 and Strontium-85, with half-lives of less than 70 days, have decayed away. The present concentration of radioactivity in the soils is estimated to be 0.080 nanocuries (0.000000080 of one millicurie) per gram with a total of less than eight millicuries for the whole mound. For comparison, one gram of potassium as it is produced in nature contains 0.8 nanocuries per gram of radioactive Potassium-40. That is ten times the level existing at the Ogotoruk Creek Valley site.

A risk assessment review by the Oak Ridge Institute for Science and Education in Tennessee found the concentration of radioactivity at the mound poses no risk to human health or the environment.

In 1992, both the State of Alaska and the U.S. Army Corps of Engineers made a survey to determine the condition of the mound and to measure any radioactive emissions. The Alaska Department of Environmental Conservation concluded the radioactive material remains intact, frozen beneath the permafrost just as it was buried 30 years ago. Testing conducted by the Army Corps of Engineers indicates there are no radiation levels above background at the surface. Sample soil cores, also taken by the Corps of Engineers, do not show any levels of radioactivity that are harmful to public health and safety or the environment.

From these investigations, both federal and state of Alaska scientists concluded that the wastes left from Project Chariot pose no hazard to human health or the environment. However, the mound does constitute a radioactive waste site which the Department of Energy must study and evaluate for removal.

During October 1992, representatives from DOE and the State of Alaska conducted public meetings at local villages to talk about Project Chariot. On October 21, representatives from DOE, and the state of Alaska as well as residents from Point Hope inspected the Chariot site and took radiation readings of the area. No readings were registered above background at the surface of the disposal mound.

Next Step

DOE has a mandate to clean up waste sites left from 40 years of Cold War activities. The Ogotoruk Creek Valley site is one of many that must be fully studied and understood. Scientists must know what radioactive elements are left in the soil as a result of Project Chariot. Once this identification process is complete, DOE plans to dig out the area and place the soils in containers. The containers will be shipped for permanent disposal to a federally-permitted DOE facility for low-level radioactive waste management. These are state-of-the-art, high-technology, secured facilities where radioactive wastes from the nation's defense activities are isolated from people and the surrounding environment.

After the waste soils are removed from the mound, DOE, and the state of Alaska, will conduct a final close out environmental survey. This is scheduled to take place in late summer 1993.

STATE OF ALAS

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Health Risk Assessment of Radioisotopes at Cape Thompson, Alaska

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Introduction

A number of scientific studies were conducted in the Cape Thompson, Alaska, area from 1958 to 1963 in preparation for Project Chariot--the proposed creation of a deep-water harbor by a nuclear explosion. Most of these studies were of the geology and ecology of the area. In 1962 an experiment was conducted at Cape Thompson to study how radioactive particles move if applied to the soil and water in the area. After this experiment was completed, the isotopes and all potentially contaminated soil used were moved to a disposal site, buried, and covered by clean soil. A formal report of the radioisotope experiment was published in 1966.[1]

In 1992 Dan O'Neill, a research associate at the University of Alaska Fairbanks who was studying Project Chariot, obtained a letter indicating that the amount of radioisotopes buried at the site exceeded the amount allowed in the permit issued in 1962 by the Atomic Energy Commission for on-site burial.[2] Public release of this information by Mr. O'Neill gained wide-spread attention when announced as a banner headline, "Nuclear Waste Dump Discovered," in September. A series of front-page news stories and lack of local knowledge of specific information about the Cape Thompson experiments caused much concern and anxiety. Local residents feared that the nuclear wastes in the disposal site might be the cause of cancers among residents of northwest Alaska, especially among residents of the villages nearest to the site; Point Hope, 32 miles to the northwest, and Kivalina, 41 miles to the southeast.

Since the existence of the disposal site was publicized, there has been much discussion about what should be done to remedy this situation. Initially many demanded that the material be dug up and moved to a radiation storage facility in the lower 48. On September 15, Governor Walter Hickel and Senator Frank Murkowski visited Point Hope and the abandoned site at Cape Thompson. Both promised immediate action and indicated that any residual waste would be removed and the site cleaned up by March 1993. Some feel the health risk posed by the site to be so great that removal this winter should be undertaken, even though the environmental conditions at Cape Thompson in winter could pose a great threat to the safety of personnel working at the site and traveling to and from the site.

This paper will review the radioisotope experiment conducted at Cape Thompson, studies on cancer and radiation exposure among native villagers in the arctic, and the health risk posed by the site to local residents, especially subsistence hunters who may visit the disposal site.

Background

In August 1962 scientists with the U.S. Geological Survey, acting on behalf of the U.S. Atomic Energy Commission, conducted an experiment to evaluate the potential effects of Project Chariot on local water supplies in northwestern Alaska. The use of a nuclear explosion to blast a harbor at the site would release radioactive particles into the environment. The experiment at Cape Thompson was conducted to evaluate how radioactive particles would move when deposited onto the surface of the tundra. The study was designed to measure movement of radioactive particles into the ground and over the surface into streams and ponds. Results were intended to enable scientists to predict the effects of a nuclear detonation's radiation impact on the area.

In the experiment a total of twelve test plots were studied. Mixed fission products and measured amounts of three specific radioisotopes totalling 26 millicuries of radioactive material were diluted in a total of 43.5 pounds of sand and soil and applied to the 12 test plots. The three identified radioisotopes used in this experiment were 6 millicuries of $Cesium^{137}$, 5 millicuries of $Iodine^{131}$, and 5 millicuries of $Strontium^{85}$. Ten millicuries of Sedan Fallout mixed fission products also were used. Three test plots were seeded with $Cesium^{137}$; two plots each were seeded with $Strontium^{85}$ and $Iodine^{131}$; and 5 plots received Sedan Fallout mixed fission products.

The Sedan mixed fission products were collected by placing a tray on the ground one mile from ground zero of the Sedan nuclear detonation at the Nevada Test Site. This detonation was similar in type to that planned for the Project Chariot detonation. The Sedan nuclear detonation was one of a series of nuclear tests conducted by the U.S. Government in the 1950s and 1960s. Scientists are able with great accuracy to deduce detailed characteristics of the nuclear device being tested from analysis of fallout products. For this reason, exact details of the composition of radioisotopes collected during the Sedan test were classified. According to the Department of Energy Field Office in Las Vegas, information on the component isotopes of the Sedan fallout mixed fission products remains classified. Efforts are underway within the Department of Energy to obtain and release this information.

In ten of the 12 experimental test sites at Cape Thompson, radioisotopes mixed with soil or sand were applied to the surface of the sites. The sites were then sprayed with water to simulate natural rainfall, and the movement of the isotopes after the simulated rainfall was assessed. In one plot a percolation test was performed to measure the underground movement of radioisotopes. In one plot, 1.7 millicuries of Sedan mixed fission products were dispersed in a small stream. Twenty-four hours after the stream dispersal, there was no detectable increase in radiation above background measured anywhere along the stream site.

Following the experiments conducted at Cape Thompson in August 1962, the test plots were dug up and all dirt and other debris collected were transported in 55-gallon drums to a disposal site. At the disposal site the drums were emptied into the burial site prepared by bulldozing a trench down to permafrost. A total of 1,600 cubic feet of soil weighing 15,000 pounds was moved from the test plots to the burial site. Additional soil was then mixed with the material, and the disposal material was then buried with four feet of clean soil using a bulldozer. After burial of the material, there was no detectable radiation above background levels both at the surface of the burial site and at each of the test plots from which the disposal material had been excavated.

The full details of the experiment, except for identification of the Sedan fallout radioisotopes, were published by the scientists conducting the experiment. Copies were provided to the U.S. Geological Survey offices in Anchorage, Fairbanks, and Juneau, and have been available to the public since 1966. Photographs taken while the experiments were being conducted document that no protective clothing was worn by the participants.

As noted by Mr. O'Neill, the Atomic Energy Commission (AEC) notified the U.S. Geological Survey (USGS) on January 23, 1963, that the amounts of Cesium^{137} and Strontium^{85} left buried at Cape Thompson exceeded the amount allowed under federal regulations. The AEC requested a written statement or explanation detailing the quantities and physical and chemical form(s) of the materials buried; the method of burial; an environmental analysis of the site's topography, geology, and hydrologic characteristics; and an assessment of nearby facilities that might potentially be affected by the materials. The AEC also requested information on any corrective steps that had already been undertaken or which were planned for the future.[3]

The USGS replied to the Atomic Energy Commission by letter on February 28, 1963, noting that the AEC had authorized on site burial of remaining radioactive material when it approved the license to conduct the experiment for the experiment. The license approved use of up to 5 curies of mixed fission products with the understanding that of the radioactive material transported to Cape Thompson for the experiment, less than two percent would be returned to Denver for analysis, and over 98 percent would remain at Cape Thompson. The USGS provided the detailed information requested by the AEC. Although the quantities of radioactive materials buried at Cape Thompson exceeded permissible amounts under the U.S. Code of Federal Regulations, the materials posed no hazard because of the small amounts used, the shielding provided by intermixed and topcover soil (as demonstrated by the absence of detectable radiation above background levels atop the burial material), and the hydrologic and climatic conditions of the site.[4]

On March 7, 1963, the AEC replied to the USGS indicating appreciation for their cooperation in providing details of the disposal[5]. In a memo dated April 10, 1963, all activities regarding the status of the experimental site were summarized by the AEC, Division of Licensing and

Regulation (DL&R). The AEC DL&R concluded, "We believe no further action is warranted," and "In summary, we (at last) feel satisfied the radioactive waste mound at the Chariot site does not represent a health and safety problem and...it can be abandoned."[6] No further action regarding the materials at Cape Thompson was recommended.[6]

After the radioisotopes and soil were buried in 1962, the site remained undisturbed. There was no disruption to the burial site topcover until 1992 when samples were taken as part of the current effort to evaluate the site. Atop the burial site, there remains no detectable radiation exposure above the background levels of the area. Background radiation levels in the area are low, ranging from 3 to 6 microRoentgens per hour--26 to 52 milliRoetgens per year. The background and current levels of radiation at the Cape Thompson site are no higher than levels at other areas in northwest Alaska.[7]

The amount of radioisotopes remaining in the disposal material in 1992 is considerably less than what was buried in 1962. Radioisotopes undergo spontaneous disintegration. This process results in the release of the high-energy particles, or gamma rays, referred to as ionizing radiation. Iodine^{131} has a half-life of 8 days. Strontium^{15} has a half-life of 64 days. During the past 30 years, these radioisotopes have completely disintegrated and no longer are a source of radiation at Cape Thompson. Cesium^{137} has a half-life of 30 years: Of the 6 millicuries of Cesium^{157} buried in 1962, only 3 millicuries remain in the disposal site. Similar reductions have occurred to the radioisotopes of the Sedan Fallout mixed fission products. Because information on the specific component isotopes of the Sedan Fallout material remains classified, a precise calculation of the remaining radioactivity of the Sedan Fallout material buried at the site is not possible at this time. Of the 24.3 millicuries of material buried in 1962, there remains a maximum of 11.3 millicuries of radioisotopes in 1992, assuming that the Sedan Fallout material has an extremely long half-life, and none of the material has undergone disintegration. Assuming that the Sedan Fallout disintegrates with a half-life of 30 years, only 7 millicuries would remain at present. The USGS estimates that the amount of radioactive material remaining at the Cape Thompson site is no more than 3-5 millicuries, and probably is less than 2 millicuries.[8]

When radioisotope atoms disintegrate, they release energy primarily in the form of particles (alpha and beta) and high energy photons--(gamma). Alpha particles are relatively large particles that can penetrate only 3 to 5 cm of air and are stopped by a thin sheet of paper and the outer layers of skin. Because alpha particles are unable to penetrate the outer skin, radioisotopes emitting alpha particles are only a risk if ingested or inhaled. Beta particles are lighter particles with higher penetration but are stopped in a few meters of air or a few millimeters of aluminum. Radioisotopes emitting beta particles potentially can be a health risk both for internal and external exposures. Radioisotopes emitting gamma rays present the most serious potential risk for external exposures because gamma rays are the most penetrating form of radiation. All forms of radiation are attenuated by passage through solid materials. Glass and plastic are commonly used for shielding against beta radiation, and concrete and lead for x-ray and gamma radiation.

At Cape Thompson very effective shielding was and is still provided by the soil that was mixed with the radioisotopes used in the experiments and the four-foot thick covering of clean soil put on top of the disposed radioisotopes. All remaining radioisotopes are continuing to undergo spontaneous disintegration with the release of radiation. The effectiveness of this shielding is demonstrated by the fact that there was no increase in radiation readings above background levels directly atop the disposal site in 1962, and as expected, none was detected in 1992.

The Department of Energy has calculated predictions of radiation exposures to individuals at Cape Thompson using computer modeling based on the amounts and types of radioisotopes used at the site. In a worst case scenario, if an individual were to have remained atop the burial site 24 hours per day for a full year, the most additional radiation he could receive from the site over and above background would be 10^{-4} milliRoentgen.[9] This amount of radiation is equivalent to about one millionth of a routine chest x-ray or to the exposure a person receives in nine hundredths of a second in a jet plane at cruising altitude. Even if the four feet of top cover were removed, the maximum additional radiation exposure to an individual lying in the disposal material 24 hours per day for a year would only be equal to the maximum recommended yearly radiation exposure for civilians of 100 milliR per year. (The recommended maximum permissible occupational exposure is 500 milliR per year.)

Ingestion of radioisotopes can present a potentially serious health risk. However in order to exceed maximum permissible quarterly ingestion limits for $Cesium^{137}$, one would have to consume over 16 cubic feet of the disposal material every three months. One would become sick from eating dirt long before ingesting enough $Cesium^{137}$ to experience any short-term or long-term radiation-related health problems.

<u>Background</u> -- Effects of Radiation on Health

The health effects of a radiation exposure are dependent on a number of factors, including:

1. Total amount and type of radiation exposure.
2. Rate of exposure.
3. Method of exposure, i.e., internal--ingested or inhaled--or external exposure to the skin.
4. Amount of body exposed.
5. Individual variability.
6. Relative sensitivity of cells and tissues.
7. Parts of the body exposed.
8. Nutrition, oxygenation, and metabolic state of tissues exposed.[10]

Persons who receive an acute, whole-body exposure to a large dose of radiation may quickly experience serious injury or death, as seen at Hiroshima and Nagasaki in World War II or after the Chernobyl disaster in 1986. Exposures of only a portion of the body to high levels of radiation may cause tissue death in the area of exposure but leave the unexposed body tissues to function normally. One of the major components of cancer treatment is radiation therapy in which cancer or tumor cells are killed using high doses of radiation focused onto the tumor or cancer cells.

Exposures to low amounts of radiation do not cause immediate effects, but potentially may cause damage to chromosomes or proteins within cells that may eventually progress to certain types of cancers. However, there are also enzymes within cells which repair cellular injuries caused by radiation and other toxic substances. For this reason people with exposure to a high dose of radiation may have little acute or long-term health effects if the exposure is received over an extended period of time, whereas an acute exposure to the same amount of radiation may produce severe injury or death.

We are all exposed continuously to small amounts of natural radiation. This natural radiation includes cosmic radiation in the form of galactic cosmic rays and solar particle radiation from the sun; and radiation in the ground and water arising from naturally-occurring radioisotopes uranium, actinium, and thorium, and their breakdown product isotopes. Radon, a naturally-occurring breakdown product of uranium^{235}, has recently gained much attention as a potential source of radiation exposure, especially in houses with unventilated basements built atop bedrock. The level of naturally-occurring or background radiation varies at different locations in the world, the United States, and Alaska. In general, terrestrial levels vary with the types of soil and rock in the area. Cosmic radiation varies with altitude and latitude.[11] For example, average background radiation exposures are approximately 150 milliRoetgens per year in San Francisco and 500 milliRoetgens per year in Denver, Colorado.[12]

Background exposure levels at the Project Chariot site at Cape Thompson, averaging 40 milliRoentgens per year, are much lower than those at San Francisco or Denver.[13] For comparison, the total annual radiation exposure at the Cape Thompson site is approximately equivalent to that of 4 chest x-rays or that received on eight round-trip, cross-country airline flights. One lateral lumbar spine x-ray provides a radiation exposure approximately 140 times that received in an entire year at the Cape Thompson site.

Exposures to low levels of radiation, including the low background radiation levels at the Cape Thompson site, do not raise the risk of development of cancer. No evidence of increased risk of cancer has been demonstrated with radiation exposures under 20 rads.[14,15] One would have to live at the Cape Thompson site for approximately 500 years to reach the minimum exposure level associated with possibl[illegible] creased risk of cancer.

Approximately 30 percent of the United States population develops cancer of some type during their lifetime, and 20 percent of the population dies of cancer. Exposure to 100 chest x-rays would increase the probability of developing cancer at some time in one's lifetime from 30.0% to 30.04%. In a population of 10,000 people, each exposed to 100 chest x-rays, 3,004 people would be predicted to develop some type of cancer rather than the 3,000 expected if each person in the population were not exposed to 100 chest x-rays. This additional risk is for all types of cancer. The increased risk for any specific cancer is much lower and is probably undetectable. Long-term follow-up studies of approximately 600,000 radiation workers with occupational radiation exposures dating as far back as the early 1940s have not shown any association between occupational exposure to radiation and increased risk of cancer.

For a long time there has been a concern about cancer rates among native populations in Alaska. A number of studies have examined the rates of cancer and potential risk factors for the development of cancer in Native populations, including radiation exposure from nuclear fallout.[16]

Matthew McKenna recently studied cancer in the North Slope from 1984 to 1989.[17] He found that the age-adjusted cancer rate among North Slope residents was approximately 5 percent higher than the general cancer rate of the entire United States. When stratified by sex, male North Slope residents had a cancer rate 15 percent lower than the overall U.S. rate while female North Slope residents had a rate 25 percent higher than the U.S. rate. The age-adjusted cancer rate among residents of Point Hope was 38 percent higher than the overall U.S. rate; this difference was not statistically significant due to the small population of Point Hope residents. The eight cancers that were diagnosed in Point Hope residents from 1984 to 1989 included 2 cases of lung cancer, 2 cases of cervical cancer, and 1 case each of stomach, bone, colon and testicular cancer.

The common types of cancers associated with radiation exposure among Hiroshima and Nagasaki bomb survivors and others with known radiation exposure have included thyroid cancers, leukemia, multiple myeloma, and breast cancer in females.[18] None of these cancers was noted among Point Hope residents from 1984 to 1989.

Lung cancer and cervical cancer, the two cancers noted to be higher in frequency among North Slope residents than among the U.S. total population, are both associated with well-established risk factors. Lung cancer is strongly related to cigarette smoking. Risk factors for cervical cancer include early age at intercourse, numerous sexual partners, and history of sexually transmitted diseases.[19]

Concerns have been expressed that the buried radioisotope material may enter the food chain of Native subsistence hunters and their families through uptake by plants growing atop the burial site which are in turn eaten by caribou grazing at the site. Extensive research was done documenting the deposition of radionuclides in the arctic as a result of atmospheric nuclear tests in the 1950s.[20-23] Cesium[137] was shown to enter the food chain and was detectable in very low amounts in lichens, caribou, and Alaska Natives. In the 1980s several detailed studies reviewed all available findings and concluded that levels were so low as to be on no public health concern.[16,24]

Radioactive fallout from an above ground nuclear detonation normally settles at the earth surface where certain radioisotopes are absorbed by plants and enter the food chain. However, the radioisotopes at Cape Thompson were buried directly atop the permafrost and covered by four feet of topcover. The material is likely to be frozen most or all of the year; the material is located well below the roots of the surface plants, precluding its introduction into the food chain.

Stutzman and Nelson studied cancer incidence among residents of villages in northern Alaska from 1969 to 1983, hypothesizing that an increase in cancers associated with radiation exposure might be found in this population as a result of exposure to radioactive fallout from U.S. and Soviet nuclear testing of the 1950s and 1960s.[16] As part of their study they reviewed results of whole-body radioisotope burden measurements made during the 1960s.[20-23] The levels of radioisotopes in Point Hope residents were among the lowest of all the North Slope villages tested. Among North Slope residents the incidence of cancers associated with radiation exposure was lower than the U.S. rate. Increased rates of cancer of the nasopharynx and liver were found among North Slope men; similarly increased rates of cancer of the nasopharynx, gallbladder, cervix, and kidney were noted among North Slope women. Stutzman and Nelson concluded that changes in cancer incidence observed among North Slope residents were much more likely a result of changes in diet and behavior (especially use of tobacco), and infection with certain viruses, than a result of radiation exposure.

Conclusions and Recommendations

1. The radioisotopes buried at Cape Thompson present no health risk to subsistence hunters in the area or to persons living in nearby villages. They have never presented a risk and will not present a risk if left in their present state. The small amount of radiation released by the remaining radioisotopes is completely attenuated by the soil mixed with the radioisotopes in the disposal material and by the overlying topcover. Individuals remaining atop the burial site indefinitely would experience absolutely no increased health risk of radiation-related cancer or other health problems. Given the low background radiation levels at Cape Thompson, the risk of radiation-related cancers is lower than most other places in the United States.
2. All available evidence shows that past, current, and future potential health problems of residents of Point Hope are not related to radiation exposure at Cape Thompson. Epidemiologic studies of cancer among North Slope residents and Point Hope residents have not shown an excess of the types of cancers known from studies elsewhere to be associated with radiation exposure.
3. Given that the burial site presents absolutely no health risk, there is no indication for the site to be excavated or for the small amounts of remaining materials to be removed.
4. Potential exists for serious injuries or fatalities to occur if removal is attempted. Logistics are difficult. It would be tragic if anyone suffered an injury or fatality in an effort to clean up materials that pose no health threat to any living creature.
5. Removal of the material from the tundra at Cape Thompson would require the expenditure of millions of dollars. During this investigation the situation at Cape Thompson has been reviewed with a number of radiation physicists. When queried on whether the radioisotopes should be moved, the answer was uniformly and emphatically no. Money required for the Cape Thompson cleanup could be put to much better use studying health problems of North Slope residents and addressing the significant public health problems

facing Point Hope and other Alaskan villages and communities, including problems of smoking, alcohol, and vaccine-preventible diseases.

6. Given the strength of scientific evidence, major efforts need to be focused on communicating existing information to local residents. Essential are efforts to identify credible individuals who are trusted by local residents and to support a process that enables local residents and all other Alaskans to examine all the evidence. Supplemental funds should be made available to empower the local communities to assess evidence now available so they can regain control over their lives.

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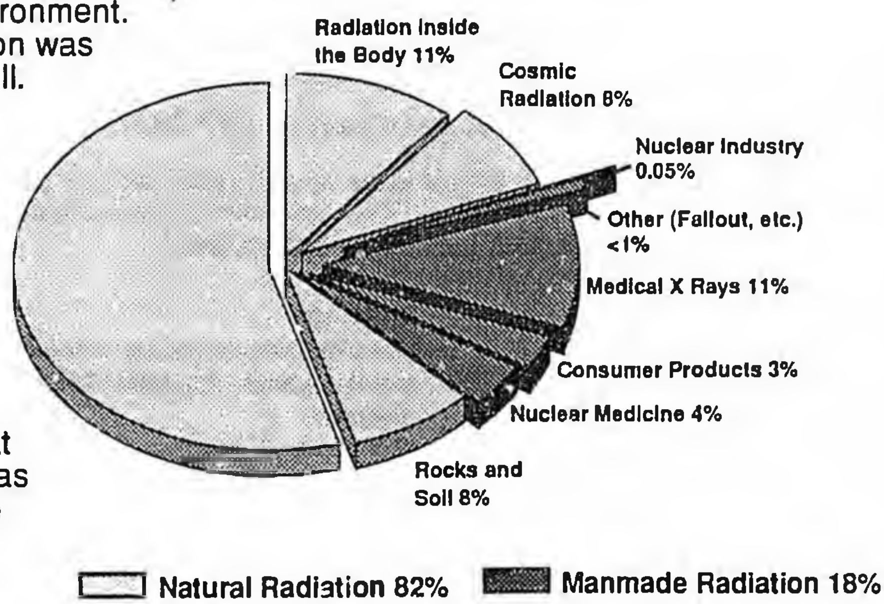
Radiation in the Environment

- *Background radiation*
- *Manmade radiation*
- *Units of Measure*

Radiation is a natural part of our environment. When our planet was formed, radiation was present, and radiation surrounds it still. Natural radiation reaches earth from outer space and continuously radiates from the rocks, soil, and water on the earth. During the last century, humankind discovered radiation, how to use it, and how to control it.



Many materials, both natural and manmade, are radioactive. These materials are composed of atoms that release energetic particles or waves as they change (decay) into more stable forms. These particles and waves are referred to as radiation and their emission as radioactivity.

As the pie chart shows, most background radiation (82%) is from natural sources. By far the largest source is radon, an odorless, colorless gas given off by natural radium in the Earth's crust. Manmade radiation, mostly from medical uses and consumer products, accounts for about eighteen percent of our total exposure, and the nuclear industry is responsible for less than one percent.

Units of Measure

Radiation can be measured in a variety of ways. Typically, units of measure show either 1) the radioactivity present in a substance, or 2) the radiation being given off.

The radioactivity of a substance is measured in terms of the decay per unit of time. The curie is the standard unit for this measurement and is based on the amount of radioactivity contained in 1 gram of radium. Numerically, 1 curie is equal to 37 billion disintegrations per second. The amounts of radioactivity that people normally work with are in the millicurie (one-thousandth of a curie) or microcurie (one-millionth of a curie) range. Levels of radioactivity in the environment from both

Radiation that has enough energy to cause a change in the atomic balance of substances it passes through is called ionizing radiation. There are three basic forms of ionizing radiation.

Alpha particles are the largest and slowest moving type of radiation. They are easily stopped by a sheet of paper or the skin. Alpha particles can move through the air only a few inches before being stopped by air molecules.

Beta particles are much smaller and faster moving than alpha particles. Beta particles pass through paper or skin and can travel in the air for about 10 feet. However, they can be stopped by a thin shielding such as a sheet of aluminum foil.

Gamma radiation is a type of electromagnetic wave that travels at the speed of light. It takes a thick shield of steel, lead, or concrete to stop gamma rays. X-rays and cosmic rays are examples of gamma radiation.

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natural and man-made sources are in the picocurie (one-trillionth of a curie) range.

Radiation levels are measured in various units. Radiation absorbed by humans is measured in either rad or rem. The rem is the most descriptive because it measures the ability of the specific type of radiation to do damage to biological tissue. Again, typical measurements are often in the millirem (mrem), or one-thousandth of a rem, range. On the average, Americans receive about 360 mrem of radiation a year. Most of this (97%) is from natural radiation and medical exposure.

Common Sources of Radiation

Because the radioactivity of individual samples varies, the numbers given here are approximate or represent an average. They are shown to provide a perspective for concentrations and levels of radioactivity rather than dose.

mrem = millirem
pCi = picccurie

Cosmic Radiation

Cosmic radiation is high-energy gamma radiation that originates in other space and filters through our atmosphere.

Sea Level .... 26 mrem/year
(Increases about 1/2 mrem for each additional 100 feet in elevation)
Atlanta, Georgia .... 31 mrem/year
(1,050 feet)
Denver, Colorado...... 50 mrem/year
(5,300 feet)
Minneapolis, Minnesota . 30 mrem/year
(815 feet)
Salt Lake City, Utah .... 46 mrem/year
(4,400 feet)

Terrestrial Radiation

Terrestrial sources are naturally radioactive elements in the soil and water such as uranium, radium, and thorium. Average levels of these elements are 1 pCi/gram of soil.

United States (avg.) .... 26 mrem/year
Denver, Colorado...... 63 mrem/year
Nile Delta, Egypt ..... 350 mrem/year
Paris, France .... 350 mrem/year
Coast of Kerala, India .. 400 mrem/year
McAlpe, Brazil ...... 2,558 mrem/year
Pacos De Caldas
Brazil .... 7,000 mrem/year

Buildings

Many building materials, especially granite, contain naturally radioactive elements.

U.S. Capitol Building ..... 85 mrem/year
Base of
Statue of Liberty.........325 mrem/year
Grand Central Station.... 525 mrem/year
The Vatican .... 800 mrem/year

Radon

Radon levels in buildings vary, depending on geographic location, from 0.1 to 200 pCi/liter.

Average Indoor
Radon Level .... 1.5 pCi/liter
Occupational Working
Limit .... 200.0 pCi/liter

Food

Food contributes an average of 20 mrem/year, mostly from potassium-40, carbon-14, hydrogen-3, radium-226, and thorium-232.

Beer .... 390 pCi/liter
Tap Water................ 20 pCi/liter
Milk .... 1,400 pCi/liter
Salad Oil .... 4,900 pCi/liter
Whiskey .... 1,200 pCi/liter
Brazil Nuts .... 14 pCi/g
Bananas .... 3 pCi/g
Flour .... 0.14 pCi/g
Peanuts & Peanut Butter ..... 0.12 pCi/g
Tea .... 0.40 pCi/g

Medical Treatment

The exposures from medical diagnosis vary widely according to the required procedure, the equipment and film used for X-rays, and the skill of the operator.

Chest X-Ray .... 10 mrem
Dental X-Ray, Each .... 100 mrem

Consumer Goods

Cigarettes - two packs/day
(polonium-210) ...... 8,000 mrem/year
Color Television .... <1 mrem/year
Gas Lantern Mantle
(thorium-232) .... 2 mrem/year
Highway Construction .... 4 mrem/year
Airplane Travel at 39,000 feet
(cosmic) .... 0.5 mrem/hour
Natural Gas Heating and Cooking
(radon-222) .... 2 mrem/year
Phosphate Fertilizers ..... 4 mrem/year
Porcelain Dentures
(uranium) .... 1,500 mrem/year
Radioluminescent Clock
(promethium-147) ...... <1 mrem/year
Smoke Detector
(americium-241) ...... 0.01 mrem/year

International Nuclear Weapons Test Fallout from pre-1980 atmospheric tests

average for a U.S.
citizen .... 1 mrem/year

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DOE/EM-0064P

Perspectives on Radioactivity

- *Measuring radioactivity*
- *Radioactivity in household materials*
- *Radioactivity in industry*

Radioactivity is a naturally occurring phenomena that is part of nature. It comes from cosmic rays, the sun, the earth, and manmade sources. Natural radiation is called "background radiation" and makes up about 82% of the average person's daily exposure to radiation. Medical sources, such as X-rays, make up the majority of the rest of our exposure. Nuclear materials production activities account for less than 1% of all radioactivity.

Although discovered only in the last century, radioactivity is one of the most widely studied and best understood of all natural phenomena. Radioactivity stems from the activity of atoms, the building blocks of matter. All things, whether natural or manmade, are made up of atoms. Some atoms are stable, which means they retain their form and substance forever. Others are unstable and change readily to different forms. As atoms "transform" or decay, they emit radioactivity in the form of waves and particles.

The amount of time atoms take to become stable varies greatly and is measured in "half-lives." One half-life is the amount of time required for one-half of a given quantity of a radioactive element to stop emitting radioactivity. The half-life, along with the kind of radiation emitted and its energy level or activity, is important in determining the degree of hazard from any given radioactive substance.

Measuring Radioactivity

The curie is a standard measure for the amount of radioactivity contained in radioactive material. It was named after the French scientist Marie Curie for her landmark research into the nature of radioactivity.

The basis for the curie is the radioactivity of one gram of radium, the source of radon. Radium decays at a rate of about 2.2 trillion disintegrations (2.2×10^{12}) per minute. A

Unit of Radioactivity	Symbol	Disintegrations Per Minute	Dollar Analogy	Examples of Radioactive Materials
1 Curie	Ci	2×10^{12} or 2 Trillion	2 Times the Annual Federal Budget	Nuclear Medicine Generator
1 Millicurie	mCi	2×10^{9} or 2 Billion	Cost of a New Interstate Highway from Atlanta to San Francisco	Amount Used for a Brain or Liver Scan
1 Microcurie	μCi	2×10^{6} or 2 Million	All-Star Baseball Player's Salary	Amount Used in Thyroid Tests
1 Nanocurie	nCi	2×10^{3} or 2 Thousand	Annual Home Energy Costs	Consumer Products
1 Picocurie	pCi	2	Cost of a Hamburger and Coke	Background Radiation Levels

This chart shows the relative differences between units of radioactivity and gives approximate analogies in dollars The number of disintegrations per minute has been rounded off to the nearest whole number.

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picocurie is one trillionth of a curie. Thus, a picocurie represents 2.2 disintegrations per minute.

To put the relative size of one trillionth into perspective, consider that if the Earth were reduced to one trillionth of its diameter, the "pico earth" would be smaller in diameter than a speck of dust. In fact, it would be six times smaller than the thickness of a human hair.

The difference between the curie and the picocurie is so vast that other metric units are used between them. These are as follows:

Millicurie = 1/1,000 (one thousandth) of a curie

Microcurie = 1/1,000,000 (one millionth) of a curie

Nanocurie = 1/1,000,000,000 (one billionth) of a curie

Picocurie = 1/1,000,000,000,000 (one trillionth) of a curie

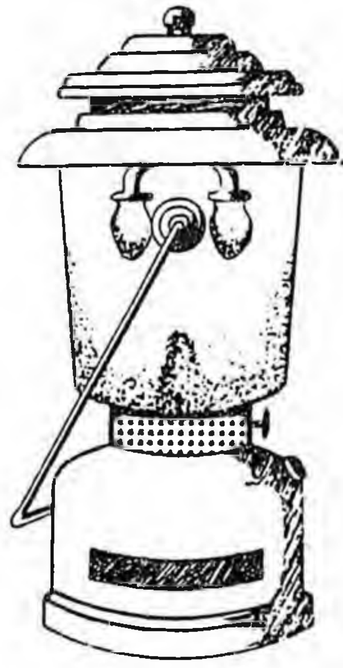
Around the House

Many household products emit a small amount of radioactivity or use radioactive materials. Examples include microwave ovens, smoke detectors, dentures, color televisions, camera and eyeglass lenses, and anti-static brushes. The radioactive component is added to the products either specifically to make them work or as a result of using compounds of elements like thorium and uranium in producing them. The amount of radiation the products give off is very small and is not hazardous.

Building materials such as brick and stone contain radioactivity. Thus, a home made from wood would have a lower level of background radiation than one built from bricks or stone such as granite. Because of cosmic rays, a person living at an altitude of five thousand feet in Denver, Colorado, receives nearly twice as much cosmic radiation from outer space as a person living at sea level in Washington, D.C. Similarly, high concentrations of radioactive minerals in beach sand in Brazil and India expose local residents to between ten and 100 times the levels of background radiation in the U.S. Even the human body contains very low-level radioactive materials. Every person has 500,000 atoms decaying in our bodies every minute. And some foods which are essential to good health contain naturally occurring radioactive elements, such as potassium-40 and carbon-14.

Lanterns: In a New Light

About 20 million gas lantern mantles are used by campers each year in the United States. Under today's standards, the amount of natural radioactivity found in a lantern mantle would require precautions in handling it at many government or industry sites. The radioactivity present would contaminate 15 pounds of dirt to above allowable levels. The average mantle contains 1/3 of a gram of thorium oxide, which contains approximately 100,000 picocuries per gram. The approximately 35,000 picocuries of radioactivity in the mantle would, if thrown onto the ground, be considered low-level radioactive contamination at a government or industry facility. However, the radiation from a gas lantern mantle is far less than the average chest X-ray.



Radiation and Industry

In addition to medical uses, defense applications, energy generation, and consumer products, radiation is used in industry. For example, radiography is used in much the same way as doctors use X-rays. It locates defects in metal casings and welds that are hard to detect. It determines microscopic thicknesses of materials, such as metal foils, and the amount of adhesive on masking tape. Radiography can also locate structural defects in statues and buildings. Archaeologists use a technique involving the radioactive decay of carbon-14 to date prehistoric objects accurately. Radiation can also be used to validate the authenticity of artwork.

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STATE OF ALASKA

WALTER J. HICKEL, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

OFFICE OF THE COMMISSIONER
410 WILLOUGHBY AVENUE, SUITE 105
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March 18, 1993

The Honorable Walter J. Hickel
Governor of the State of Alaska
P.O. Box 11011
Juneau, Alaska 99801

Dear Governor Hickel:

Last September 25th you asked the State Emergency Response Commission (SERC) to conduct a review of radiological threats facing Alaskans and the preparedness of federal, state and local agencies to respond to those threats. Enclosed is that review.

As you can see, the SERC made five recommendations at this time, as detailed in the summary, for further follow up. At the same time, we addressed and gave you the status of a number of initiatives already taken by your administration to protect Alaskans from radiological threats, domestic and foreign.

In the reference section of the report, you will also see additional recommendations which were not yet adopted by the SERC. Among them, and worthy of further debate in your cabinet, are the continuing State approach to Project Chariot and the cleanup, improved radon monitoring and mitigation, the issue of whether or not to seek primacy on nuclear regulation from the federal government, and improvements to the State's monitoring capability.

In the months to come, the SERC will be following up with you on these recommendations. We would propose to further develop a plan for consolidation of agency efforts and rationalization of Alaska's laws, and work with the Legislature in the interim. We are also prepared to do whatever you choose to convey these needs and recommendations to the federal government. In addition, let me say that we are thankful for the presence of organizations such as the Northern Forum and the Arctic Environmental Protection Strategy that provide a mechanism, for the first time, for serious discussion of these issues in the arctic. Your leadership in raising these issues with the highest levels of Russia's government has also been very helpful.

Finally, we would like to thank the North Slope Borough, the federal and state agencies, and the private individuals who contributed to this report in so short a time. We will follow up with you to convey this report to the federal decision makers wherever necessary.

Best regards.

Sincerely,

John A. Sandor
Commissioner

MT/CS/heb (g:\comm\hickel.ltr)

Enclosure: Preliminary Report to Governor Walter J. Hickel: *Radiological Threats and Release Response Preparedness in the State of Alaska*, March 1993

cc Members of the State Emergency Response Commission
Members of the Emergency Response Committee of the SERC
Members of the Alaska Legislature

Preliminary Report to Governor Walter J. Hickel

Radiological Threats and Release Response Preparedness in the State of Alaska

March 1993

Prepared by the Alaska State Emergency Response Commission, Emergency Response Committee

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Introduction

Concern over radiological issues in Alaska has heightened as the public has become aware of potential radiological threats from a 30 year-old radioactive waste dump near Pt. Hope, Radioisotope Thermal Generators (RTGs) deployed in Alaska by the military, and newly available information from a hearing of the U.S. Senate Select Committee on Intelligence, held by Alaska Senator Frank Murkowski in 1992 concerning radiological contamination from nuclear reactors and waste dumps in the former Soviet Union. In response to these concerns the Governor requested the State Emergency Response Commission (SERC) to review radiological threats and response preparedness in Alaska. The goal of the review was to identify sources of radiation hazards, determine the level of preparedness to respond to these threats, and to make recommendations for reducing risk and enhancing response. *(See letter from Governor Walter J. Hickel in Appendices.)*

The SERC tasked their Emergency Response Committee (ERC) with conducting the review with the following objectives:

- Identify the radiological sources that could threaten the health and safety of Alaskans, including both in-state and international sources;
- Assess the agreements and procedures in place whereby State and local agencies are notified of a release or potential release of radiological materials from both in-state and international sources;
- Assess the State's ability to detect radiation hazards so that protective measures may be initiated; and
- Recommend measures that the State could take to reduce the risks of radiological hazards, through such strategies as source control and reduction, public education, and improved monitoring and response capability.

In order to draw on a large pool of expertise the ERC assembled a team of experts from various State agencies and individuals with responsibility or experience with radiation issues. The ERC assigned a "team leader" for each of the major components of the report. Each team leader was responsible for assembling the required information/analysis and writing their section of the report. Input from other agencies, individuals and sources was also solicited and was channeled directly through the team leaders.

Organizations contributing to this report include the Department of Environmental Conservation/Divisions of Spill Prevention and Response, and Environmental Quality; Department of Health and Social Services/Division of Public Health; Department of Military and Veterans Affairs/Division of Emergency Services, Alaska Health Project; Department of Law/Civil Division; and University of Alaska/Environment and Natural Resources Institute. Dr. Ernest B. Meloche, M.D., Chairman of Ketchikan's Local Emergency Planning Committee

(LEPC) was a major contributor of information concerning health effects of radiation. Mayor Jeslie Kaleak, Sr. of the North Slope Borough reviewed and commented on the draft report. (see Appendix) Carl Schrader, as staff to the SERC provided overall report coordination and authored the report summary.

Timely and valuable information was provided by the Conference of Radiation Control Program Directors, Inc. who, coincident with the Governor's request, sent a team of federal and state radiation control practitioners to Alaska to perform a review of Alaska's radiation control program. Their review and recommendations are included as appendices to this report.

Because of the volume and range of information presented, the Summary provides a synthesis of the information contained in the Reference Section, along with additional recommendations and comments from the SERC and other interested parties who reviewed the draft report. The Summary begins with a summary of the key recommendations by the SERC for the Governor's consideration. This is followed by a list of current Administration initiatives addressing radiological issues in Alaska. The remainder of the Executive Summary provides a synthesis of the information presented in the individual sections of the report. The synthesis begins by describing the health risks and pathways of exposure of Alaskans to radiation. This is followed by an inventory of possible sources of radiation exposure both from sources within the state and from sources and activities beyond our shores. Because of concern over possible contamination from foreign sources, existing procedures for notification of a release are examined, as well as the capability to monitor the presence of contamination or exposure. The next section of the report summarizes federal, state, and local response plans and actual response capability for accidental radioactive releases. The last section discusses the State of Alaska's authority to regulate radioactive sources and to respond to threats.

In reviewing this report and the recommendations, it is important to note the following limitations:

- Although this report is fairly comprehensive in scope, time and resources did not permit a thorough examination of all issues. This report is preliminary in nature, and is limited to identifying the major issues and opportunities for reducing risk and improving response capability. The report will provide the starting point for a more detailed analysis of specific issues and recommendations, with the goal of developing an overall strategy for reducing the risks of radiological hazards to Alaskans.

- This report, in all cases attempts to be factual and objective. Issues of high visibility and media exposure were not elevated above less visible but equally important radiological threats to public health.

- This report does not attempt to rank radiological threats to public health and the environment against other environmental or health threats which may be of more immediate concern to the people of Alaska. These include contaminated sites, drinking water, wastewater disposal, natural disasters, etc.

Summary

RECOMMENDATIONS

In preparing this report and recommendations, the State Emergency Response Commission (SERC) reviewed existing policies and initiatives of the Governor and State of Alaska. An analysis of the recommendations received from contributors to this report is provided in Section I. Many of the recommendations received from contributors are now being implemented or are being sought from U.S. or foreign governments. Some additional recommendations are easy to implement and would likely result in a significant reduction in risk to Alaskans. Other recommendations, however, will require additional investigation to determine the costs and benefits of implementation. The SERC supports forwarding five key recommendations to the Governor at this time.

- **The State should revise and implement the existing X-ray unit inspection program to ensure that X-ray units are inspected at the frequency recommended to protect public health.** The greatest exposure of most Alaskans to radiation comes from diagnostic X-rays used in medical and dental facilities. Inspection of X-ray machines and correction of the deficiencies is the most effective way to minimize unnecessary exposure. Inspections in Alaska are far behind schedule, resulting in unnecessary exposure and increased risk to human health.

- **The State should consolidate the major radiation protection and response planning activities within one agency.** Responsibilities for radiation protection are severely fragmented, being placed within four state agencies. In some cases, these responsibilities are overlapping and duplicative, and in some cases the responsibilities are not clear.

- **The State statutes and regulations pertaining to radiological hazards should be consolidated and updated.** Legislative authority is fragmented in various statutes, and provides for some overlap and duplication of responsibilities.

- **Major efforts need to be focused on communicating the risk from radiological sources to Alaskans, especially rural residents.** Efforts are needed to identify credible individuals who are trusted by local residents and to support a process that enables local residents all over Alaska to examine all the evidence regarding radiological threats. Local communities should be empowered to assess evidence now available so that they can make informed decisions regarding radiological threats.

- **Governor Hickel should request the government of the Russian Federation to seek consultation with Alaska and the United States government on the proposed construction of new nuclear facilities.** At the January 13, 1993 meeting of the State Emergency Response Commission (SERC), the following motion was passed: *"Wherever the government of the Russian Federation has* *proposals to construct new nuclear facilities that have the potential of impacts across international boundaries, the SERC recommends that the potentially affected international communities be consulted and that the impacted local communities also be consulted."* This SERC resolution should be forwarded to the Russian Federation.

DISCUSSION

Inspection of X-ray and mammography units

Not only is diagnostic X-ray by far the single largest source of exposure to man-made radiation, it is also the source for which the biggest dose reduction gains can occur without having a negative impact on the benefits to the public. Alaska has a registration and inspection program in DHSS which oversees facilities using X-ray tubes. An inspection frequency has been established for the various types of facilities, but due to lack of staff, inspections are far behind schedule.

Nationally established standards for inspection and calibration of X-ray equipment recommend equipment in hospitals, doctors' offices and chiropractors' offices to be inspected annually. Dental offices should be inspected on a 2-3 year schedule. Because of staff limitations, inspections in Alaska are typically performed only every 3-6 years, and in some outlying areas X-ray equipment has not been inspected in ten years. There are 1265 X-ray tubes registered at 459 facilities in the state. In addtion, there are 27 mammography units in Alaska that require annual inspections. To date, two out of seven mammography units inspected have not met required criteria. The Conference of Radiation Control Program Directors (CRCPD) recommends two full-time professional/technical staff per 1,000 tubes to meet the required inspection frequency, based on national averages. However, because of the size of the state and longer travel times required to service outlying communities, the CRCPD recommends a staffing level of 2 full-time professional/technical plus one full-time clerical staff for Alaska.

The State presently has only one radiation physicist, who performs inspections on a part-time basis. The State should revise the existing inspection plan and implement the plan at the recommended inspection frequency. Until additional staff can be added, a designated amount of time should be devoted each month for doing as many inspections as possible.

Consolidation of major radiation protection activities within one agency

Responsibility for radiation protection activities is now spread among four agencies - the departments of Health and Social Services (DHSS), Military and Veterans Affairs (DMVA), Environmental Conservation (DEC), and Labor (DOL). This fragmentation results in overlapping responsibilities and duplication of effort. There is presently a lack of coordination between key elements of protection such as monitoring, planning, response, information management, and responding to public concerns.

The Conference of Radiation Control Program Directors, Inc. (CRCPD) recommends that a state's Radiation Control Program (RCP) should be a separate government entity, and should be easily identifiable and visible to the public. The public's concern with radiation exposure should be easily translatable from a radiation expert who can provide competent risk based answers to their concerns. The program should be located within the state organizational structure so that it is parallel with comparable health and safety programs, and with a single person responsible for directing the work of the program. An audit by the CRCPD of Alaska's radiation control activities recommends that DEC should house this program. The SERC, while adopting the recommendation for a combined program, did not consider the issue of which State department should be the lead agency.

Radiation control regulation update

The existing radiation control regulations are significantly outdated; last being amended in 1978. Legislative authority is fragmented in various statutes, and provides for some overlap and duplication of responsibilities. The State statutes and regulations pertaining to radiological hazards should be consolidated and updated. For example, the State should consider becoming an "Agreement State" with the federal Nuclear Regulatory Commission (NRC) which would give the State authority to regulate industries now regulated by the NRC. Many radiation sources in Alaska, such as Naturally Occurring Radioactive Materials (NORMs), are not regulated by the NRC and are currently not regulated by the State of Alaska.

Risk communication

For years, national security considerations have shrouded nuclear information in secrecy. The historic failure of federal and state agencies to adequately inform communities of the presence of radiological hazards or to communicate the risks that they pose has created an atmosphere of mistrust of authorities in respect to radiological issues. The perception of continued secrecy on the part of government agencies makes people suspect the worst when they do learn of the presence of radiological materials in or near their communities. The recent public outrage over the "discovery" of contaminated soils buried near Pt. Hope and Radioisotope Thermal Generators (RTGs) on Burnt Mountain exemplify this concern. Federal and state agencies were aware of the presence of these radiological materials, but had failed to adequately communicate their presence and associated risks to the local communities. Information regarding potential radiological threats must be made available to the public, and the information must be presented to the community by credible individuals in such a manner that they can understand the actual level of risk involved, and can take actions towards reducing those risks where the community feels that the risks are unacceptable.

Notification of new nuclear facility construction in the Russian Federation

By a fluke in wind patterns, fallout from the Chernobyl accident barely missed Alaska. Nuclear facilities located in the former Soviet Union continue to pose a threat to Alaskans because to the close proximity and risk of frequent and catastrophic releases. Inspections of Soviet-built nuclear power generation facilities by members of the international scientific community have raised serious questions regarding the safety of the design of existing plants and the ability to safely maintain and operate them, given the current social and economic crisis in the area. In spite of the demonstrated problems with nuclear power safety and waste disposal in the former Soviet Union, and the abundance of alternative energy sources such as oil and natural gas, the Russian government continues to pursue a broad ranging program of nuclear power plant construction in the Russian Far East and the Arctic. Notification provisions, were an accident to happen again, are weak - inside Russia and out. Since an accident at a nuclear facility in the former Soviet Union has the potential to impact other countries, including the United States and particularly Alaska, the communities that would potentially be impacted should be directly involved in the decision to construct any new nuclear facilities.

CURRENT ADMINISTRATION INITIATIVES ADDRESSING RADIOLOGICAL ISSUES

Governor Hickel, the State of Alaska, and Alaska's delegation in Congress have taken an active role in radiation issues both within the state, and in the international community where radiological releases from nuclear power plant accidents and ocean dumping have the potential of affecting Alaskans. The following is a list of current Administration initiatives that address many of the radiological issues discussed in this report:

1. **Project Chariot cleanup at Pt. Hope.** Governor Hickel and Senator Frank Murkowski committed to removal of all of the radioactively contaminated soil from Project Chariot that was buried at Pt. Hope by the Atomic Energy Commission in 1962. The Alaska Department of Environmental Conservation (DEC) is working with the U.S. Department of Energy (DOE) on remediation, operations and safety plans. Cleanup plans have been made in close consultation with the local Multi-Agency Committee (MAC) and Citizen's Advisory Group (CAG).

   The cleanup operations have been set for summer 1993 for safety and logistical considerations and to minimize disruption to subsistence hunts for whale, seal, and walrus. Background sampling for environmental contamination will be done in the disposal area and in the Ogotoruk Creek Valley. Unless significant radioactive contaminant levels are found outside of the mound this would complete the restoration/removal activities. To be certain, the State has requested declassification of all relevant records from Project Chariot operations in Alaska. A State-DOE Memorandum of Agreement will fund State oversight and will allow transfers of monitoring equipment after the cleanup is complete. Studies concerning other nuclear tests (see Amchitka, below) and long term health effects from possible exposure to fallout from Russian nuclear testing and other sources will continue and will be covered in other MOAs.

2. **Contaminated soils at Ft. Greely.** A nuclear power plant was operated by the U.S. Army at Ft. Greely near Delta Junction from 1962 to 1972 and subsequently decommissioned. The reactor core, spent fuel rods and other high level radioactivity were removed and shipped to Hanford, Washington. The residue of the reactor and adjacent spent fuel pit were entombed in concrete, and the site is monitored on a continuing basis. During the summer of 1992 repairs were made to a cracked concrete block wall that had been placed during decommissioning. The repairs required excavation of contaminated soil, which is considered low level radioactive waste. The U.S Army at Ft. Belvoir, Virginia has responsibility for this material, which has been placed in 57 drums, and plans to move the material to a low level storage facility in the lower 48 states. The Army is awaiting disbursement of funds before they can proceed with issuing a contract to transport the drums. The State of Alaska and U.S. Army Corps of Engineers, Alaska Office are monitoring the situation.

3. **Naturally Occurring Radioactive Materials (NORM).** In the spring of 1991 radiation experts hired by the Anchorage Daily News found low level radioactive contamination in an oil industry pipe cleaning yard on the Kenai Peninsula. Contamination was also found inside pipes that had been given away by the oil industry. The source of the contamination was naturally occurring radioactive material (NORM) that formed as scale on the inside of pipes during oil production.

The Department of Environmental Conservation, with the assistance of the Alaska Oil and Gas Association, undertook a limited NORM screening project of pipe used for construction of playground equipment at three Kenai Peninsula Borough public facilities. One piece of playground equipment containing slightly elevated levels of NORM was identified. No action was taken by the borough since the pipe is sealed. All soil contamination identified at the pipe cleaning yard has been cleaned up. Pipes found to be contaminated are now stored pending approval of an oil industry project to clean the pipe safely and to inject the contaminated pipe scale deep into the earth.

DEC is preparing field guidance for the proper storage, cleaning and safe disposal of equipment contaminated with naturally occurring radioactive material. The agency is working with the Departments of Labor, Health and Social Services, the Alaska Oil and Gas Conservation Commission, environmental organizations and British Petroleum. The field guidance will define performance standards for worker health and safety issues, environmental monitoring during storage and cleaning operations, contingency planning, and disposal requirements.

4. **Contamination at Amchitka.** Amchitka Island, located in the Aleutians, was the site of three nuclear test explosions conducted by the Atomic Energy Commission between 1965 and 1971 is included as an Off-Site Area in the U.S. Department of Energy's Environmental Restoration Program of the Nevada Test Site. According to fate and transport models there is a potential for radionuclide movement over time from deep aquifers to the Pacific Ocean and the Bering Sea. The U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA) are monitoring for surface impacts every two years. To date surface contamination has only been detected in the vicinity of Project Long Shot, where trace amounts of tritium slightly below drinking water standards have been found in area groundwater.

   The DOE plans to perform a Remedial Investigation/Feasibility study and is committed to long term monitoring. The DEC Southcentral Regional Office is participating with the Northern Regional Office in negotiating an Agreement in Principle with the DOE to define the working relationship between the Department and DOE, and submitted a draft grant request in December 1992 for regional oversight expenses. Staff have requested historical documents from the DOE and are expecting to participate in the next field monitoring trip scheduled for fall 1993.

5. **Radioisotope Thermal Generators (RTGs).** In response to public concern over the safety of RTGs located in Alaska, the State has contacted the Nuclear Regulatory Commission and branches of the military and identified ten (10) RTGs at Burnt Mountain north of Fort Yukon and three (3) at Fairway Rock west of Wales. DEC staff have reviewed manufacturer's drawings and literature and visited the Burnt Mountain site. There has been no release of radiation and the devices appear very durable. The military has assured us that they are safe and that they are designed to safely supply small amounts of electrical power in extreme climates or at great depths under the ocean.

6. **Monitoring - environmental.** In August 1992, with help from EPA, DEC is reinstating a statewide radiation monitoring network consisting of sampling sites in Anchorage, Fairbanks and Juneau. The sites are part of the EPA funded ERAMS (Environmental Radiation Ambient Monitoring System) national radiation monitoring network. The system, however, had been out of commission since post-Chernobyl monitoring activities concluded. As of the date of this report, the monitors are not yet fully operational. DEC plans to supplement this system with additional monitoring stations (see #7 below).

7. **Monitoring - enhanced environmental monitoring capability.** To expand monitoring and to provide real time capability for airborne contamination monitoring, the State is pursuing the placement of sophisticated monitoring equipment - Pressurized Ion Chamber (PIC) monitoring systems around the perimeter of the state. Funding for this enhanced monitoring capability is being sought from the Department of Energy (DOE), Department of Defense (DOD) and the Environmental Protection Agency (EPA).

8. **Monitoring - laboratory capability.** To expand the in-state monitoring and radiological sample analysis capability, DEC is requesting funding for a radiochemist for the Juneau Environmental Analysis Laboratory.

9. **International - nuclear power safety.** The State of Alaska sent Randy Rice, an Environmental Specialist to attend an international conference in Russia on "Power Engineering and the Environment" sponsored by the organization "ADESKO". Papers were presented showing the advantages of nuclear power over coal, oil and hydroelectric power. The conference passed a resolution proposing a broad ranging program of new nuclear power plant construction in the Russian Far East and Arctic. Mr. Rice, as the only American representative at the conference refused to endorse this resolution. The resolution was later adopted by the Russian Parliament.

   Mr. Rice brought the information back to Alaska for the State to assess the implications of expansion of the Russian nuclear power program. As a result, the SERC passed a resolution asking that the construction of any new nuclear facilities in the Russian Federation be done in consultation with the states threatened by a potential accidental release.

10. **International - nuclear power safety.** The State of Alaska is generally supportive of efforts by the U.S. Department of State to lend assistance to the former Soviet Union to increase safety of operations at its nuclear power plants. In meetings with the U.S. Department of State and the Nuclear Regulatory Commission, DHSS Commissioner Ted Mala and DEC Deputy Commissioner Mead Treadwell requested that the assistance be extended to plants operating in the Russian Far East.

11. **International - nuclear power safety, Bilibino nuclear power plant.** Governor Hickel has specifically requested through the Northern Forum, an association of fourteen regional governors of northern states, that the Nuclear Regulatory Commission (NRC) and EPA to send a team of experts, including representatives from Alaska to visit the Bilibino power plant and to assess the emergency response and notification needs for the protection of Alaskan citizens. In a February, 1993 meeting between Governor Hickel and Governor Nazarov of the Chukota Region of Russia, Governor Nazarov invited a state-federal team to

visit the Bilibino Nuclear Power Plant. The State will send a team of Alaskan nuclear and emergency planning experts as part of this combined state-federal effort.

12. **International - notification.** In 1991, the eight Arctic nations agreed to the Arctic Environmental Protection Strategy (AEPS), which includes agreements to assess Arctic contamination from all sources, as well as ways to improve emergency response. The State of Alaska is invited to participate in U.S. delegations to AEPS meetings. Erv Martin, Director of DMVA, Division of Emergency Services pressed during the last Emergency Response working group meeting in Sweden, October 1992, to gain better notification of Arctic nuclear incidents, including direct communication to State and regional governments. The State is pursuing adoption of the proposal at the AEPS ministerial meeting in September 1993.

13. **International - notification.** Following receipt of information that a significant radioactive release had occurred from the nuclear power plant at Bilibino, Russia on July 10,1991 Governor Hickel wrote a letter to Robert Strauss, United States Ambassador to Russia (April 16, 1992) expressing concern over the lack of notification regarding the incident. In the case of an accident with the potential to cross international borders, it is incumbent on the host nation to assess the situation and inform those who might be threatened. By international agreement the International Atomic Energy Agency (IAEA) has responsibility for notifying governments of nuclear releases into the atmosphere which could pose a public danger. Ambassador Strauss responded that the accident was not seen as having the potential for trans-border effects.

14. **International - response.** The Northern Forum, an association of fourteen regional governors of northern states chaired by Governor Hickel will seek through the Environmental Protection and Emergency Response Project to conduct a drill of an international response to a nuclear incident during the year 1993.

15. **International - monitoring of marine environment.** The State of Alaska supports studies by the Office of Naval Research on the threat of radiation from ocean dumping by Russia, and seeks a role for the University of Alaska. The Alaska Congressional Delegation members helped secure funding for this work.

HEALTH EFFECTS OF RADIATION

Forms of Radiation

There are two general types of radiation hazards - *ionizing* and *non-ionizing* radiation. Both forms of radiation when absorbed by living tissue in sufficient quantities can cause chemical and physical damage which may result in illness or death. *Ionizing radiation* consists of energy or small (subatomic) particles such as gamma, beta, or alpha radiation that have sufficient energy to cause atoms or molecules that it collides with to become charged or "ionized". This is the type of radiation that usually comes to mind when we think of "radiation" or "radioactivity". Ionizing radiation comes from both man-made and natural sources. Man-made sources include fuel and waste from nuclear power and weapons plants, nuclear weapons, fallout, X-ray machines, etc. Natural sources include cosmic rays from outer space, radon, uranium and other mineral and petroleum sources.

Non-Ionizing radiation refers to radiation at the lower end of the energy spectrum and includes ultraviolet and visible light, infrared radiation, microwaves, radio waves, heat, and electric currents. As with ionizing radiation, there are both man-made and natural sources of non-ionizing radiation. Non-ionizing radiation is abundant in the natural environment and includes sunlight, heat, and the earth's magnetic field. Man-made sources include lasers, tanning booths, microwave and radar transmitters, and electrical appliances. Although a lower-energy form of radiation than ionizing radiation, some forms of non-ionizing radiation such as ultraviolet light may pose substantial health risks.

High Dose Radiation Effects

If a person receives a high dose of radiation, such as may occur as a result of a nuclear explosion (Hiroshima) or nuclear power related accident (Chernobyl) the body cells can be damaged and cease functioning, resulting in a breakdown of basic body functions. A high enough dose will result in death. If the exposure was not high enough to cause death, delayed effects may occur. These delayed effects may include cataracts, sterility, altered growth and development in children, and development of specific forms of cancer such as Leukemia.

There are few high-level sources of radiation in Alaska capable of causing a high dose exposure and no documented cases of worker or public exposure. There are currently no nuclear power utilities in Alaska, and few (if any) high-level industrial sources. A nuclear power plant was operated at Fort Greely in the 1960s and was decommissioned, encased in concrete and buried in 1972. High-level sources in the state are limited primarily to military applications such as nuclear weapons, and nuclear powered submarines.

Low Dose and Delayed Radiation Effects

Of the factors which determine the amount of exposure to radiation, and the eventual effects upon the individual, the most important are the amount and type of radiation present, the distance from the source of radiation, the protective barriers between the individual and the source of radiation, and the duration of exposure. If radioactive materials are taken into the body and incorporated into our body tissues, the distance is very small, there is no barrier at all, and the duration of exposure is potentially very long. An amount of radioactivity that is insignificant when present in the environment may pose a serious health risk when we become internally contaminated. Internal contamination can occur through eating contaminated foodstuffs, including fish, seaweeds, animals, and milk. Similar exposure occurs through drinking contaminated water or breathing contaminated dust within the air as might occur with fallout from distant nuclear explosions or nuclear power plant accidents such as happened at Chernobyl.

Health effects from chronic (long-term) low levels of exposure are similar to delayed effects of high dose exposure. The main result of exposure is increased risk of some forms of cancer, but because the effects can occur many years or decades later, it is difficult to link the exposure to the resulting cancer. It is known however, that certain sources of radiation are linked to specific forms of cancer. For example, many pioneer radiologists and scores of atomic bomb victims died of leukemia; radium watch dial painters exhibited high incidence of bone cancer; lung cancer is prevalent in the uranium mining industry, and thyroid cancer among children living near Chernobyl is common.

Global fallout studies conducted after the intensive nuclear testing of the 1960s related exposure to certain isotopes with specific cancers. Only a few of the radionuclides contained in fallout pose a significant long-term health hazard since only a few isotopes occur in abundance, have relatively long half-lives and have chemical characteristics that facilitate transport and concentration through the food chain, and accumulate in sensitive human tissues. Leukemia, breast cancer and bone sarcoma were identified as the malignancies most likely to be induced from internally deposited Cesium-137 and Strontium-90.

Health Effects of Non-Ionizing Radiation

Health effects of some forms of non-ionizing radiation are similar to those of ionizing radiation. Excessive exposure to ultraviolet light, either from the sun or from tanning booths, for example, is a well know cause of skin cancer, and light from lasers can cause eye damage and blindness. Health effects of other forms of non-ionizing radiation are less well known. Exposure to high intensity microwaves used in communications and radar, and exposure to electromagnetic fields are suspected of contributing to some forms of cancer. Electromagnetic fields associated with power transmission lines, and even effects of the earths magnetic field in some high latitude locations have been associated with headaches and other maladies. At present, however, the potential health effects of microwaves and electromagnetic fields is a controversial subject among the scientific community.

PAST EXPOSURE OF ALASKANS TO RADIOLOGICAL THREATS

Exposure to X-rays

The greatest exposure of most Alaskans to man-made radiation comes from diagnostic X-rays used in medical and dental facilities. Diagnostic X-rays pose a minimal risk if the exposure is properly controlled and monitored. Excessive exposure, however, may result from improperly calibrated or adjusted X-ray equipment. Alaska has a registration and inspection program for X-ray tubes, but due to lack of staff inspections are far behind schedule.

Exposure to Radon

Radon is a radioactive gas that has been associated with lung cancer. Approximately 9% of homes and other buildings in Alaska which have been tested for radon exceeded EPA recommended limits for corrective action. This percentage was found to be much higher in some areas such as Fairbanks, where 18% of the homes tested exceeded the action level.

Exposure of Alaskans to fallout

Intensive nuclear testing in the 1960s resulted in exposure from fallout to people in western and northern Alaska. Radioactive Cesium and Strontium were deposited on the tundra and were concentrated in the food chain by caribou grazing on the lichen. Alaskans utilizing caribou as a food source were exposed to elevated levels of these isotopes. A study of the exposed populations showed that the body burdens returned to normal within twenty years and that the cancer risk to the populations exposed to the fallout was low.

Project Chariot

Project Chariot refers to a project proposed in the early 1960's to use a nuclear explosion to construct a deep water port near Cape Thompson in the northwestern arctic. The project was never completed, but a study was conducted in the area in 1962 to determine how radioactive particles would move if deposited on the tundra. Radioactive materials similar to what was expected to result from the explosion were mixed with soil and placed in test plots on the ground. Very little movement of the radioactive material was detected. Following the experiment the contaminated soil was mixed with additional soil to dilute the material and then covered with four feet of clean soil. This soil remains frozen for most of the year.

The public recently learned of the buried contaminated soil, which prompted concerns by local residents of possible health risks from the site. Subsequent investigations by state and federal agencies failed to detect elevated surface levels of radiation in the area, and have concluded that contamination has not entered the food chain where it could have posed a risk to subsistence hunters. In fact, due to natural radioactive decay, radioactivity of the buried soil has been reduced to less than half of the original amount. A study of the rates of cancer in the population failed to detect elevated rates of radiation-related cancer. Recent studies have concluded that the site does not present a present or future health risk, and that risk of physical injury during proposed "clean-up" operations would far outweigh any potential health threat.

In spite of the scientific evidence demonstrating the buried material does not pose a health threat, concern in the community remains high. This concern and mistrust is not unexpected. Much of the public concern over radiation stems from the difficulty of communicating the actual risk from something that is to many very mysterious, cannot be seen, smelled or tasted, and over which to individual has little direct control. The challenge remains to establish the trust of local residents and to clearly communicate the risks.

INVENTORY OF SOURCES/THREATS

Alaskans are faced with numerous sources of radiation both within the state and from international sources. Any of these sources, if not properly contained and managed, may result in exposure and threaten the health and well-being of Alaskans. Any attempt to rank the relative level of risk to Alaskans from these sources would be a difficult and controversial task, and is beyond the scope of this report. What follows is a general description of the sources identified in this report with a limited assessment of the level of threat that they pose to Alaskans. The major sources of radiation hazards that could potentially effect Alaskans are summarized in Table 1.

INTERNATIONAL SOURCES

Alaska is unique among the 50 states by virtue of our proximity to the former Soviet Union (see Figure 1). As the threat of nuclear war has receded from the forefront, we are becoming increasingly aware of the threat of nuclear accidents and serious environmental contamination that has resulted from the widespread use of nuclear technologies, with few regulations regarding nuclear safety and waste disposal practices. Because Alaskans share the arctic and subarctic environment with the former Soviet Union, contamination from these sources must be considered a threat.

Nuclear weapons

Since the end of the Cold War and the collapse of the Soviet Union, the threat of nuclear weapons may have lessened, but has not disappeared. Nuclear weapons continue to proliferate throughout the world and their use by other nations and by terrorists cannot be ruled out. Threat from nuclear weapons may result from direct use against the State in an act of war, or from fallout from use elsewhere in the northern hemisphere, from testing, or from accidental detonation .

Table 1.
RADIATION SOURCES AND HAZARDS
POTENTIALLY AFFECTING ALASKA

ALASKA

Radiation and Radioisotopes Used for Medical and Industrial Purposes

Location	Type	Notes
Statewide	X-rays, cobalt-60, molybdenum-99, iodine-131 and other materials used in medical diagnosis and treatment	Hospitals and clinics, dental offices, etc.[1]
Statewide	Cobalt-60, iridium-192, americium and other materials used in industrial radiographic examinations	Industrial service companies, laboratories and industrial facilities[2]
Statewide	Low-energy microwave transmission towers used for long-distance communications	Health risks unknown
Statewide	Low-energy radar guns for speed-limit control used by law enforcement personnel	Health risks suspected; extent unknown
Statewide	Lasers - used in compact disk players, computer printers, and numerous other applications	Health risks unknown
Statewide	Americium-241 and other isotopes—used in smoke detectors	Health risks unknown

Radiation and Radioisotopes Used for Lighting and Power Purposes

Location	Type	Notes
Bradley Lake, Kenai Peninsula	Microwave energy transmission tower	Health risks unknown
Burnt Mtn.	Strontium-90 Sentinel radioisotope thermoelectric generators (RTGs)	Operated by the U.S. Air Force
Fairway Rock (Bering Sea)	Strontium-90 Sentinel RTGs	Operated by the U.S. Air Force

Table 1, continued

Fort Greely	Decommissioned nuclear reactor	Operated by the U.S. Army
Statewide	Radioluminescent (RL) or tritium emergency lighting systems	Used in public and commercial buildings
Various remote airfields[3]	RL or tritium lighting systems	Operated by Alaska Dept. of Transportation and Public Facilities

<u>Other Radiation Sources and Radioactive Materials</u>

Location	Type	Notes
Amchitka Island	Atomic Energy Commission (AEC)/Dept. of Defense tests	Former nuclear weapons detonation site in 1960s
Back Island	Nuclear submarine base	Operated by U.S. Navy
Cape Lisburne	Former Distant Early Warning (DEW) line site[4]	
Cape Thompson	Site of radioactive waste experimentChariot") - fission products and 15,000 poundsof contaminated soil	
Clear Air Force Base	Ballistic Missile Early Warning System Site (high-power microwave station)	Operated by the U.S. Air Force
Statewide	Radium-228, other naturally occurring radioactive materials (NORMs)[5]	Occurs statewide
Statewide	Radon[6]	

FORMER SOVIET UNION

Location	Type	Notes
Bilibino, Chutkotka	Nuclear power plant[7]	Low level release 6/10/91
Chukotsk Peninsula	Former nuclear weapons testing site (1950s)	Residents have ongoing health problems
Novaya Zemlya	Nuclear weapons testing and radioactive waste dumping site	Extent unknown

Table 1, continued

Kara Sea	Radioactive waste dumping site - old reactor cores, hulks of nuclear-powered ships	Extent unknown

INTERNATIONAL

Location	Type	Notes
Arctic Ocean	Radioactive waste dumping, runoff from inland nuclear test sites and land-based nuclear facilities and waste dumps in Russia	Extent unknown
Pacific Ocean	Dumping of 235 containers of nuclear waste between 1958 and 1969 approximately 350 miles SW of Ketchikan	Dumped by American Mail Line under license from AEC

NOTES

[1] There are approximately 1,265 x-ray tubes located in about 459 facilities in Alaska; further information on these sources can be obtained from the Health Facilities Licensing and Certification Section, Division of Medical Assistance, Department of Health and Human Services, Anchorage, Alaska.

[2] There are approximately 62 active licenses in Alaska; a list of these licenses can be obtained from the U.S. Nuclear Regulatory Commission, Office of State Programs, Washington, D.C. Approximately 60 additional non-regulated sources also exist in the state, according to Report on review of the Alaska radiation protection program: preliminary draft: Conference of Radiation Control Program Directors, Inc. (CRCPD), November 30, 1992.

[3] Reportedly in use at Chicken, Coldfoot, Council and possibly at other remote airfields in Alaska.

[4] Forty-one "formerly utilized defense sites" in Alaska under DOD jurisdiction are listed in Sites contaminated and potentially contaminated with radioactivity in the United States: preliminary draft; U.S. Environmental Protection Agency, February 1991. According to the report, the exact number and distribution of these sites could not be readily determined. Five additional sites under the jurisdiction of other federal agencies are listed in the report. A majority of these sites utilize instruments and/or measurement devices with sealed radioactive sources, and thus "significant residual radioactivity is not expected."

[5] NORMs may occur in oil fields, at mine sites and in any material (such as used oil field pipe) that has been brought up from underground.

[6] About 9% of approximately 3,000 tests of school, homes, and day-care centers statewide have revealed elevated radon levels. [CRCPD report, November 30, 1992.]

[7] There are 20 other nuclear power plant installations as well as numerous nuclear waste storage sites and materials processing plants in the western and central parts of the former Soviet Union with the potential to impact Alaska in the event of a major radiation release.

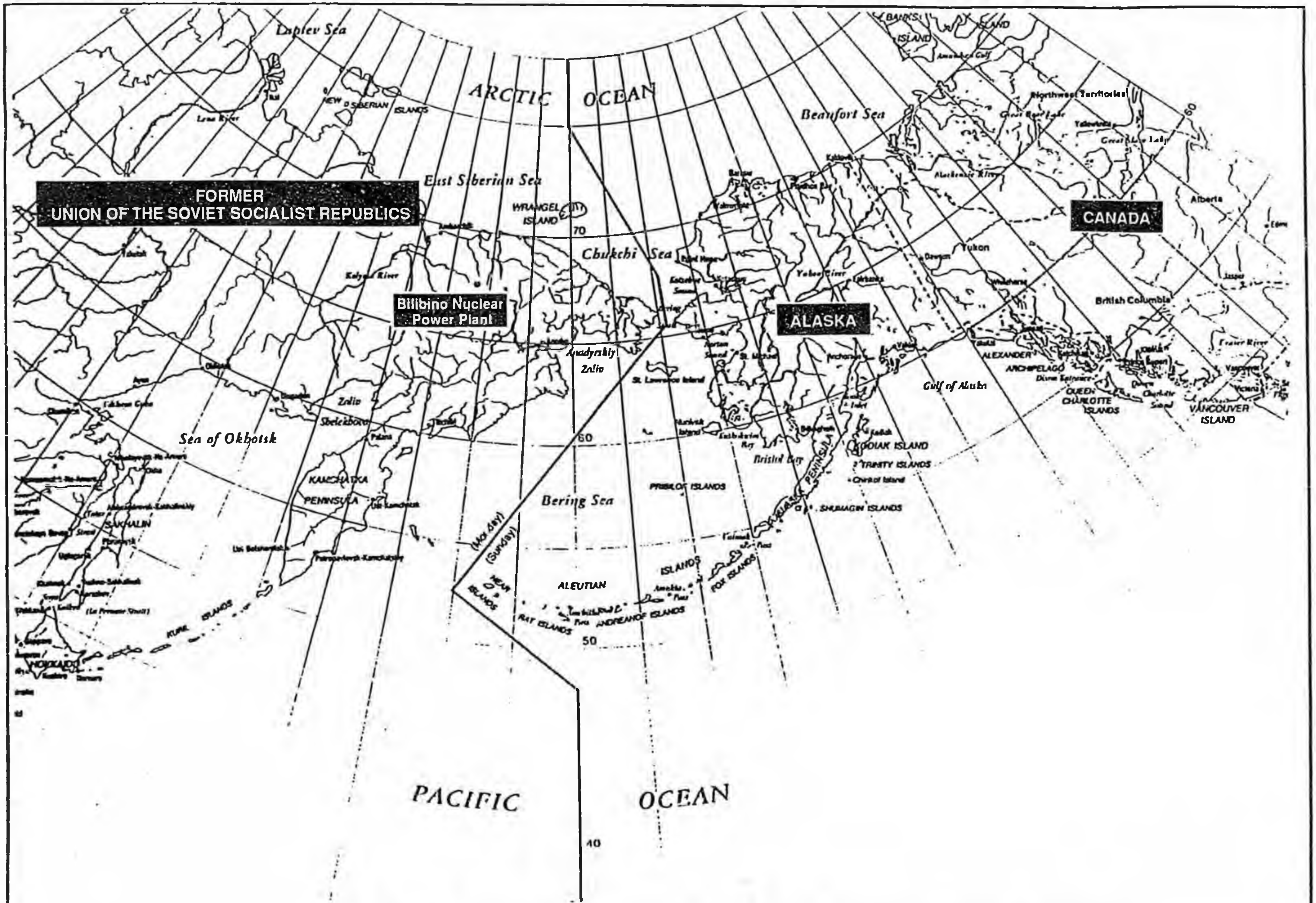

Figure 1. Geographic Relationship of Alaska to the Former Soviet Union

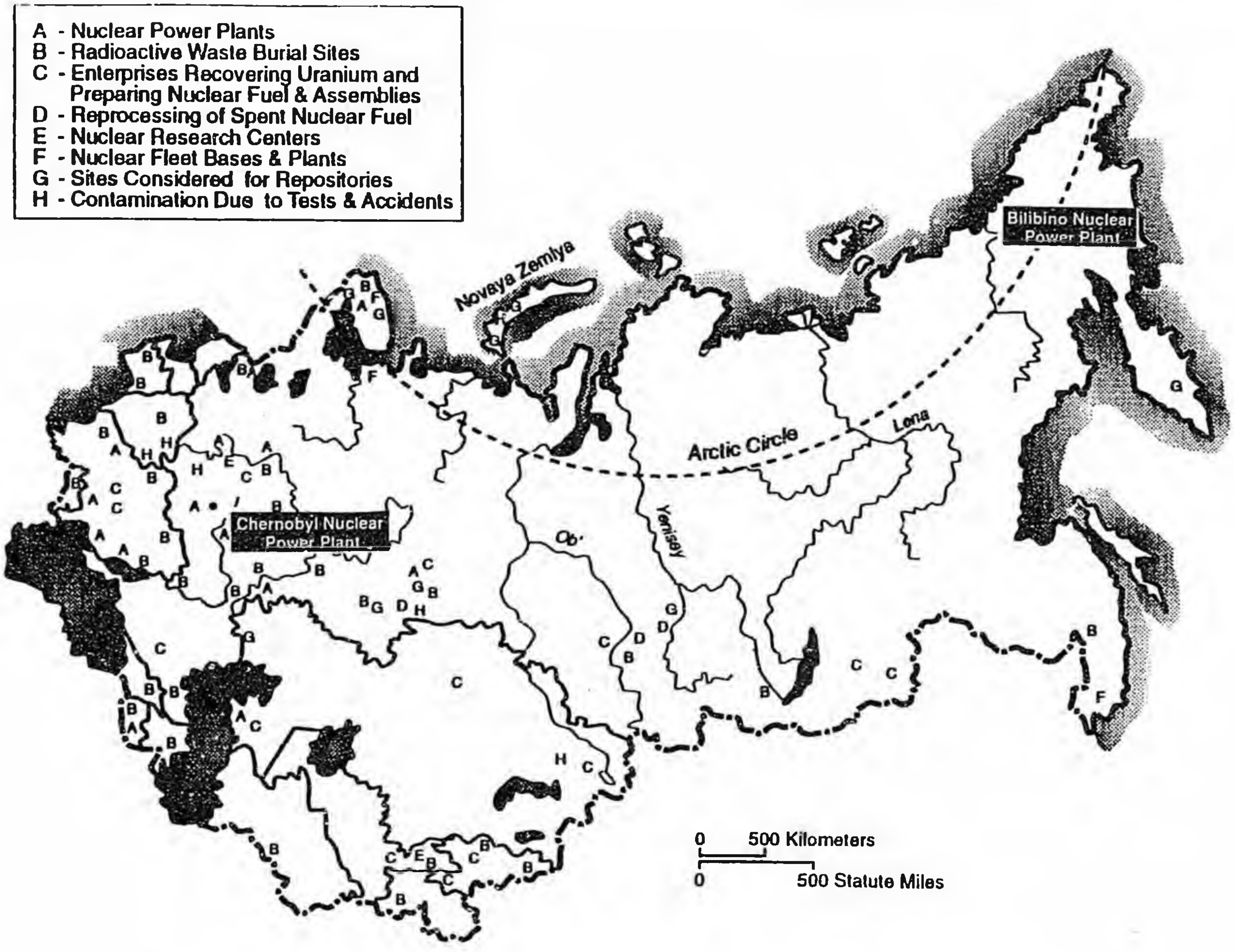

Figure 2. Radioactive Contamination Map of the Former Soviet Union

(from *Radioactive Contamination of the Arctic Region, Baltic Sea, and the Sea of Japan from Activity in the Former Soviet Union*, USDOE, September 1992).

Nuclear power generation facilities

There are a total of sixty-two Soviet-designed reactors presently operating at twenty-one nuclear power generation facilities in the former Soviet republics and Eastern Europe (see Figure 2). One of these nuclear power plants, located at Bilibino, on the Chukotsk Peninsula is within a few hundred miles of western Alaska and has a history of releases. Most of these facilities are of substandard construction with a long history of both reported and unreported releases. Fifteen of these reactors are of the same design as the Chernobyl reactor. The risk of a repeat of the Chernobyl tragedy can not be ignored. Department of Energy analysts have projected an eventual toll of 40,000 lives. Half the deaths are projected to be outside the former Soviet Union, in the areas of Scandinavia beneath the fallout plume. An Alaskan scientist observed that unusual weather patterns diverted much of the fallout which would probably have landed in Alaska.

There is continued concern by the international community over the poor design, maintenance and operation of nuclear power plants in the Russian Far East, especially during the present times of economic crisis and political instability in the area. There are strong pressures within Russia to continue expansion of nuclear power generation in spite of abundant and safer alternative sources of energy.

Nuclear waste

Large areas of the former Soviet Union have been heavily contaminated with radioactivity as a result of extensive nuclear weapons testing and uncontrolled dumping of waste from nuclear power and weapons manufacturing plants. Radioactivity from many of these contaminated sites has migrated into streams and rivers, and eventually to the arctic ocean and adjacent seas which we share. Novaya Zemlya, an island in the Barents Sea, for example, has been used extensively for nuclear testing and waste storage. Ocean dumping of high level nuclear wastes such as old reactor cores, abandoned nuclear submarines and nuclear weapons has been common in the Kara Sea and other areas. Radiological contamination from these sources may be transported by ocean currents and concentrated by physical processes such as sedimentation, and may be further concentrated in the food chain. Alaskans living on the coast of western and northern Alaska who utilize subsistence food resources such as fish, birds and marine mammals are particularly at risk from ocean contamination.

IN-STATE SOURCES

According to a recent EPA Office of Radiation Programs report Alaska has 91 "Sites with Potential Residual Radioactivity." These numbers do not include sites potentially contaminated with Naturally Occurring Radioactive Materials (NORM).

There are approximately 62 active licenses in the state for sources licensed and inspected by the U.S. Nuclear Regulatory Commission (NRC). An additional 50 - 60 sources of NORM also exist in the state which are not regulated by the NRC. (See Table 2 Below)

Table 2

AGENCY/INDUSTRY TYPE	NUMBER OF SITES
Federal	
Department of Commerce	1
Department of Defense	1 base
	1 power production
	41 formerly used defense sites
Department of Health &Social Services	1
Department of the Interior	1

AGENCY/INDUSTRY TYPE	NUMBER OF SITES
State or Private	
Hospitals	8
Manufacturing	21 RAD devices/prods.
Non-Defense Research Labs	11
Mining	1 mineral processor 4 active or inactive uranium mines
TOTAL	91

Radiation and Radioisotopes used for Medical Purposes

X-rays. The greatest exposure of Alaskans to radiation comes from diagnostic X-rays used in medical and dental facilities. There are 1265 X-ray tubes located at 459 facilities in Alaska. Not only is diagnostic X-ray by far the single largest source of exposure to man-made radiation, it is also the source for which the biggest dose reduction gains can occur with minimal regulatory burden and cost. Poorly adjusted or operated X-ray tubes have the potential of exposing the patient and operator to excessively high doses of radiation. Alaska has a registration and inspection program for X-ray tubes, but due to lack of staff inspections are far behind schedule.

Radioisotopes including cobalt-60, molybdenum-99, and iodine-131 are used in diagnostics and medical treatments such as cancer therapy. Many of these isotopes with a short half life are produced in reactors and shipped by air to hospitals that use them. There is always the potential for an accident or spill in their movement to, and use in hospitals.

Radiation and Radioisotopes used for Industrial Purposes

Radioisotopes such as cobalt-60, iridium-192, and americium are used for radiographic examinations to determine the integrity of pipe and vessel walls, to study the behavior of materials, and to examine the effects of corrosion and erosion on wall thickness. In Alaska these materials are used primarily by the petroleum industry at production and pipeline facilities. Very small quantities of americium-241 and other isotopes are used in smoke detectors.

Radiation and Radioisotopes used for Power and Lighting

Radioisotope Thermal Generators (RTGs) are self-contained power plants that generate electricity through the radioactive decay of an isotope, strontium-90. RTGs are ideal for providing small amounts of power in remote locations because they do not require an operator for fueling or maintenance, and operate safely and reliably in extreme climates. Thirteen RTGs are in use by the military in Alaska. Ten (10) RTGs are located at Burnt Mountain north of Fort Yukon and three (3) at Fairway Rock west of Wales. Public concern over the safety of RTGs was recently sparked by a recent wildland fire near the Burnt Mountain RTGs. The State has contacted the military and DEC staff have reviewed manufacturer's drawings and literature and visited the Burnt Mountain site. There has been no release of radiation and the devices appear to be very safe and durable.

Radioluminescent Lights (RLs) are fixtures that utilize the isotope tritium to generate light. These are commonly used as exit lights in aircraft, and well over half of the public and commercial buildings in Anchorage, Fairbanks and Juneau employ RL lights for exit signs. RLs may also be used for runway lighting on some remote airfields in Alaska. Radioluminescent lights have been in use for many years and are considered to be quite safe.

Nuclear powered satellites used for telecommunications and military purposes will eventually re-enter the earth's atmosphere and disintegrate. Although a large portion of the satellite will "burn up" on re-entry, particularly heavy and compact components such as the nuclear power generator may fall into the ocean or on land. It is difficult to predict with accuracy the location where satellite components will land, although the timing of re-entry is easier to predict. Alaska would probably be most vulnerable to re-entry of a satellite in a "polar orbit".

Naturally Occurring Radioactive Materials (NORM)

Radon is a radioactive gas that has been associated with lung cancer, and is probably one of the greatest sources of exposure to Alaskans. Approximately 9% of homes and other buildings in Alaska which have been tested for radon exceeded recommended limits for corrective action. This percentage was found to be much higher in some areas, such as the Fairbanks area where 18% of the homes exceeded the level of concern. Radon may also be found in drinking water, and public water supplies are routinely monitored for radioactivity. So far, radon has only been detected in one public water system (Haines).

Petroleum and mining activities often bring naturally occurring radioactive materials to the surface. Mine tailings, and oil and gas soils may contain low levels of radioactivity, and the pipes and equipment used in the process may become radioactive. Scale forming on the inside of oil piping may be radioactive, and is sometimes removed (de-scaled) and disposed of via injection wells. The tendency to scale increases when water injection is used to enhance recovery in depleted oil deposits, and the problem may increase as the oil fields become more depleted. There have been concerns and DEC investigations about used oil field pipe in the Kenai region that has been made into playground equipment. One piece of playground equipment containing slightly elevated levels of NORM was identified. No action was taken since the pipe is sealed and does not present a health threat.

Contaminated Sites

Ft. Greely. A nuclear power plant was operated at Ft. Greely from 1962 to 1972 and subsequently decommissioned. The reactor core, spent fuel rods and other high level radioactivity were removed and shipped out of state and the residue of the reactor and adjacent spent fuel pit were entombed in concrete. The site is monitored on a continuing basis. During the summer of 1992 repairs were made to a cracked concrete block wall that had been placed during decommissioning. The repairs required excavation of contaminated soil, which is considered low level radioactive waste. The material has been placed in 57 drums and is awaiting shipment to a low level storage facility in the lower 48 states.

Formerly used defense sites. Forty-one "formerly utilized defense sites" in Alaska are identified in a recent EPA report: *Sites contaminated and potentially contaminated with radioactivity in the United States*; preliminary draft; U.S. EPA, February 1991. These sites are under the jurisdiction of DOD. Five additional sites under the jurisdiction of other federal agencies are also listed in the report. According to the report, the exact number and distribution of these sites could not be readily determined.

Cape Thompson, located near Pt. Hope in northwestern Alaska was a test site in the early 1960s for a study, known as Project Chariot, to determine the feasibility of using a nuclear explosion to construct a deepwater port. Low level radioactive materials similar to what was expected to result from the explosion were mixed with soil and placed in test plots on the ground. Following the experiment, the contaminated soil was mixed with additional soil to dilute the material and then covered with four feet of clean soil. Residents of Pt. Hope recently became concerned of possible health risks from the site. Subsequent investigations by state and federal agencies failed to detect elevated surface levels of radiation in the area, and have concluded that contamination has not entered the food chain where it could have posed a risk to subsistence hunters. The contaminated material is scheduled for removal during summer 1993 for disposal at a location in the lower 48 states.

Amchitka Island was the site of three nuclear test shots conducted by the Atomic Energy Commission between 1965 and 1971. Studies have shown that there is a potential for radionuclide movement over time from deep aquifers to the Pacific Ocean and the Bering Sea. The DOE and EPA are monitoring for surface impacts every two years. To date surface contamination has only been detected at one location in groundwater where trace amounts of tritium were detected at levels slightly below drinking water standards.

Ocean dumping of low level nuclear wastes took place at a location approximately 350 miles to the southwest of Ketchikan. During the 1950s and 1960s the American Mail Line, under license by the Atomic Energy Commission dumped 124 Ci of nuclear material. Between 1958-1960 one hundred and ninety-seven (197) containers were dropped at 50°56' N, 136°03'W. Another thirty-eight (38) containers were dropped at 52°25'N, 140°12' W between 1962 and 1969. The fate of this material is not known.

Military Applications

Nuclear weapons may be present in the state at military bases, or aboard military aircraft or vessels. Accidental detonations, however unlikely, are possible. More likely than accidental detonations are accidents during transportation of nuclear weapons into or out of the state or between military bases. Although not documented in the State of Alaska, aircraft carrying nuclear weapons have crashed, and submarines carrying nuclear weapons have sunk in other parts of the world. These types of transportation-related accidents have historically not resulted in nuclear detonations or widespread nuclear contamination, but the possibility still exists.

Nuclear powered vessels, particularly submarines may transit Alaskan waters. There is the potential for a reactor accident or unplanned radioactive discharge aboard these vessels. The U.S navy operates an acoustic testing range on Back Island, near Ketchikan where submarines transit through an array of acoustic sensors to measure noise and to determine the "acoustic fingerprint" of individual vessels. These vessels may, or may not carry nuclear weapons.

Nonionizing Radiation Sources

Ultraviolet light is a component of natural sunlight and is the cause of "sunburn" and a major cause of skin cancer. The earth's ozone layer in the upper atmosphere filters out the majority of these harmful rays. However, thinning of this protective ozone layer over the polar regions (the "hole in the ozone layer") has recently been documented, and public health officials in some northern countries issue health advisories to minimize exposure during periods of minimum ozone cover. Ultraviolet light is also used in tanning salons, where overexposure poses a very real health risk. Tanning salons are regulated in many states, but are not presently regulated in Alaska.

Lasers are used in Compact Disk (CD) players, and in some industrial applications such as surveying. The only health risk from CD players is from direct exposure of the eyes which could result in blindness. CD players are designed to prevent direct exposure and are considered to be safe. Industrial applications of lasers are regulated by the federal Occupational Safety and Health Act (OSHA) and are not considered to be a threat to the general public.

Microwaves are commonly used in home appliances (microwave ovens), radar, and telecommunications. Early concern with microwave ovens centered around potential interference with "pace-makers" used by some heart patients. Modern microwave ovens emit far less radiation than older models, this concern has been eliminated. High energy radar is a hazard to individuals in the immediate proximity of the beam, and injuries occurred at Clear Air Force Base in 1983 when six civilian workers were directly in front of a radar unit when it was turned on. Other than occupational exposure, high energy radar is not considered a threat to the public. Low energy radar, such as commonly used by public safety officers to enforce speed limits is suspected of contributing to testicular cancer in some officers who hold the units in their lap. Low energy radar is not considered to be a threat to the public.

Although the health effects of exposure to high levels of microwaves have been documented, the effects of low level exposure is not well known. Some studies have suggested a link to cancer and other health problems, but more research is needed before a clear cause-and-effect relationship can be determined.

Electromagnetic Fields (EMFs) exist anywhere electricity flows, such as around power transmission lines, electrical motors, and home appliances. Health effects of EMFs is a controversial issue among scientists, but there is a growing concern that EMFs may be associated with promotion (not the cause) of cancer.

NOTIFICATION

In-state Notification

Guidelines for notifying State and local authorities of radiological emergencies are contained in the Federal Radiological Emergency Response Plan (FRERP) of 1985. The plan covers any peacetime radiological emergency that would require a significant response by federal agencies. Under this plan the responsible party (owner/operator) is required to notify the appropriate local, state and federal authorities of a radiological emergency. It is the State's policy to immediately notify and involve local government and response organizations in the event of a radiological release or threat.

The Cognizant Federal Agency (CFA) must be notified of a release by the responsible party. There are three federal agencies designated to perform in the CFA role: Nuclear Regulatory Commission (NRC), Department of Energy (DOE), and Department of Defense (DOD). The NRC and DOE have cognizance of facilities which they regulate and license to operate. The DOD has cognizance of military installations, facilities, and lands that may be temporarily designated as a National Defense Area or National Security Area. If there are no clear-cut reasons to designate one of these three agencies as the CFA, the Federal Emergency Management Agency (FEMA) will make the federal notification required of a CFA.

Following CFA notification by the responsible party, the CFA will notify FEMA through the Emergency Information Coordination Center. FEMA verifies that the state has been notified by contacting the state; therefore, the plan provides for the state to be notified twice, once by the responsible party and again by FEMA.

In many cases, local or state agencies are the first to become aware of a radiological emergency. In these situations the local emergency services or State Troopers are called to the site of the incident. The Incident Commander notifies the State Health Physicist at DHSS, with DMVA as an alternate, should the Health Physicist not be reached. The State agency notified also notifies other State agencies whose jurisdiction may be involved. The Federal Emergency Management Agency is notified by the State should additional assistance be required.

International Notification

Through international agreement, the International Atomic Energy Agency (IAEA) has responsibility for notifying governments of nuclear releases into the atmosphere that have the potential to cross international borders. However, at this time not all nations are included in the agreement, and no drills or exercises have been conducted. In addition, the international capability for monitoring a release is limited. No agency has been identified that would provide international notification of a release into the ocean.

In the event of an incident which could affect the United States, the IAEA or country will notify the U.S. State Department. The State Department will notify the Nuclear Regulatory Commission (NRC) command network. The NRC command post will notify its regions and the National Response Center, the Department of Energy, Federal Emergency Management Agency, National Weather Service, and the State of Alaska.

The Federal Radiological Emergency Response Plan (FRERP) addresses U S. radiological emergencies posing a threat to neighbor nations such as Canada and Mexico. In such cases the plan makes it incumbent on the CFA and FEMA, in consultation with the State Department and other appropriate federal agencies, to coordinate and cooperate with the affected countries. Radiological emergencies originating in neighboring countries are not specifically mentioned in the plan, but if an international incident were to pose a danger to the U.S. the federal response would utilize the FRERP guidelines.

There is presently no international convention on the safety of nuclear power plants or other nuclear installations, although the recommendations issued by IAEA are generally recognized. A meeting of international experts on emergency prevention, preparedness and response in the Arctic was held in Lulea, Sweden in October, 1992. The draft report of the meeting identified the need for a global convention on radiological accident prevention and considered it of utmost importance to assess the situation caused by the dumping of radiological wastes in the arctic. The report recommended as a preliminary step that an inventory be made of hazardous activities in the Arctic which could have trans-boundary effects or require international response. The State of Alaska strongly endorses this initiative.

MONITORING

Current Monitoring Capabilities.

Ambient (environmental) monitoring for radiation in Alaska is limited to three sites located near Anchorage, Fairbanks, and Juneau. These sites are operated by DEC and are part of the U.S. EPA-funded ERAMS (Environmental Radiation Ambient Monitoring System) national radiation monitoring network. Samples of airborne particulates and rain water are collected continuously and are analyzed on a weekly basis. Samples are screened locally for gross beta radiation and then are sent to an EPA laboratory in Montgomery, Alabama for detail analysis. If a sample has elevated levels of radiation, the NAREL will provide immediate notification.

Public drinking water systems serving twenty five (25) or more people (Class A systems) are required by State and federal regulations to monitor for radiation (gross alpha) every four years. One sample per quarter per quarter is collected over the year. This monitoring is oriented towards detecting radiation from natural underground sources that can contaminate groundwater. Surface water systems serving greater than 100,000 people (only Municipality of Anchorage) are required to monitor for manmade radioactivity (gross beta, strontium-90 and tritium) every four years. While there is a specified schedule for routine monitoring of these drinking water systems, few have fully complied. DEC has made an attempt to sample each system at least one time, although some systems may have been missed during this effort. Drinking water is sampled so infrequently (every four years) that this routine monitoring would likely not detect an acute radiological release.

Radon monitoring is done on a limited basis, and has been completed at around 3,000 schools, homes and day-care centers under a grant from EPA. So far, about 9% of the homes tested have radon levels grater than the EPA action level.

Limitations of Existing Environmental Radiation Ambient Monitoring System

- Limited spatial coverage. While the three monitoring stations are located near the largest population centers, there are no monitors in northern or western Alaska, the regions closest to potential sources of contamination.

- Does not provide rapid detection of contamination. Because of the long time delay between sample collection and analysis, the State would not know of elevated levels of radiation until 30 - 60 days after the occurrence.

- Does not detect radionuclides with short half-lives. Iodine-131, a fusion by-product which can be found in rainfall and surface waters, has a half-life of 8 days, By the time a sample is analyzed the Iodine is no longer radioactive.

Network Improvement Options

To improve the State's radiation monitoring capability and provide an early warning notification, the Department could augment the present monitoring network with the latest Pressurized Ion Chamber (PIC) monitoring systems. These monitors provide real-time measurements which are transmitted by phone or satellite and can detect low-level gamma radiation. PICs are being used in several other states as the backbone of their radiation compliance monitoring networks. The PIC radiation monitoring systems are not available through the U.S. EPA and would need to be purchased by the State. Other radiation monitoring systems are also available that could augment the existing system by increasing the number of sites being monitored, and provide real-time notification.

Additional Monitoring Options

In addition to improving the existing ERAMS network, the following additional monitoring options should be considered.

- Monitoring of the marine environment is presently not being done on a routine basis to detect contamination from ocean dumping. Marine monitoring should be considered.
- Monitoring of the food chain, including biota, vegetation, soil sediment, and water samples from all regions of the State should be considered. Particular attention should be given to subsistence food resources from both terrestrial and marine environments.
- In-state laboratory analysis capability could be enhanced. The State currently has only limited capabilities to analyze for radiation. The capability for rapid sample analysis is an important component of in-state monitoring and response capability.

RESPONSE CAPABILITY

Because most radiological materials are either under the control of, or licensed by the federal government, response to most peacetime radiological emergencies are covered by the Federal Radiological Emergency Response Plan (FRERP). This plan assigns specific federal agencies principal roles in responding to peacetime radiological emergencies at fixed nuclear facilities, transportation accident sites, and other incidents such as nuclear-powered satellite re-entry. The federal plan assigns a Lead Federal Agency (LFA) responsibility for protecting the public and the environment at the accident site, and assigns the state and local governments responsibility for the public and the environment beyond the site. There are three federal agencies designated to perform in the LFA role: Nuclear Regulatory Commission (NRC), Department of Energy (DOE), and Department of Defense (DOD). The NRC and DOE have cognizance of facilities which they regulate and license to operate. The DOD has cognizance of military installations, facilities, and lands that may be temporarily designated as a National Defense Area or National Security Area.

The primary role of the state and local authorities is to determine and implement measures to protect life, property, and the environment in areas outside the boundaries of fixed nuclear facilities or otherwise not under control of a federal agency.

State's Response

The State's response is limited primarily to assessing an incident, protecting the population from immediate exposure, and providing technical assistance to local or federal responders. Technical assistance is provided through the State's Radiological Physicist/DHSS, the

Radiological Defense Officer/DMVA, and through DEC. The State is not equipped to actually decontaminate the site of a release, and relies primarily on federal response resources for actual cleanup.

State agency responsibilities are detailed in a 1982 Memorandum of Understanding (MOU) among DHSS, DMVA, DEC, and DOL concerning emergency response to peacetime radiation incidents and accidents. The MOU assigns DHSS as lead agency, with DMVA as an alternate contact for notification and response coordination. Each of the MOU signatories is responsible to serve as contact with their federal counterparts as follows:

State Agency	Federal Counterpart
DHSS	FDA & NRC
DMVA	FEMA
DEC	EPA
DOL	OSHA

The MOU stipulates that any State agency receiving notification is to notify DHSS. DHSS is to notify the other party to the agreement when a problem exists, or where there is a potential problem within their area of responsibility.

Local Government's Response

Many local responders have been trained to recognize and provide an initial response to radiological releases. Some local governments can totally respond to low-level releases. Local response in most cases will be limited to isolating the spill to protect the population from immediate exposure, and to contacting the appropriate State and federal agencies for technical assistance.

Radiological Defense Program (RADEF)

The Radiological Defense (RADEF) program is oriented primarily towards nuclear attack preparedness, but contains several program elements that are applicable to peacetime needs. The program is managed within DMVA by the State Radiological Defense Officer (RDO) and is also staffed by a Radiological Instrument Technician who operates the State's Maintenance and Calibration Facility.

The RADEF Program consists of the following components:

- Planning assistance to local communities in the development of Radiological Defense/Protection Annexes to their emergency operations plans.
- Technical assistance to State and local agencies in the form of advice on mitigation, response and recovery measures, as well as participation in field operations (when requested).
- Radiological Training is provided to State and local agency personnel and includes Radiation Monitor, Radiological Response Team, and Radiological Defense Officer courses. In addition, the State RDO coordinates State employee attendance to the Radiological Emergency Response Operations course offered by FEMA in Nevada. To date, 382 students have completed the Radiation

Monitor Course; 312 students have completed the Radiation Response Team Course, 104 students have completed the Radiological Defence Officer Course; and 14 students have attended the Radiological Emergency Response Operations Course.

- **Radiological Instruments** used for emergency monitoring are maintained and calibrated. There are approximately 2,000 radiological instrument kits designed for nuclear defense sheltering and monitoring operations. These kits are being updated to enable workers and responders with risk of exposure to detect radiation and measure accumulated dosages.

LEGAL ANALYSIS

Federal Laws

Prior to the Atomic Energy Act of 1954 the use, control, and ownership of nuclear technology was a federal monopoly. The 1954 Act was to intended to promote the technological development of nuclear power. The Act allowed the private construction, ownership, and operation of commercial nuclear power reactors under the strict supervision of the Atomic Energy Commission. The Act also gave the Commission exclusive jurisdiction to license the transfer, delivery, receipt, acquisition, possession, and use of nuclear materials.

In 1959 the Atomic Energy Act was amended to provide the states a role in regulating nuclear materials by authorizing the Atomic Energy Commission (now the Nuclear Regulatory Commission) to enter into agreements with state governors to transfer authority to the states for control over nuclear materials in quantities not sufficient to form a critical mass (bomb). The "Agreement State," maintains the authority to regulate the materials covered by the agreement for the protection of the public health and safety from radiation hazards. State programs are required to be "coordinated and compatible" with those of the Nuclear Regulatory Commission.

Nuclear Waste

The Nuclear Waste Policy Act of 1982 specifies the federal responsibility and policy for the disposal of high-level waste and spent nuclear fuel, and defines the relationship between the federal government and state governments. The act authorizes construction of a permanent repository for high level waste (Yucca Mountain, Nevada) and development of alternative long-term disposal options. It also provides for the safe stabilization and long term protection of sites for the disposal of low-level radioactive wastes.

Congress in 1980 enacted the Low-Level Radioactive Waste Policy Act (1980 Act) that was amended in 1985 which declares a federal policy of holding each state "responsible for providing, either by itself or in cooperation with other states, for the disposal of low-level radioactive waste generated within the state," including certain waste generated by the federal government and waste generated outside the state, but accepted for disposal within the state. The States of Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, and Wyoming have entered into the Northwest Interstate Compact on Low-Level Radioactive Waste Management. In Alaska, the compact was enacted into law in 1983 as AS 46.45.010. Under AS 46.45.020, the Commissioner of the DEC is authorized to adopt regulations and perform all other acts necessary or incidental to carry out the compact.

The 1985 Act also provides that an Agreement State has authority to regulate the disposal of low-level radioactive waste under the terms of the agreement. The State of Alaska is not an Agreement State.

State Laws and Regulations

The state statutes and regulations pertaining to radiation hazards are outdated and have not been updated since 1978. Legislative authority is fragmented in various statutes, and provides for some overlap and duplication of responsibilities.

Although the NRC regulates the use of most radioactive material, many radiological sources such as Naturally Occurring Radioactive Materials (NORM) are the responsibility of the individual states. Alaska's regulations are not comprehensive with respect to sources not regulated by the NRC, and do not include NORMs.

Alaska should consider assuming responsibility for regulating radioactive materials presently regulated by the NRC by becoming an "Agreement State". By becoming an Agreement State, Alaska would be able to assess the same cost recovery fees that the NRC now charges, and would have access to training programs offered by NRC and technical help in all phases of radiation protection activities. However, several other states have opted not to became an Agreement State because of the significant resource commitment. If Alaska decides to accept this responsibility, the State would be the sole regulator for radiological materials, as the NRC would retain regulatory responsibility solely for nuclear power plants, of which there are none in Alaska.

REFERENCE SECTION

INTRODUCTION

The following reference sections and appendices which address various aspects of radiological threats and preparedness, were submitted to the State Emergency Response Commission (SERC) by team leaders and others with expertise and interest in radiation issues in Alaska. This information was used as the basis for the synthesis and recommendations contained in the report Summary.

The information and recommendations contained in these sections represent the views and perspectives of the contributing authors or agencies, and are included in the report with only minor editing. The SERC does not necessarily support all of these recommendations, nor does the SERC certify the accuracy of all statements and information provided by the authors.

Section I —Recommendations

Many issues were raised by team leaders and others contributing to this report concerning the radiological threats facing Alaskans, and the State's level of preparedness to respond to these threats. These issues and recommendations for addressing them are summarized in this section.

Section II - Health Risks

This section includes three papers addressing various aspects of health risks and past exposure of Alaskans to radiological materials.

Health Risks to Alaskans from Radiation and Recommended Monitoring Procedures by Dr. Ernest B. Meloche, MD describes the medical effects of exposure to radiation, identifies sources of potential exposure to Alaskans, and provides recommendations for improving our ability to monitor for radiological contamination in the environment.

Past Radiation Incidents and Concerns in Alaska was prepared by Carl M. Hild, Executive Director of the Alaska Health Project. This report describes some of the health effects of both ionizing and nonionizing radiation and discusses some of the historical incidents and sources of potential radiological exposure in Alaska.

Health Risk Assessment of Radioisotopes at Cape Thompson, Alaska by Bruce Chandler, M.D. and John Middaugh, M.D. of the Department of Health and Social Services is an assessment of the health effects of contaminated soil from Project Chariot buried near Cape Thompson, Alaska.

Section III —Inventory of Sources/Threats

This section was prepared by Lyle Perrigo of the Environment and Natural Resources Institute, University of Alaska, Anchorage, and identifies the major sources of radiation hazards in Alaska.

Section IV—Notification

This section was prepared by John Hensley, the State Radiological Defense Officer at the Department of Military and Veterans Affairs, Division of Emergency Services. The section describes procedures in place for notification of federal, state and local emergency response agencies in the event of a radiological release or emergency.

Section V—Monitoring Capability

This section was provided by Gerry Guay, Department of Environmental Conservation, Division of Environmental Quality, Air Quality Management Section, with contributions by Deena Henkins, Wastewater and Water Treatment Section. The State's current capabilities to monitor or detect the presence of radiation in the environment is described.

Section VI—Response Capability

This section was prepared by John Hensley, the State Radiological Defense Officer at the Department of Military and Veterans Affairs, Division of Emergency Services. The section describes the capability of federal, state and local emergency response agencies to respond to a radiological release or emergency in Alaska.

Section VII—Legal Analysis

This section was prepared by Marie Sansone, Department of Law, Civil Division and describes the regulation of nuclear facilities and materials by the U.S. Nuclear Regulatory Commission, the problem of radioactive waste, and legal responsibility for emergency response preparedness.

Section I. Recommendations

INTRODUCTION

Many issues were raised by team leaders and others contributing to this report concerning the State's level of preparedness to respond to radiological threats, and to reduce risk to Alaskans from exposure to radiation. These issues and some recommendations are summarized and discussed below. Recommendations that the SERC supports forwarding to the governor at this time are included in the summary section.

ORGANIZATIONAL

ISSUES

- Responsibilities for radiation protection are severely fragmented, being placed within four agencies. In some cases, these responsibilities are overlapping and duplicative, and in some cases the responsibilities are not clear.
- Often important information regarding radiological sources is not transmitted between agencies or across administrations through time.
- According to an audit of Alaska's radiation control program by the Conference of Radiation Control Program Directors (CRCPD) a comprehensive Radiation Control Program (RCP) for Alaska would require nine (9) Professional/Technical Full-Time Equivalent (FTE) and two (2) Clerical FTE devoted to radiation protection activities. The State presently has only three (3) professional and one (1) clerical staff in the program. Seven additional staff would be needed to fully implement the program.

RECOMMENDATIONS

- Consolidate the major radiation protection and response planning activities within one agency.
- If consolidation cannot be performed, then Memoranda of Understanding (MOU) should be developed between each agency which clearly identifies the responsibilities of each.
- Establish a radiological source database within a single State agency.
- Add additional staff to the Radiation Control Program.

DISCUSSION

Responsibility for radiation protection activities is now spread among several agencies - primarily DHSS, DMVA, DEC, and DOL. This fragmentation results in overlapping responsibilities and duplication of effort. There is presently a lack of coordination between key elements such as monitoring, planning, response, information management, and responding to public concerns. The CRCPD recommends that radiation control activities in state governments should be within a single agency. Based on an audit of existing activities and responsibilities, CRCPD recommends that Environmental Conservation should house this program. The Radiation Control Program (RCP) should be a separate government entity, and should be easily identifiable and visible to the public. The public's concern with radiation exposure should be easily translatable from a radiation expert who can provide competent risk based answers to their concerns. The program should be located within the state organizational structure so that it is parallel with comparable health and safety programs, and with a single person responsible for directing the work of the program.

The CRCPD audit suggests that funding for and expanded RCP can be obtained through fees charged for licensing, registration and inspection of sources, funding from federal grants to conduct X-ray performance and mammography surveys and funding from EPA to implement a radon awareness program.

MONITORING & INSPECTION

ISSUES

- The greatest exposure of most Alaskans to radiation comes from diagnostic X-rays used in medical and dental facilities. Inspection of X-ray machines is the most effective way to minimize exposure. Inspections in Alaska are far behind schedule, resulting in unnecessary risk to human health.
- Radon is one of the greatest sources of radiation exposure to Alaskans, and has a large potential for dose reduction. The activities associated with radon monitoring and public education are not well focused.
- The ability to detect airborne radiological contamination from nuclear reactor accidents, nuclear weapons detonations, and other sources outside of Alaska is very limited. The State currently maintains a statewide monitoring network of only three sampling sites located in Anchorage, Fairbanks and Juneau. The system is limited in the extent of spatial coverage, requires 30 - 60 days for sample analysis and is limited in the types of radiation that can be detected.
- There is presently no capability to monitor the marine environment for contamination from ocean dumping and other sources.
- A potential pathway of exposure to radiation is through consumption of plants and animals that may be contaminated. An example would be consumption of caribou that have eaten lichen contaminated by fallout from nuclear testing. There is currently no program for monitoring contamination in the food chain.
- Many potential sources of radiological contamination have been identified but it is not known what the current levels of contamination in the state might be.
- There is a need for better information on the location and quantities of radiological materials to alert first responders to fires and releases of radiological materials. Placarding requirements for radiological materials are not well enforced.

RECOMMENDATIONS

- Develop and implement a program to inspect X-ray units at the required frequency.
- The activities associated with radon should be more focused. A plan should be developed to inform the citizens about radon, and information should be made available on how to mitigate identified problems.
- Augment the present airborne radiation monitoring network with Pressurized Ion Chamber (PIC) monitoring systems.
- Develop a program to monitor radiological contamination in the marine environment. Of particular concern is radiological contamination in the marine food chain.
- Develop a program to monitor important food sources such as fish, marine

mammals and wildlife as potential pathways for exposure.

- Conduct a baseline radiation study to identify the present level of contamination statewide. This process should include collecting biota, vegetation, soil sediment, and water samples from all regions of the state.
- Collect and compile information from facilities that possess or transport radiological materials and disseminate to first responders.
- Enforce placarding requirements for radiological materials.

DISCUSSION

Not only is diagnostic X-ray by far the single largest source of exposure to manmade radiation, it is also the source for which the biggest dose reduction gains can occur without having a negative impact on the benefits to the public. Alaska has a registration and inspection program in DHSS which oversees facilities using X-ray tubes. An inspection frequency has been established for the various types of facilities, but due to lack of staff, inspections are far behind schedule.

Nationally established standards for inspection and calibration of X-ray equipment recommend equipment in hospitals, doctors' offices and chiropractors' offices to be inspected annually. Dental offices should be inspected on a 2-3 year schedule. Because of staff limitations, inspections in Alaska are typically performed only every 3-6 years, and in some outlying areas X-ray equipment has not been inspected in ten years. There are 1265 X-ray tubes registered at 459 facilities in the state. In addtion, there are 27 mammography units in Alaska that require annual inspections. To date, two out of seven mammography units inspected have not met required criteria. The Conference of Radiation Control Program Directors (CRCPD) recommends two full-time professional/technical staff per 1,000 tubes to meet the required inspection frequency, based on national averages. However, because of the size of the state and longer travel times required to service outlying communities, the CRCPD recommends a staffing level of 2 full-time professional/technical plus one full-time clerical staff for Alaska.

The State presently has only one radiation physicist, who performs inspections on a part-time basis. The State should revise the existing inspection plan and implement the plan at the recommended inspection frequency. Until additional staff can be added, a designated amount of time should be devoted each month for doing as many inspections as possible. The present ambiant monitoring system has only limited coverage, is limited in what it can measure, and requires laboratory analysis of samples. Because of the long time required between sample collection and analysis (30-60 days) contamination would only be detected well after the exposure. Monitoring equipment is available that is sensitive to low levels of contamination and can provide real-time measurements. Pressurized Ion Chamber (PIC) monitoring systems would cost approximately $25,000 each to purchase and install. At least one full time employee would be required to manage and maintain the monitoring network. It is not known at this time how many additional monitors would be required or where they would be located.

RESPONSE CAPABILITY

ISSUES

- In the event of a spill or release of radiation the State's response capability is limited to protecting public health and safety at the scene and notifying federal authorities. The state should consider developing the capability to control a spill and decontaminate the site or personnel.

- In case of an emergency, the State has only minimal on scene monitoring capability which is oriented primarily to threat of nuclear war. The State should consider developing a plan to have environmental samples analyzed in-state for radioactive contaminants in case of an emergency.
- The State does not have a written plan to respond to radiological emergencies. The existing spill response plans focus on hazardous substance spills and do not include radiological hazards.

RECOMMENDATIONS

- Develop the capability to decontaminate the site of a release.
- Develop a plan to have environmental samples analyzed in-state for radioactive contaminants in case of an emergency.
- Designate one agency with responsibility to develop a comprehensive Radiological Emergency Response Program. That agency should coordinate with all other applicable state and local agencies to write a comprehensive Radiological Emergency Response Plan.

REGULATORY AND LEGISLATIVE

ISSUES

- Legislative authority is fragmented in various statutes, and provides for some overlap and duplication of responsibilities.
- Many sources of Naturally Occurring Radioactive Materials are not regulated by either the federal Nuclear Regulatory Commission or by the State.
- The State does not currently regulate most sources of non-ionizing radiation.
- The federal Atomic Energy Act allows states to assume regulatory responsibility for some radioactive materials regulated by the federal NRC. This is referred to as becoming an NRC "Agreement State". Alaska is presently not an Agreement State.

RECOMMENDATIONS

- Consolidate and update statutes and regulations pertaining to radiological hazards.
- Pursue licensing and regulating all NORM sources not covered by the NRC.
- Promulgate regulations for non-ionizing radiation and develop a program to respond to health and safety needs of the public and workers.
- Assume the responsibility to regulate radioactive materials under the Atomic Energy Act by becoming and "Agreement State".

DISCUSSION

Agreement State status would allow the State to regulate virtually all radiological sources in Alaska, and would allow the State to assess the same cost recovery fees that the NRC charges. However, a number of states have opted not to take that option for control of radioactive materials, since it requires a significant resource commitment. In the event that Alaska chooses to pursue this avenue, all enforcement by NRC will cease, since the only area of control retained by NRC in Agreement States is for regulation of nuclear power plants. Prior to pursuing this option, Alaska should determine what resources NRC has expended to maintain oversight in the State and whether the level of oversight by NRC was adequate. This will reflect the costs Alaska will likely incur as an Agreement State. If the state judges it practical to do so, it should become and 'Agreement State". As the CRCPD stated, doing so '... would enable the State to respond more completely to incidents which may occur within the State boundary and beyond'. Becoming an Agreement State would allow Alaska to bring home a great deal of control over radioactive materials and allow the State itself to make sure incidents such as the radioactive waste burial at Cape Thompson do not occur.

Section II. Health Risks

Included in this section are three papers addressing various aspects of health risks and past exposure of Alaskans to radiological materials.

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Health Risks to Alaskans from Radiation and Recommended Monitoring Procedures

by Ernest B. Meloche, MD

INTRODUCTION

When Alaskans hear that there is something radioactive in their neighborhood most experience some degree of worry as to how that radiation might affect their health and that of their family and friends. Such concerns were expressed clearly by Sarah James of the Gwich'in People near Burnt Mountain (1) and accurately echoed by Governor Hickel in his letter to the State Emergency Response Commission. (2) The foundations for such fears are quite understandable. Lethal damage can occur through exposure to high level radioactive sources with no perceptible warning that such radioactivity is present. Detection of such dangers can only be done through use of modern radiation monitoring devices.

Individually we have not the tools nor the expertise needed to detect a radiation threat. Likewise, individually we can not effectively respond to a real radiation threat to our people. Thus, it's generally accepted we have to do these things as a community, locally, state wide, nationally and within the community of nations. To that end, Governor Hickel has requested information detailing what known radiation threats exist to Alaskans, and what our response capability is at this time. (2) This report on the health risks to Alaskans from Radiation and on recommended monitoring procedures is written in response to that request.

ANALYSIS

Medical Effects of High Dose Radiation

What are the medical effects of radiation upon a human being? Ionizing radiation damages people in several basic ways. First the radiation can damage the body's cells directly. Cells damaged in this way cease functioning causing a breakdown in basic body functions. This leads to a complex spectrum of symptoms known as the Acute Radiation Syndrome. If a high enough dose was received this syndrome results in the death of the person so exposed. (3)

Delayed effects of High Dose Radiation

If the person's exposure was not high enough to cause death, the individual becomes subject to possible delayed effects of radiation. These delayed effects may include cataracts, sterility, altered growth and development in children, an increase in stillbirth in women exposed while pregnant and birth defects in children exposed before birth. One of the most important delayed effects is the development of cancers following radiation exposure. An accepted, well known example is the development of Leukemia following irradiation. (4)

Low Dose Radiation Effects

In addition to damage from high dose exposure, we have a more difficult to quantify risk from lower level radioactive contamination within the environment. We are continuously exposed to background radiation from a variety of sources including cosmic rays, release of radioactive materials from common activities such as mining, drilling for oil and natural gas production, fallout from past nuclear explosions, exposure to medically indicated radiation, exposure from nuclear power generation and from other consumer products. All of the nuclear weapons and nuclear power production contribution to background radiation levels combined comprise less than 1/20th of the amount of irradiation one receives through natural exposure to cosmic rays. As a person goes up in altitude the exposure to cosmic rays increases, so someone in an airplane is more exposed to radiation than someone on the ground. Still the average exposure to background radiation is quite low, in the realm of 200 millirems per year. This is mostly unavoidable exposure. (5)

It is important to realize, however, that the effects of environmental contamination can become important health risks to human beings because certain factors can magnify background radiation effects upon an individual. Radioactive materials may become concentrated by many processes. For example, through mechanical actions of currents and tides, waterborne contamination in the sea may reach much higher concentrations at some locations due to preferential settling of the silt to the sea bottom. Likewise some radioactive materials can be concentrated as they move through the food chain toward human consumption. (6)

Internal Radioactive Contamination

Medically it becomes a much more serious problem if radioactive materials are taken within the human body. This is called internal contamination. It can occur through eating contaminated foodstuffs, including fish, seaweeds, mammals, milk and manufactured products. Similar exposure occurs through drinking contaminated water. Breathing of contaminated dust within the air as might occur with fallout from distant nuclear explosions or nuclear power plant accidents such as happened at Chernobyl also results in internal contamination. Should an individual ever be present when radioactive materials were present at the site of an explosion, either a nuclear explosion or more likely a conventional explosion where radioactive materials were present, they might have wounds which were contaminated by radioactive materials.

Such internal contamination may become quite serious, depending on the amount of radioactive material within the body. The reason internal contamination becomes more serious is based upon simple nuclear physics. Of the factors which determine the amount of exposure to radiation, and the eventual effects of that exposure upon the individual, the most important are the amount and type of radiation present, the distance from the source of radiation, the protective barriers between the individual and the source of radiation, and the duration of exposure to that radiation. Obviously, if radioactive materials are taken into the body and incorporated into our body tissues, the distance is very small, there is no barrier at all, and the duration of exposure is potentially very long. Thus, in such a circumstance, an amount of radioactivity that is totally insignificant when present in the background of the environment surrounding us becomes quite important to our long term health when we become internally contaminated. (3)

External Radioactive Contamination

In addition, direct contact on the skin by contaminated substances such as sand, sediments or through use of contaminated equipment causes external radiation contamination. (6) Such external contamination can cause a local radiation injury response similar to a thermal burn, but with delayed healing and quite severe pain. (3)

Burnt Mountain and the Radiation Thermal Generators

The Radioactive Thermal Generators (RTG's) on Burnt Mountain, as well as any nuclear weapons on military installations and the radiation sources for medical use or nuclear power generation are contained, controlled land based radioactive materials. Such materials, while contained and controlled properly, present practically no health risk to Alaskans. The dangers develop whenever the control or the containment breaks down. Then the risks become manifest dependent upon how the containment was broken. Leaking of radioactive materials into surrounding air, water or ground then becomes radioactive contamination of the environment which could lead to internal contamination of local residents in the methods mentioned above. Proper security and monitoring of locations where radioactive materials are stored is mandatory under United States Federal regulations. Procedures for such security, periodic inspections and monitoring of known sites should be reviewed to insure they are adequate to satisfy the current concerns of Alaskans. As mentioned below, however, there may be no current methods for assessing the degree of environmental contamination of a land based low level radiation release.

Cape Thompson Nuclear Waste Dump Site

Similarly there is a risk from release of radioactive materials at the Cape Thompson site or other as yet unknown sites within the state where radioactive materials are present without ongoing control and containment. To the best of my knowledge there are few if any protocols for radiological monitoring of a land based environment surrounding such a site to insure there is no spread of the material via the food chain to the human population.

There is no simple way for a lay-person to know whether their environment has been subjected to radioactive contamination. At the multi-agency meeting called to develop a response to the problem of the nuclear waste dump left at Cape Thompson, Mayor Koonuk wisely expressed a desire to have radiation detection equipment sent to his community immediately so they could monitor their radioactive risk themselves. (7) Most modern field detection devices can record the presence of as low as 0.01 mREM sources of radioactivity. These devices would tell us whether there are any detectable radiation sources within their range. What is not known, however, is whether there are any sources shielded from detection by water, soil, or other barriers to detection.

In the past extensive study and monitoring has been done in other areas to determine whether there was an increase in contamination of the aquatic environment. The Environmental Protection Agency in 1989 produced a report on the "Radiological Surveys of the Naval Facilities on Puget Sound." It looked for the presence of radioactive materials within Puget Sound in an exacting scientific manner. They did studies upon the water, sediment and marine life, measuring radioactivity using the very sensitive germanium detector to search for low level contamination which might be overlooked by less sensitive devices. (8)

Likewise the Fisheries Laboratory Lowestoft in 1989 did an extensive study of radioactivity in north European waters using other, equally sensitive tools in their search for suspected environmental contamination. (9)

No such study has been done on Alaskan environments suspected of radioactive contamination. To protect the health of Alaskans it would be prudent for the Governor to request such studies be done, along with a plan for ongoing monitoring of our environment. It would seem that protection of the United States against international sources of radioactive contamination would be a task assumed by our Federal Government, hopefully with enthusiastic international cooperation and assistance.

The Risk of Airborne Contamination from Nuclear Reactor Accidents or Fallout from Russia, or Elsewhere

There is a risk of airborne clouds of radioactive materials from a nuclear power plant accident such as Chernobyl. The plant at Bilibino is of a similar type as that used in Chernobyl. The monitoring presently in place for Alaskans for detection of airborne radiation is not adequate. There are two available methods for measuring airborne radiation. One device measures radioactivity and gives results immediately. The other collects specimens sent to a national laboratory with results in days or weeks. These devices are located in Fairbanks, Anchorage and Juneau. I am told only one site is actively in use due to budgetary considerations. Such devices are quite expensive to purchase and operate.

If a cloud of radioactivity is approaching Alaska, it would be prudent to have devices functioning which could detect the radiation as it arrived. Plans exist for general response to such an event, including things to do which can decrease the health risk to the population. (11,12,14) All such plans, to be implemented, imply that the radioactive cloud is detected in a timely fashion. Without use of modern monitoring methods, detection of such contamination is impossible for the citizens of Alaska, thus impairing our ability to respond appropriately to real and present dangers.

Contamination of the Russian Arctic Waters with Radioactive Wastes

The Federal reports discovered by Senator Murkowski regarding the radioactive contamination of the Arctic Ocean by Russian radioactive wastes is one of the most frightening of all radiation threats to Alaskans. No current monitoring is in place, though rumors abound regarding intended studies by the federal government. Studies and an ongoing monitoring of the Arctic aquatic environment at least as thorough as that done within the Puget Sound and in the Northern European sea should be initiated as soon as possible to respond to this threat. (10)

Nuclear Vessels Passing through Alaskan Waters and Planes Passing through our Airspace

Normal operations of nuclear powered ships have some release of radioactivity into the sea water. The exact amounts of aquatic contamination and the effect upon an aquatic environment is apparently known by the US Navy, but the actual data and reports seem hard to find. In addition to normal operations, there are many documented accidents on record of both US Military vessels and other international vessels, where radioactive materials were spilled, contributing to the general radioactive contamination of the oceans. It would appear, however, that whatever contamination occurred by such activities could easily be monitored from a public health perspective in the same manner as we would monitor the threat from Russian contamination of the Arctic ocean. Thus through responding appropriately to our threat from the Russian Arctic contamination, our government could simultaneously be providing our military with the tools and methods needed to document the degree of safety present in using Naval nuclear power.

Nuclear Explosions

As the cold war ends, there is less likelihood of risk to Alaskans from military nuclear explosions within the state. Such a risk is dealt with extensively through the federal government's program of civil defense, including the civilian response. Incorporation of this response plan into state and local disaster planning is being done at this time. All the health effects of both high and low level radiation exposures mentioned above would play a part in such an event. (11,12)

General Considerations Regarding the Biologic Dose of Radiation Received and It's Effects

Lastly, when an individual experiences internal contamination from radioactive materials, their bodily processes affect the amount of damage received. Anything taken into the body is metabolized by the body and excreted. The time from ingestion to excretion of 50% of the material is known as the Biological Half Life. Since all radioactive materials also have specific Radioactive Half Lives (the time it takes for one half of the material present to decay) we have two mechanisms whereby an individual contaminated with such materials eliminates the radioactive substances. It is generally accepted that after a total of 10 relative half lives, (a combination of the biological and physical half lives of the radioisotopes) there is essentially nothing left of the original material within the human so exposed. (13)

While this may seem reassuring, it is not. What it means is that an individual can be exposed to a damaging dose of internal radiation and then over a period of time all evidence that the person was exposed will disappear. The damage done, however, will remain. Cancer developed years later will have been caused without any means to link it directly to that radiation exposure. Since there are many other things which cause cancer, it becomes difficult, if not impossible to tell which was the primary cause. This difficulty is one of the reasons it is so hard to develop data on the delayed effects of low dose radiation exposure in man.

Sometimes the only way to discover there has been an effect of radiation upon a group of individuals is when unusual cancers appear in a pattern which fits a potential exposure to radiation. This is one of the reasons the Alaska State Medical Association and the Alaska Native Health program participate in a Cancer Registry which tracks the appearance and epidemiology of cancers within the state. Using this method to discover radiation threats is obviously too late to help those so exposed, but is a significant argument in favor of a more effective monitoring system world wide.

DISCUSSION

After reviewing the information available at this time it appears there are some real and present dangers from radiation contamination to the people of Alaska. The most significant and global threat is the danger to the polar region and perhaps the whole Pacific Rim through the contamination of the Arctic Ocean along the Russian coast. To the people of Cape Thompson, however, the immediate and present danger in the nuclear waste dump must be their primary concern, just as the Gwich'in people must focus on the radioactive materials on Burnt Mountain.

We are all Alaskans. We do not shrink from danger. We value our lives, our families, our people and our country. What we all want to know is the same. What is the nature of the danger? How can we detect it? How can we remove its threat to our people, lands and waters? Reassurances from the federal government experts are unlikely to be valued without verifiable action taken to deal with the unknowns at this time. Soon the State of Alaska and the United States Government will be deciding what actions to take to clarify with certainty the threats of radiation injury to Alaskans, and to develop plans for meeting this danger successfully. I submit the following recommendations for our leaders to consider as they plan their response.

RECOMMENDATIONS

We should develop a reliable and verifiable monitoring system to detect airborne radioactivity within Alaska:
Given the wind patterns of Alaskan weather it would seem that one active station in Fairbanks is not enough. If the budget would allow it, stations in Fairbanks, Barrow, Nome, Anchorage and Juneau should sufficiently cover Alaska's weather pattern and provide adequate and timely warning for all population centers.

The Department of Defense could establish monitoring stations at all military bases, with adequate training for their staff, providing real time monitoring of the environment similar to their continuous weather monitoring. I believe if the president were to make protection of our environment a clear part of the mission of our military units the task would be done well and with distinction. This concept, while it may seem new and bold, is in fact simply an extension of a proven fact. The US Coast Guard has served with distinction regarding environmental protection for years. Extension of their mission statement to the other branches of the uniformed services is a simple action for the president to take, should he choose to do so. The benefits, worldwide, could be tremendous.

An international consideration should be made by the US Government as they approach this problem. I believe it is both timely and correct to consider a world wide air monitoring system through international cooperation. At the very least, developing an environmental monitoring system through the circumpolar region is to the advantage of the Alaskan people and should be pursued by our Governor, as he has done in the past.

We should develop a monitoring system for the Aquatic Environment of the Arctic Ocean, Bering Sea, Gulf of Alaska, Cook Inlet and the Inside Passage:
This system of monitoring should be extensive, rather than site specific. It should take into

account the Native diets when designing the study. I believe all people would agree it would be important to insure that whales which grow to their massive size through eating of tons of smaller creatures within the Alaskan waters are not somehow concentrating what is otherwise a low level radioactive contamination. That could be a risk to the Native population as well as a greater risk to the whales than international whaling. The many types of fish caught within our waters should be included in such a study as well as the sea cucumbers, mollusks, seaweeds and other marine life. The sea bottom should be widely sampled, especially at sites which might lend themselves to physical accumulation of contaminants through action of tides and silt deposition. Spot checking of boats passing through Arctic waters and of gear used in sea-going operations should be instituted.

It is important to do more than a single study and consider the task completed. The Russian contamination of the Arctic is large and significant. We should commit ourselves to ongoing monitoring, probably throughout our lifetimes. Radiation exposure of significance can be a transient event with permanent effects. The containers holding the Russian waste may hold for 20 years and then discharge all at once. Since some of their radioactive materials have physical half lives well over 20 years such a discharge could still consist of a significant contamination. This is not a short term problem. We should not expect a short term solution.

As with air monitoring, pursuing international cooperation throughout the Circumpolar region, the Pacific Rim and perhaps world wide would be a wise course to follow at this time when planning our studies of the aquatic environment.

We should develop similar methods for studying land based low level environmental contamination:
As we develop the methods to look at this problem, we must remember to include the Caribou as well as other components of the Native diet and lifestyle as we are choosing together which aspects of our environment to examine.

We should have an established on-going and written commitment to the long term health care of any Alaskans who may have been exposed to radiation injury:
This is a topic which should be submitted to the Alaska State Medical Association for assistance in planning the long term surveillance of the subject. Any health care task force active at this time should take the subject of radiation injury into consideration as a public health problem which may need focused action to be properly handled.

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Past Radiation Incidents and Concerns in Alaska

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INTRODUCTION

This section of the report will look at what radiation issues have come into the public's view in recent years. Many of these items are from news clippings or reports that did not receive wide circulation but were discussed in public forums. The intent is to show that there have been concerns about radiation in Alaska for many years, that our state has been seen as a site for piloting programs which use nuclear materials, and that generally the population is not aware of the activities until there is a problem.

NON-IONIZING RADIATION

It has long been known that over exposure to the Arctic sun will lead to snow blindness, as witnessed by the traditional Inuit snow goggles. A thousand years ago the Inuit were performing eye surgery using traditional jade knives and lice to remove clouding growths that were the result of long term exposure to bright light. This condition, that we today call pterygium, and snow blindness are associated with over exposure to ultra violet radiation. In addition ultra violet radiation from sun, and its reflection from snow, also causes skin burns and contributes to skin cancer.

Recent studies from Canada show that there are significant changes in the earth's geomagnetic field directly under the active aurora. These shifts may, like other fluctuating electromagnetic fields promote cancers. This is a controversial issue, and no clear connection with cancer has been made. Senator Stevens sits on the Office of Technology Assessment committee that produced a major report on the topic of electromagnetic fields and their association to cancer. There may be some intensities, some durations, and some frequencies that are more likely to cause cellular damage and promote cancers than others.

It is theorized that this exposure may also contribute to disorders of the central nervous system. Traditionally the Inuit reported headaches and backaches during high auroral activity. There have been comments and concerns on the number of individuals in the populations of the north who take medication for, or suffer from, conditions of the central nervous system. This is an open area for research at this time. Alaska could be a potential research site due to this natural geomagnetic flux.

Studies done during the construction of the Trans Alaska Pipeline System looked at tellurian energy, natural electrical currents in the ground that may be associated to the geomagnetic field and the solar wind. The concern was great enough to cause the pipe to be grounded to reduce the electrical effects of increased corrosion due to the earth's natural electrical energy. Again Alaska would be a natural research site for studying this little know type of radiation.

IONIZING RADIATION

NORM (Naturally Occurring Radioactive Materials) can be found from anything that has been brought up from underground. Mine tailings, and oil and gas soils may be radioactive. The pipes and equipment used in the process may become radioactive. The State of

Louisiana's Departments of Environmental Quality and Health and Human Services have investigated NORM in the oil fields of the Gulf of Mexico and found 533 pCi/gram of soil which is equivalent to levels found in nuclear weapons plants and uranium mills. Exposures at levels of 8 millirem/hr have been recorded at drill rigs which is the equivalent of two bone X-rays during an eight hour shift. This exposure may increase the risk of cancer. There have been concerns and DEC investigations about used oil field pipe in the Kenai region that has been made into play ground equipment and used for residential water well casing. In 1991 a Unocal well in Cook Inlet was measured at 9.2 +- 2.1 pCi/l of Radium 228. The methods of descaling the pipe and tracking its further use need to be reviewed and a system implemented in Alaska. Alaska's definition of hazardous waste should include radioactive materials.

Radon is a radioactive gas that has been associated with lung cancer. The EPA has set the level of concern in residential settings at 4 pCi/l. If this level is exceeded then mitigation should take place to reduce the risk of lung cancer. A survey has shown that 3% of homes sampled in Fairbanks area have levels over 20 pCi/l and that 18% of the homes have over the 4 pCi/l level of concern. Several years ago it was noted that there were elevated radon levels in Barrow homes due to radon that was coming up from the natural gas well and being pumped into every residence. A follow-up study of these natural occurrences would again use the Arctic as a natural laboratory.

RADIATION FROM MAN MADE SOURCES

Non-Ionizing Radiation

Man has learned to generate ultra violet radiation for cosmetic purposes and health treatments. It is now being shown that tanning booths may be causing skin and eye damage, and may contribute to skin cancer. Medical treatments are much more closely regulated to avoid overexposure; however, levels of safe operation in tanning booths are currently being debated by the health and science communities. These units are know to cause skin burns if not used properly.

Electromagnetic Fields (EMF), and especially Extremely Low Frequency (ELF) EMF, are of concern along the radiation spectrum. These fields are created where ever electricity is flowing: around large electric motors, electric welding devices for metal and plastic, and large transmission lines. They are also generated around household wiring and appliances. It is now recommended that pregnant women should not use electric blankets as their use as been associated with birth defects. It has been shown that an electric field around a broken bone that has not healed on its own, will help calcium be laid down and mending will be accelerated.

It is very controversial to say anything else about electricity and human health and even the leading technical journal of the nation "Science" has recently run articles on the opposing points of view. There is growing documentation that EMFs are associated with the promotion (not the cause) of cancers. It is difficult to convince the public of any suspected health concern, when the top scientist can not determine the risk. Without solid technical materials making a convincing argument to the public becomes impossible.

In Alaska we have many local electrical generation plants, and small, poorly wired homes, with a large dependence on electricity for heat and light during the long winter hours when most people spend the vast majority of their time indoors. Our living styles should be investigated to see if they contribute to ill health as compared to other areas of the country where people do not spend as much time indoors.

In addition to the radiation aspects the use of electricity can be harmful in itself. Burns and electrocutions occur regularly around Alaska. During the last legislative session there were recommendations to expand the use of hot sticks for handling 5kV lines. During the same session there was a bill on the concerns of using Video Display Terminals at work and requirements for basic EMF awareness training for State employees.

Radio/microwaves —These have been of concern in Alaska. When microwave ovens first came on the market there was great concern about using them if people nearby were wearing heart pace-makers. The concerns centered on the failing of the battery, a changing of the rhythm of the unit, or general heating of the implant causing local burns. With well sealed microwave ovens and research these concerns have been eliminated. In Alaska there are three current concerns about microwaves.

High Energy Radar--Clear Air Force Station had a problem in 1983 when six civilian workers were in front of a radar unit when it was turned on. They were exposed to a high-powered microwave radiation field. This was documented an a Government Accounting Office report from November 1985, "Radiation Accident, Incident at Clear Air Force Station, Alaska." It was proceeded by accusations by Congressional Representative Don Young that the Air Force had tried to cover-up the incident. It is unknown if any long term follow-up for health concerns has been provided.

Low Energy Radar —Recent reports have shown increased levels of testicular cancers among public safety officers who regularly control speed limits with radar guns which are held on their lap. These occupational exposures have preliminary findings but further investigation is warranted to assess the concern in greater detail. With the suspected cause identified, warnings should be provided, or guidelines for use created, for our State Troopers. If not we risk the potential cost of the loss of health of other law enforcement officers.

Communication— Microwaves at low energy are used in long distant communications. For years the citizens of the Glenn Alps subdivision of Anchorage fought to keep a microwave transmission tower from impacting their homes. There is still concern that they are being exposed to radiation that will compromise their health. No known health follow-up has been instigated.

In these three cases, we know that high energy microwaves can be used to cook and they can be harmful to people in their path; however, we do not know as much about low energy microwaves. The concern then comes from not knowing the duration, intensity, and frequency of the radiation which may cause harm now or in the future.

Lasers are a relatively new form of aligned radiation. They use to be found only in research centers. Now they are in everyone's CD player, at grocery check out lines, at trophy engravers, at local auto repair business to align frames and wheels, in pointers at business meetings, and in computer printers; and most are capable of causing blindness, or electrical shock or electrocution if misshandled. There has been very little written about the precautions of the use of these items in comparison with the breadth of their application. It is unclear as to what length of exposure at what intensity and frequency will cause eye damage that will only become evident in time.

Ionizing Radiation

When ions are generated the field of radiation becomes more mysterious and less understood by the general population. X-Rays are used throughout Alaska. Most people associate them with medical practices and therefore they have a good connotation.

There are X-Ray machines in hospitals, health clinics, dental offices, and chiropractors practices throughout the state. They are also located in welding shops to check work, at industrial sites to monitor equipment for wear, and located where many people, including first responders, may not expect.

Radioactive isotopes (radioisotopes) are similar to X-rays in that they historically have been associated with health but now have a major industrial use. In Alaska physiological experiments were conducted as part of the International Biome Project for Circumpolar Populations. Citizens from Wainwright and possibly other communities were asked in the 1950's to take a radioactive isotope (Iodine 131) pill and then sit in a cold room to measure their ability to withstand cold. This report was written up in October 1957, Arctic Aeromedical Laboratory #57-21. It is unclear if the "volunteers" understood the nature of the experiment in detail.

In 1991 a bucket holding radioisotopes was discovered in an abandoned trailer in Deadhorse. State and Federal requirements for storage were not being met and the material was causing local contamination. In 1989 the University of Alaska launched two rockets from Poker Flats with what has been called only "nucleation material" for studies of the upper atmosphere. The contingency plans, in case of rocket failure, would have potentially released the "nucleation material", most likely a short-lived radioactive isotope, on the tundra near ANWR or in the Arctic Ocean along its preliminary flight path. It is unclear as to exactly what materials were being used in either of these cases and how the Deadhorse materials and contamination were handled.

A fire in 1990 near Deadhorse caused a radiation release that is assumed to be the result of isotope tracking materials. It is unclear how much may have gone into the air and traveled west in the prevailing winds, past Barrow and into Russia. It is unknown if we alerted them as we hope we would be alerted in case of a release on their side, further south where the winds blow our direction. Again, the fire fighters and first responders need to know what is in a burning building before starting to put out the fire or aid the victims. Likewise, those in authority, both in the private sector and those who license the materials, need to know to inform other communities of a potential exposure.

Another use of isotopes is for detectors. The most commonly used in many homes are smoke detectors. The isotope usually in the units is .8 microcurie of Americium 241, an alpha radiation emitter. The use of these units has reportedly saved hundreds of lives. At the same time non-working units are requested to be disposed of appropriately.

Radioisotope Thermoelectric Generators (RTGs) have made the news in the summer of 1992 due to a wild fire near Burnt Mountain in northeast Alaska, near ANWR. The local residents soon called for their removal. The current staff of the DEC, DES, H&SS, and the Governor's office did not know of the placement of these units in Alaska; however, it is known that previous staff of these offices were knowledgeable in the late 1960's and early 1970's when the first units were brought to the state. These units were used on Fairway Rock in the Bering Strait and at Lake Clark Pass for navigational aids. In true serendipity, it was reported by Lyle Perrigo in "Cold Regions Isotope Applications," in April of 1976, that RTG navigational aids at the Hinchenbrook Entrance to Prince William Sound on Seal Rocks and Wessel Reef could prevent a marine oil spill. To ponder the effect of one RTG beacon on Bligh Reef today is certainly reflective.

In the report on their potential use, a survey of a number of health agencies and Native corporations resulted in interest in RTG use to "improve the quality of life." This would occur through thermoradiation sterilization of sewage sludge in rural communities, for keeping water systems from freezing, and in reducing the levels of disease and increase life expectancy through greater sanitation.

On the industrial side RTGs were recommended for use in the oil fields. Their heat would keep the oil's viscosity low and therefore increase the production of the field.

Radioluminescent (RL) lights are fixtures that use nuclear materials to generate light. These are regularly used in EXIT signs in commercial aircraft. In 1984 they were used at Skwentna in a pilot project for runway lighting. In 1987 the State purchased a number of systems for rural runways. In 1988 there was a fire in Council. The building, where all the RL lights for the runway were stored, burned and released an estimated 3,000 Ci of tritium. There has been no known health follow-up of the first responders nor community members who were exposed to this radiation.

Nuclear generators are very large radioactive systems which have incredibly complex controls and safety measures. Three-Mile Island in Pennsylvania showed the world in the 1970's that even with sophisticated systems there could be releases of nuclear material. Four events have occurred that have had or may have direct impact on Alaska.

Chernobyl. When the reactor went bad at Chernobyl in 1986, then Governor Sheffield requested a team begin to monitor for fallout. It was soon learned that there were few recording stations and that there was little to do until the samples had been evaluated. This evaluation would unfortunately be complete after any exposure had already occurred to the local populations. It was becoming clear that we were not prepared to deal with such exposures and had no plans to evacuate the residents of the North Slope Borough or Fairbanks if the levels were high enough for concern. Alaska saw very little impact from the massive release at Chernobyl due to "good" weather. That does not mean that is was sunny and calm in the Arctic, but that the wind patterns were such at the time that virtually no radiation came from the Polar Easterlies into Alaska.

Bilibino. A Moscow news report alerted Alaskan health officials that there had been a release of nuclear material in eastern Russia in 1991 at the Bilibino nuclear generator. It was well after the fact and no one in this state or country had mounted a monitoring program similar to the one requested during the Chernobyl incident. There has been a site investigative team which visited the facility to learn more about the release which was then classified as very minor. However, the question of exposure and what notification system is in place for future events is not clear.

Novaya Zemlya. Greenpeace International sailed a vessel into the Arctic Ocean to get near this archipelago off the north shore of Russia. What they found was massive nuclear contamination from failed reactors, nuclear dumping, and abandoned nuclear powered vessels. The news of this site has sent numerous nations scrambling to being an active monitoring program for international pollution. The University of Alaska Fairbanks has commissioned the vessel Alpha Helix to collect seawater in the Bering Strait and Chukchi Sea to monitor contamination. Contamination of the Arctic ocean may impact subsistence food sources for Alaskan Inuit as well as contaminate the entire Arctic Ocean basin which drains primarily into the north Atlantic.

Fort Greely. In the 1960's the first nuclear generator in the world was erected in Alaska at Fort Greely near Delta Junction. In 1972 it was decided to decommission the power plant's SM-1A reactor. Much nuclear material had to be disposed of and the bulk, 1,377,455 Ci, was shipped out of state. Contaminated water was injected into a 250 foot well near the site. The remaining approximately 49,000 Ci was encased. However, according to the decommissioning report there were problems with the AM-9 chemical grout that was to contain the area. During the grouting process AM-9 fumes made workers sick and it is unclear to what substances they were exposed. When the material did not gel as anticipated it was decided not to correct the situation, not to mix more AM-9 grout, and not to expose the workers who were already sick to more chemical fumes. It was decided to encase the reactor with concrete without the appropriate gel of AM-9 chemical grout. It is therefore implied from the final official report that the reactor was not appropriately nor securely decommissioned.
During the final military inspections of the decommissioned reactor 13 sites still were over the goal of 80 microrad/hr. and 28 sites were still over the goal of 200d/m per 100 cm2. It is clear from these reports that the decommissioning did not go according to the plans nor meet the expected goals, and yet for twenty years it has remained, with only occasional inspections for integrity. It is unclear if the aquifer or area close to the injection well was ever adequately examined for possible contamination. It would appear practical, and for the good of the citizens of Alaska, to know that this reactor was appropriately decommissioned using today's best available technology. This again provides a real world opportunity to demonstrate our technical ability to safely close down a nuclear generator. In light of conditions in Russia and in our ageing nuclear generators around the country this could be a valuable research/practical effort.

Nuclear waste has been making the news and impacting Alaskans significantly for many years. Most recently the Cape Thompson issue of left-over materials from Project Chariot, the first attempt to experiment on the peaceful use of nuclear energy. In 1958 Edward Teller and members of the Atomic Energy Commission came to Juneau and unveiled a plan to blast a harbor near Point Hope. The blast would be the equivalent of 40% of all the fire power used in World War II. In 1959 he discussed the plans with the University of Alaska. In 1960 he made a public announcement in the "lower 48" that the work would take place. During those three years no one talked to the people of Point Hope about this idea. In 1961 local residents began a process of active concern about the environment that many believe was the most significant single event in establishing the current environmental movement, with the possible exception of the publishing of "Silent Spring." In 1962 the idea of Project Chariot was shelved and slowly slipped into the past.

In the early 1980's the people of Point Hope voiced concern over the perceived high levels of cancer in their community. The North Slope Borough Health Department was told upon investigation that no nuclear materials had ever been taken to Cape Thompson for Project Chariot. In 1992 the public became aware of declassified documents that showed that not only were testing isotopes taken to the site, but that 400 cubic feet of "mixed fission materials" from the Project Sedan site in Nevada were taken and used for testing as well. It is unclear as to how all of this test material, especially the Sedan material at Project Chariot environmental experimental sites 116 and 117, were cleaned up and placed in a common pit to be allowed to freeze in place. This "toxic popsicle" and the questions of overall use of radioactive isotopes at Cape Thompson now constitutes a nuclear waste site.

People are concerned over the number of cancers to young people in Point Hope. In Dr. McKenna's report "Cancer in the North Slope Borough 1984 to 1989" he states:

> *"The crude rate of cancer in Point Hope (272.1 per 100,000) was once again lower than the U.S. rate because of the young population. However, the age-adjusted rate was 38 percent higher. Since the rates are based on only eight cancers the confidence interval of this rate includes the general U.S. rate suggesting it could be a chance event." then later "In reference to the village of Point Hope there did seem to be a high rate of cancer than that of the general U.S. However, these rates are based on very small numbers." then later "In conclusion there does not seem to be a definite trend of character to the cancer incidence in the North Slope which could impute an industrial pollutant as a causative agent."*

Therefore the young population may be showing a higher risk of cancer than the rest of the country, but because of the small numbers in the community any interpretation cannot be statistically valid. With data in this form the only conclusion is that we do not know for sure.

The government surely owes the people of Point Hope a far better explanation for their cancer rates after the recent disclosure that they have been living near unwanted nuclear material for thirty years. If more studies are needed then they should be done. With the new openness in health science in Russia an international investigation would be possible and help clarify and confirm reports of higher cancer incidents on the western side of the Bering Strait. A wider study comparing Alaska to Canada and Russia could shed light on cancer that may be caused by materials coming in from the west or diseases caused by the proximity to the magnetic pole and lack of geomagnetic shielding from cosmic radiation.

The people of Point Hope are angry and are taking their own action. On October 13th they adopted the "Inupiat Code of Offenses Against Peace and Security of Mankind." This international code is specifically directed at the harm of local residents as well as global pollution that would result from activities such as what occurred at Cape Thompson thirty years ago. They also are preparing to file charges through the World Court against the United States of America.

In addition to Project Chariot the people of western and northern Alaska have had to deal with some of the highest levels of Cesium and Strontium radioisotope fallout from atmospheric testing. These particles were drawn to the north by magnetic fields, blown there by prevailing winds, and deposited in precipitation. The tundra lichen picked up the radiation and the caribou ate the lichen and concentrated the radiation even more. The Inuit who ate the caribou received even a higher dose of radiation. Dr. Wayne Hanson surveyed a variety of populations from the early 1960's until the 1980's when body burdens returned to background levels. The question remains as to what is the long-term impact of such ingestion of radioactivity. It is likely that no one will ever know exactly how much radioactive body burden these people carried. A long-term health study would be quite appropriate for those who were evaluated as it is known what radiation levels they had in their bodies for a period of over a decade. It would be particular interesting to do a life- time evaluation of the children born during that time period.

In addition it was reported in 1966 the there were significant amounts of Iron 55, a radioisotope, in salmon and tuna, from atmospheric nuclear weapons testing. The report states; "..individuals whose diet contained large quantities of ocean fish could have body burdens several times higher than those of the caribou-eating Eskimos,..." As many Alaskans have a high ocean fish diet the effects could be widespread. The global pollution of nuclear weapon testing fallout has impacted everyone to some extent.

Nuclear testing —In the early 1970's the Department of Defense used a loophole of language to allow them access to an area of a National Wildlife Reserve. They interpreted Navy concerns as meaning 'military weapons testing' when others interpreted it to mean 'navigational and port support' activities. The island of Amchitka was used to test nuclear warheads. It seems odd that such an experiment would be allowed in an area rich in sea life and renewable resources, as well as being high in seismic activity.

In the 1977 report "The Environment of Amchitka Island" it states:

> *"It seems likely that water carrying the more mobile radionuclides, such as tritium, could begin to discharge on the floor of the Bering Strait within a century and possibly within a few decades."*

An earthquake could send the contained radioactive materials into the ocean. This is not far from crabbing and bottom fish fisheries. At the time of the explosions there was concern about the impact to marine mammals, such as the sea otters and seals. The days immediately after the detonations there were few if any bodies recovered leading the researchers to believe little damage had been done. In the months following hundreds of bodies came to the surface. It appeared that the shock had driven the air out of the fur and lungs and the animals sank. In the cold water decomposition was slow and the bodies refloated when internally generated gases provided lift.

There have been reports of leukemia cases among the workers at the military base on the island. The workers have stated they believe the ground water to be contaminated. Tests on the water do not indicate a problem. Those individuals in question were electrical workers and it has been shown nationally that their occupation has a high level of leukemia. With either radiation there is a concern, but how is this explained to an individual.

Approximately 350 miles SW of Ketchikan, the American Mail Line, an Atomic Energy Commission licensee, dumped 124 Ci of nuclear material. This information comes from federal documents on ocean dump sites for nuclear waste. At 52°25'N, 140°12' W 38 containers were dropped between 1962 and 69. At 50°56' N, 136°03'W, 197 containers were dropped between 1958- 1960. Considering the technology of the 60's it is a matter of time before there may be bottom contamination with nuclear waste flowing toward Seattle.

According to a recent EPA Office of Radiation Programs report Alaska has 91 "Sites with Potential Residual Radioactivity."

Agency/Industry Type	Number of Sites
Federal	
Department of Commerce	1
Department of Defense	1 base
	1 power production
	41 formerly used defense sites
Department of Health & Social Services	1
Department of the Interior	1
State or Private	
Hospitals	8
Manufacturing	21 RAD devices/products
Non-Defense Research Labs	11
Mining	1 mineral processor
	4 active or inactive uranium mines
TOTAL	91

These numbers do not include sites potentially contaminated with NORM.

There has been no mention of military weapons nor nuclear vessels in Alaskan waters. These are concerns but are outside the scope of the State's awareness and response.

Throughout the discussion of each of the above topics should be general concerns. How to inform the public of the use or existence of these materials before they learn about it in an unplanned way, such as with the Burnt Mountain RTGs? If there is concern about the use of any of these materials for terrorist activities, how are they secured? As any of these materials may work well when controlled, how can their safety be assured when being transported by barges which have dumped cargo, planes that crash, and rockets that fall? As it appears that some of the RTGs and other materials do emit radiation even when sealed they require casks for transport, and these casks are heavy and greatly incumber the vehicle, what other safety concerns exist for the craft and those who must handle the items?

This year the Alaska Department of Environmental Conservation produced a report on the concerns about potential increased cancer rates in Point Hope. Scott Home stated in his conclusion:

> *"There is still a serious lack in the assessment of the total impact of the Arctic radiation climate on individuals who spend their lives at one site, versus those who move around considerably during their lives, respecting natural (solur ionic) radiation and man-made (DEW line microwave and radioactive fallout), the potential input of radon (which was found to be injected into residences at Barrow from the natural gas line several years ago, but is unlikely to occur elsewhere in the Borough), the effect of strong electromagnetic fields in these confined residential environments, and other possible causes. A [illegible]-scale study of these components to the radiation experienced by residents throughout their lives in sum, rather than in part (almost all of which have been dismissed as being of serious health consequences), is needed above all."*

The Inuit Circumpolar Conference has passed a resolution over a decade ago calling for a nuclear-free homeland, a nuclear-free Arctic. It was designed when the concern of a nuclear war with nuclear powered submarines having dog fights beneath the polar ice cap was very likely. Now the threat seems to be from past practices of poor management and potential failure of nuclear power systems, but the results would be the same: the loss of their homeland.

Alaskans are faced with the same set of radiological concerns as the Inuit when it comes to clouds of atmospheric nuclear fallout, and currents of oceanic nuclear leachate contaminating our air, water, and food. If we are to protect our homeland we must learn more about all the forms and sources of radiation. We need to understand that it is here with us now, that we are bringing in more as we build our state. We also need to understand that there may be radiation which we do not want as it drifts across our boarders, but we must know how to deal with it. It is the State's responsibility to assure that the public's health in maintained and that over exposure to radiation is controlled. It is also the State's responsibility to respond to assure public health and safety when radiation is no longer in control.

Health Risk Assessment of Radioisotopes at Cape Thompson, Alaska

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INTRODUCTION

A number of scientific studies were conducted in the Cape Thompson, Alaska, area from 1958 to 1963 in preparation for Project Chariot—the proposed creation of a deep-water harbor by a nuclear explosion. Most of these studies were of the geology and ecology of the area. In 1962 an experiment was conducted at Cape Thompson to study how radioactive particles move if applied to the soil and water in the area. After this experiment was completed, the isotopes and all potentially contaminated soil used were moved to a disposal site, buried, and covered by clean soil. A formal report of the radioisotope experiment was published in 1966.[1]

In 1992 Dan O'Neill, a research associate at the University of Alaska Fairbanks who was studying Project Chariot, obtained a letter indicating that the amount of radioisotopes buried at the site exceeded the amount allowed in the permit issued in 1962 by the Atomic Energy Commission for on-site burial.[2] Public release of this information by Mr. O'Neill gained wide-spread attention when announced as a banner headline, "Nuclear Waste Dump Discovered," in September. A series of front-page news stories and lack of local knowledge of specific information about the Cape Thompson experiments caused much concern and anxiety. Local residents feared that the nuclear wastes in the disposal site might be the cause of cancers among residents of northwest Alaska, especially among residents of the villages nearest to the site; Point Hope, 32 miles to the northwest, and Kivalina, 41 miles to the southeast.

Since the existence of the disposal site was publicized, there has been much discussion about what should be done to remedy this situation. Initially many demanded that the material be dug up and moved to a radiation storage facility in the lower 48. On September 15, Governor Walter Hickel and Senator Frank Murkowski visited Point Hope and the abandoned site at Cape Thompson. Both promised immediate action and indicated that any residual waste would be removed and the site cleaned up by March 1993. Some feel the health risk posed by the site to be so great that removal this winter should be undertaken, even though the environmental conditions at Cape Thompson in winter could pose a great threat to the safety of personnel working at the site and traveling to and from the site.

This paper will review the radioisotope experiment conducted at Cape Thompson, studies on cancer and radiation exposure among native villagers in the arctic, and the health risk posed by the site to local residents, especially subsistence hunters who may visit the disposal site.

BACKGROUND

In August 1962 scientists with the U.S. Geological Survey, acting on behalf of the U.S. Atomic Energy Commission, conducted an experiment to evaluate the potential effects of Project

Chariot on local water supplies in northwestern Alaska. The use of a nuclear explosion to blast a harbor at the site would release radioactive particles into the environment. The experiment at Cape Thompson was conducted to evaluate how radioactive particles would move when deposited onto the surface of the tundra. The study was designed to measure movement of radioactive particles into the ground and over the surface into streams and ponds. Results were intended to enable scientists to predict the effects of a nuclear detonation's radiation impact on the area.

In the experiment a total of twelve test plots were studied. Mixed fission products and measured amounts of three specific radioisotopes totalling 26 millicuries of radioactive material were diluted in a total of 43.5 pounds of sand and soil and applied to the 12 test plots. The three identified radioisotopes used in this experiment were 6 millicuries of Cesium^{137}, 5 millicuries of Iodine^{131}, and 5 millicuries of Strontium^{85}. Ten millicuries of Sedan Fallout mixed fission products also were used. Three test plots were seeded with Cesium^{137}; two plots each were seeded with Strontium^{85} and Iodine ^{131}; and 5 plots received Sedan Fallout mixed fission products.

The Sedan mixed fission products were collected by placing a tray on the ground one mile from ground zero of the Sedan nuclear detonation at the Nevada Test Site. This detonation was similar in type to that planned for the Project Chariot detonation. The Sedan nuclear detonation was one of a series of nuclear tests conducted by the U.S. Government in the 1950s and 1960s. Scientists are able with great accuracy to deduce detailed characteristics of the nuclear device being tested from analysis of fallout products. For this reason, exact details of the composition of radioisotopes collected during the Sedan test were classified. According to the Department of Energy Field Office in Las Vegas, information on the component isotopes of the Sedan fallout mixed fission products remains classified. Efforts are underway within the Department of Energy to obtain and release this information.

In ten of the 12 experimental test sites at Cape Thompson, radioisotopes mixed with soil or sand were applied to the surface of the sites. The sites were then sprayed with water to simulate natural rainfall, and the movement of the isotopes after the simulated rainfall was assessed. In one plot a percolation test was performed to measure the underground movement of radioisotopes. In one plot, 1.7 millicuries of Sedan mixed fission products were dispersed in a small stream. Twenty-four hours after the stream dispersal, there was no detectable increase in radiation above background measured anywhere along the stream site.

Following the experiments conducted at Cape Thompson in August 1962, the test plots were dug up and all dirt and other debris collected were transported in 55-gallon drums to a disposal site. At the disposal site the drums were emptied into the burial site prepared by bulldozing a trench down to permafrost. A total of 1,600 cubic feet of soil weighing 15,000 pounds was moved from the test plots to the burial site. Additional soil was then mixed with the material, and the disposal material was then buried with four feet of clean soil using a bulldozer. After burial of the material, there was no detectable radiation above background levels both at the surface of the burial site and at each of the test plots from which the disposal material had been excavated.

The full details of the experiment, except for identification of the Sedan fallout radioisotopes, were published by the scientists conducting the experiment. Copies were provided to the U.S. Geological Survey offices in Anchorage, Fairbanks, and Juneau, and have been available to the public since 1966. Photographs taken while the experiments were being conducted document that no protective clothing was worn by the participants.

As noted by Mr. O'Neill, the Atomic Energy Commission (AEC) notified the U.S. Geological Survey (USGS) on January 23, 1963, that the amounts of Cesium^{137} and Strontium^{85} left buried at Cape Thompson exceeded the amount allowed under federal regulations. The AEC requested a written statement or explanation detailing the quantities and physical and chemical form(s) of the materials buried; the method of burial; an environmental analysis of the site's topography, geology, and hydrologic characteristics; and an assessment of nearby facilities that might potentially be affected by the materials. The AEC also requested information on any corrective steps that had already been undertaken or which were planned for the future.[3]

The USGS replied to the Atomic Energy Commission by letter on February 28, 1963, noting that the AEC had authorized on site burial of remaining radioactive material when it approved the license to conduct the experiment for the experiment. The license approved use of up to 5 curies of mixed fission products with the understanding that of the radioactive material transported to Cape Thompson for the experiment, less than two percent would be returned to Denver for analysis, and over 98 percent would remain at Cape Thompson. The USGS provided the detailed information requested by the AEC. Although the quantities of radioactive materials buried at Cape Thompson exceeded permissible amounts under the U.S. Code of Federal Regulations, the materials posed no hazard because of the small amounts used, the shielding provided by intermixed and topcover soil (as demonstrated by the absence of detectable radiation above background levels atop the burial material), and the hydrologic and climatic conditions of the site.[4]

On March 7, 1963, the AEC replied to the USGS indicating appreciation for their cooperation in providing details of the disposal[5]. In a memo dated April 10, 1963, all activities regarding the status of the experimental site were summarized by the AEC, Division of Licensing and Regulation (DL&R). The AEC DL&R concluded, "We believe no further action is warranted," and "In summary, we (at last) feel satisfied the radioactive waste mound at the Chariot site does not represent a health and safety problem and...it can be abandoned."[6] No further action regarding the materials at Cape Thompson was recommended.[6]

After the radioisotopes and soil were buried in 1962, the site remained undisturbed. There was no disruption to the burial site topcover until 1992 when samples were taken as part of the current effort to evaluate the site. Atop the burial site, there remains no detectable radiation exposure above the background levels of the area. Background radiation levels in the area are low, ranging from 3 to 6 microRoentgens per hour—26 to 52 milliRoetgens per year. The background and current levels of radiation at the Cape Thompson site are no higher than levels at other areas in northwest Alaska.[7]

The amount of radioisotopes remaining in the disposal material in 1992 is considerably less than what was buried in 1962. Radioisotopes undergo spontaneous disintegration. This process results in the release of the high-energy particles, or gamma rays, referred to as ionizing radiation. Iodine^{131} has a half-life of 8 days. Strontium^{85} has a half-life of 64 days. During the past 30 years, these radioisotopes have completely disintegrated and no longer are a source of radiation at Cape Thompson. Cesium^{137} has a half-life of 30 years: Of the 6 millicuries of Cesium^{137} buried in 1962, only 3 millicuries remain in the disposal site. Similar reductions have occurred to the radioisotopes of the Sedan Fallout mixed fission products. Because information on the specific component isotopes of the Sedan Fallout material remains classified, a precise calculation of the remaining radioactivity of the Sedan Fallout material buried at the site is not possible at this time. Of the 24.3 millicuries of material buried in 1962, there remains a maximum of 11.3 millicuries of radioisotopes in 1992, assuming that the Sedan Fallout material has an extremely long half-life, and none of the material has undergone disintegration. Assuming that the Sedan Fallout disintegrates with a half-life of 30 years, only 7 millicuries would remain at present. The USGS estimates that the amount of radioactive material remaining at the Cape Thompson site is no more than 3-5 millicuries, and probably is less than 2 millicuries.[8]

When radioisotope atoms disintegrate, they release energy primarily in the form of particles (alpha and beta) and high energy photons—(gamma). Alpha particles are relatively large particles that can penetrate only 3 to 5 cm of air and are stopped by a thin sheet of paper and the outer layers of skin. Because alpha particles are unable to penetrate the outer skin, radioisotopes emitting alpha particles are only a risk if ingested or inhaled. Beta particles are lighter particles with higher penetration but are stopped in a few meters of air or a few millimeters of aluminum. Radioisotopes emitting beta particles potentially can be a health risk both for internal and external exposures. Radioisotopes emitting gamma rays present the most serious potential risk for external exposures because gamma rays are the most penetrating form of radiation. All forms of radiation are attenuated by passage through solid materials. Glass and plastic are commonly used for shielding against beta radiation, and concrete and lead for x-ray and gamma radiation.

At Cape Thompson very effective shielding was and is still provided by the soil that was mixed with the radioisotopes used in the experiments and the four-foot thick covering of clean soil put on top of the disposed radioisotopes. All remaining radioisotopes are continuing to undergo spontaneous disintegration with the release of radiation. The effectiveness of this shielding is demonstrated by the fact that there was no increase in radiation readings above background levels directly atop the disposal site in 1962, and as expected, none was detected in 1992.

The Department of Energy has calculated predictions of radiation exposures to individuals at Cape Thompson using computer modeling based on the amounts and types of radioisotopes used at the site. In a worst case scenario, if an individual were to have remained atop the burial site 24 hours per day for a full year, the most additional radiation he could receive from the site over and above background would be 10^{-5} milliRoentgen.[9] This amount of radiation is equivalent to about one millionth of a routine chest x-ray or to the exposure a person receives in nine hundredths of a second in a jet plane at cruising altitude. Even if the four feet of top cover were removed, the maximum additional radiation exposure to an individual lying in the disposal material 24 hours per day for a year would only be equal to the maximum recommended yearly radiation exposure for civilians of 100 milliR per year. (The recommended maximum permissible occupational exposure is 500 milliR per year.)

Ingestion of radioisotopes can present a potentially serious health risk. However in order to exceed maximum permissible quarterly ingestion limits for Cesium^{137}, one would have to consume over 16 cubic feet of the disposal material every three months. One would become sick from eating dirt long before ingesting enough Cesium^{137} to experience any short-term or long-term radiation-related health problems.

Background—Effects of Radiation on Health

The health effects of a radiation exposure are dependent on a number of factors, including:

1. Total amount and type of radiation exposure.
2. Rate of exposure.
3. Method of exposure, i.e., internal—ingested or inhaled—or external exposure to the skin.
4. Amount of body exposed.
5. Individual variability.
6. Relative sensitivity of cells and tissues.
7. Parts of the body exposed.
8. Nutrition, oxygenation, and metabolic state of tissues exposed.[10]

Persons who receive an acute, whole-body exposure to a large dose of radiation may quickly experience serious injury or death, as seen at Hiroshima and Nagasaki in World War II or after the Chernobyl disaster in 1986. Exposures of only a portion of the body to high levels of radiation may cause tissue death in the area of exposure but leave the unexposed body tissues to function normally. One of the major components of cancer treatment is radiation therapy in which cancer or tumor cells are killed using high doses of radiation focused onto the tumor or cancer cells.

Exposures to low amounts of radiation do not cause immediate effects, but potentially may cause damage to chromosomes or proteins within cells that may eventually progress to certain types of cancers. However, there are also enzymes within cells which repair cellular injuries caused by radiation and other toxic substances. For this reason people with exposure to a high dose of radiation may have little acute or long-term health effects if the exposure is received over an extended period of time, whereas an acute exposure to the same amount of radiation may produce severe injury or death.

We are all exposed continuously to small amounts of natural radiation. This natural radiation includes cosmic radiation in the form of galactic cosmic rays and solar particle radiation from the sun; and radiation in the ground and water arising from naturally-occurring radioisotopes uranium, actinium, and thorium, and their breakdown product isotopes. Radon, a naturally-occurring breakdown product of uranium^{235}, has recently gained much attention as a potential source of radiation exposure, especially in houses with unventilated basements built atop bedrock. The level of naturally-occurring or background radiation varies at different locations in the world, the United States, and Alaska. In general, terrestrial levels vary with the types of soil and rock in the area. Cosmic radiation varies with altitude and latitude.[11] For example, average background radiation exposures are approximately 150 milliRoetgens per year in San Francisco and 500 milliRoetgens per year in Denver, Colorado.[12]

Background exposure levels at the Project Chariot site at Cape Thompson, averaging 40 milliRoentgens per year, are much lower than those at San Francisco or Denver.[13] For comparison, the total annual radiation exposure at the Cape Thompson site is approximately equivalent to that of 4 chest x-rays or that received on eight round-trip, cross-country airline flights. One lateral lumbar spine x-ray provides a radiation exposure approximately 140 times that received in an entire year at the Cape Thompson site.

Exposures to low levels of radiation, including the low background radiation levels at the Cape Thompson site, do not raise the risk of development of cancer. No evidence of increased risk of cancer has been demonstrated with radiation exposures under 20 rads.[14,15] One would have to live at the Cape Thompson site for approximately 500 years to reach the minimum exposure level associated with possible increased risk of cancer.

Approximately 30 percent of the United States population develops cancer of some type during their lifetime, and 20 percent of the population dies of cancer. Exposure to 100 chest x-rays would increase the probability of developing cancer at some time in one's lifetime from 30.0% to 30.04%. In a population of 10,000 people, each exposed to 100 chest x-rays, 3,004 people would be predicted to develop some type of cancer rather than the 3,000 expected if each person in the population were not exposed to 100 chest x-rays. This additional risk is for all types of cancer. The increased risk for any specific cancer is much lower and is probably undetectable. Long-term follow-up studies of approximately 600,000 radiation workers with occupational radiation exposures dating as far back as the early 1940s have not shown any association between occupational exposure to radiation and increased risk of cancer.

For a long time there has been a concern about cancer rates among native populations in Alaska. A number of studies have examined the rates of cancer and potential risk factors for the development of cancer in Native populations, including radiation exposure from nuclear fallout.[16]

Matthew McKenna recently studied cancer in the North Slope from 1984 to 1989.[17] He found that the age-adjusted cancer rate among North Slope residents was approximately 5 percent higher than the general cancer rate of the entire United States. When stratified by sex, male North Slope residents had a cancer rate 15 percent lower than the overall U.S. rate while female North Slope residents had a rate 25 percent higher than the U.S. rate. The age-adjusted cancer rate among residents of Point Hope was 38 percent higher than the overall U.S. rate; this difference was not statistically significant due to the small population of Point Hope residents. The eight cancers that were diagnosed in Point Hope residents from 1984 to 1989 included 2 cases of lung cancer, 2 cases of cervical cancer, and 1 case each of stomach, bone, colon and testicular cancer.

The common types of cancers associated with radiation exposure among Hiroshima and Nagasaki bomb survivors and others with known radiation exposure have included thyroid cancers, leukemia, multiple myeloma, and breast cancer in females.[18] None of these cancers was noted among Point Hope residents from 1984 to 1989.

Lung cancer and cervical cancer, the two cancers noted to be higher in frequency among North Slope residents than among the U.S. total population, are both associated with well-established risk factors. Lung cancer is strongly related to cigarette smoking. Risk factors for cervical cancer include early age at intercourse, numerous sexual partners, and history of sexually transmitted diseases.[19]

Concerns have been expressed that the buried radioisotope material may enter the food chain of Native subsistence hunters and their families through uptake by plants growing atop the burial site which are in turn eaten by caribou grazing at the site. Extensive research was done documenting the deposition of radionuclides in the arctic as a result of atmospheric nuclear tests in the 1950s.[20-23] Cesium^{137} was shown to enter the food chain and was detectable in very low amounts in lichens, caribou, and Alaska Natives. In the 1980s several detailed studies reviewed all available findings and concluded that levels were so low as to be on no public health concern.[16,24]

Radioactive fallout from an above ground nuclear detonation normally settles at the earth surface where certain radioisotopes are absorbed by plants and enter the food chain. However, the radioisotopes at Cape Thompson were buried directly atop the permafrost and covered by four feet of topcover. The material is likely to be frozen most or all of the year; the material is located well below the roots of the surface plants, precluding its introduction into the food chain.

Stutzman and Nelson studied cancer incidence among residents of villages in northern Alaska from 1969 to 1983, hypothesizing that an increase in cancers associated with radiation exposure might be found in this population as a result of exposure to radioactive fallout from U.S. and Soviet nuclear testing of the 1950s and 1960s.[16] As part of their study they reviewed results of whole-body radioisotope burden measurements made during the 1960s.[19-23] The levels of radioisotopes in Point Hope residents were among the lowest of all the North Slope villages tested. Among North Slope residents the incidence of cancers associated with radiation exposure was lower than the U.S. rate. Increased rates of cancer of the nasopharynx and liver were found among North Slope men; similarly increased rates of cancer of the nasopharynx, gallbladder, cervix, and kidney were noted among North Slope women. Stutzman and Nelson concluded that changes in cancer incidence observed among North Slope residents were much more likely a result of changes in diet and behavior (especially use of tobacco), and infection with certain viruses, than a result of radiation exposure.

CONCLUSIONS AND RECOMMENDATIONS

1. The radioisotopes buried at Cape Thompson present no health risk to subsistence hunters in the area or to persons living in nearby villages. They have never presented a risk and will not present a risk if left in their present state. The small amount of radiation released by the remaining radioisotopes is completely attenuated by the soil mixed with the radioisotopes in the disposal material and by the overlying topcover. Individuals remaining atop the burial site indefinitely would experience absolutely no increased health risk of radiation-related cancer or other health problems. Given the low background radiation levels at Cape Thompson, the risk of radiation-related cancers is lower than most other places in the United States.
2. All available evidence shows that past, current, and future potential health problems of residents of Point Hope are not related to radiation exposure at Cape Thompson. Epidemiologic studies of cancer among North Slope residents and Point Hope residents have not shown an excess of the types of cancers known from studies elsewhere to be associated with radiation exposure.
3. Given that the burial site presents absolutely no health risk, there is no indication for the site to be excavated or for the small amounts of remaining materials to be removed.
4. Potential exists for serious injuries or fatalities to occur if removal is attempted. Logistics are difficult. It would be tragic if anyone suffered an injury or fatality in an effort to clean up materials that pose no health threat to any living creature.
5. Removal of the material from the tundra at Cape Thompson would require the expenditure of millions of dollars. During this investigation the situation at Cape Thompson has been reviewed with a number of radiation physicists. When queried on whether the radioisotopes should be moved, the answer was uniformly and emphatically no. Money required for the Cape Thompson cleanup could be put to much better use studying health problems of North Slope residents and addressing the significant public health problems facing Point Hope and other Alaskan villages and communities, including problems of

smoking, alcohol, and vaccine-preventible diseases.

6. Given the strength of scientific evidence, major efforts need to be focused on communicating existing information to local residents. Essential are efforts to identify credible individuals who are trusted by local residents and to support a process that enables local residents and all other Alaskans to examine all the evidence. Supplemental funds should be made available to empower the local communities to assess evidence now available so they can regain control over their lives.

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Section III. Inventory of Sources/Threats

INTRODUCTION

This section was compiled by Lyle Perrigo of the Environment and Natural Resources Institute, University of Alaska Anchorage, and identifies the major sources of radiation hazards in Alaska.

INVENTORY OF SOURCES/THREATS

Radiation and Radioisotopes used for Medical Purposes

X-rays are used for diagnostic and various therapeutic purposes. The isotope cobalt-60 with a half life of 5.27 years is often employed in the radiation treatment of various cancers. The localized radiation doses from x-ray and cobalt-60 treatments can be high, i.e. cumulative doses of several thousand roentgens (R/REM).

Isotopes such as molybdenum-99 with a half life of 66.02 hours and iodine-131 with a half life of 8.04 days, are used in certain medical diagnoses and treatments. Short half life materials are routinely produced in reactors and shipped by air to cities with hospitals that use them. For our report we should indicate that there is always the potential for a spill or accident in their movement to and use at hospitals. There are procedures for handling such spills.

My colleagues found that the Alaska Department of Health and Social Services has information about the number, location, and use of x-ray machines in Alaska. We do not have any data on the location and use of therapeutic cobalt-60 devices nor isotopes such as Mo-99 and I-131. It is our understanding that ADEC has access to this information. For any additional information, we suggest that the fastest and most effective way would be for Governor Hickel to write a letter to the Chairman of the Nuclear Regulatory Commission (NRC).

Radiation and Radioisotopes used for Industrial Purpose

Radioisotopes such as cobalt-60, iridium-192 and occasionally neutron back scattering sources using americium are used for industrial radiographic procedures to: i) determine the integrity of pipe and vessel walls, ii) study the behavior of materials, and iii) examine the effects of corrosion and erosion on wall thickness. These radiographic examinations are state-of-the-art procedures that are conducted throughout the world to ensure the safety of industrial equipment and systems.

My colleagues and I were unable to uncover any specific information via lower level NRC contacts in Washington, D.C. and on the Regional Office in San Francisco about the number and specific location of such systems in Alaska. One could infer that a number of service companies and laboratories in the state provide such support. There would be field usage from time to time at Prudhoe Bay, on platforms and pipelines in and around Cook Inlet, in the refineries At Fairbanks and Kenai, along the Trans-Alaska Pipeline with its various pump stations from the North Slope to Valdez at the terminal facilities at Valdez, at port facilities throughout the state, in power plants etc. Laboratories in Fairbanks, Juneau, and Anchorage also doubtlessly have industrial x-ray and other types of radiographic equipment that they employ routinely.

Our sources suggest that we acquire specific data and information about industrial usage in the same way that we recommended for x-ray equipment and radioisotopes employed for medical purposes. A letter from the Governor Hickel to the NRC Chairman would produce results quicker and with greater reliability than those we can generate in a short period of time by other means.

Radioisotopes Used for Lighting, Power, and Sterilization Purposes

Since the late 1950s the U.S. Department of Energy and its predecessors the Energy Research Development Administration (ERDA) and the Atomic Energy Commission (AEC) have encouraged the development, demonstration, and use of isotopes for non-military purposes. For Alaska that emphasis has meant the demonstration and use of radioluminescent airfield and public facility emergency lighting systems and RTGs for remote, high reliability systems demanding only small amounts of power. Proposals were made in the 1970s and early 1980s to demonstrate the efficacy of irradiation techniques in extending the shelf life of sea foods and sterilizing sewage sludge. To the best of our knowledge those proposals came to naught.

The radioluminescent lights (RL lights) or tritium lights are comprised of tritium (an isotope of hydrogen with a half life of 12.33 years) and a phosphor that emits light after excitation by the beta particles released in the decay process. RL lights are used world-wide in most commercial aircraft as exit lights. Well over half of the public and commercial building in Anchorage, Fairbanks, and Juneau employ RL lights for exit signs. These devices operate even when there are electrical power failures because they are self-contained and depend only upon the decay of tritium to function properly. Unofficial reports suggest that these highly reliable systems are used for runway lighting on the remote airfields at Chicken, Coldfoot, and Council, Alaska. RL-lights are candidates for use on remote runways where there is no electrical power for conventional runway lighting systems. Arrangements for the use of RL-lights on those airfields were made by the Alaska Department of Transportation and Public Facilities.

From very limited information we can infer that there are two strontium-90 Sentinel radioisotope thermal electric generators on Fairway Rock in the Bering Strait. The U.S. Navy is reported to operate those RTGs. The U.S. Air Force uses seven RTGs north of Ft. Yukon for its purposes. We have no information about the existence of any other RTGs that may be located in Alaska at the present time.

As with the other two uses of radioactive materials, our sources suggested that letters from Governor Hickel would be the quickest and most accurate means of acquiring information in the immediate future. In this case, the letters should be directed to the Secretaries of the Departments of Defense and Energy.

Other Radiation Sources and Radioactive Materials

The Department of Defense (DOD) may or may not have nuclear weapons in Alaska. We made absolutely no attempt to verify this one way or the other. It is conceivable that there are radioactive waste storage areas and it is known that the AEC and DOD conducted two or more nuclear detonations at Amchitka many years ago. We have no information about any of these possibilities or conditions at the present time.

The U.S. Army operated a small packaged power reactor at Ft. Greely about 20 years ago. That power system was decommissioned and, by reports, entombed. We have no definitive information about the disposition of the fuel that was used to power the system. That point should be pursued. There are perennial questions about the integrity of the entombment structure; we do not have sufficient information about those conditions to offer any comments.

There are rumors that the Departments of Agriculture, Commerce, and Transportation had interests in the use in Alaska of radioactive substances for one purpose or another. No information is available other than what I remember about the use of 7 RTGs at Lake Clark Pass by the Federal Aviation Administration (FAA) in the late 1970s. They were removed from Lake Clark Pass before 1981. Again, the quickest and surest way of determining what those agency interests were and are is for Governor Hickel to send a letter to the cognizant secretaries. For information about DOD usage the letter should be sent~ to the Assistant Secretary for Atomic Energy, Department of Defense.

It should be remembered that natural deposits of uranium and thorium ores could also contribute to the radiation dose that some of our citizens receive. Contact with the Bureau of Mines might produce useful information about the location of such deposits.

Section IV. Nofication

INTRODUCTION

This section was prepared by John Hensley, the State Radiological Defense Officer at the Department of Military and Veterans Affairs, Division of Emergency Services. The section describes the procedures in place for notification of federal, state and local emergency response agencies in the event of a radiological release or emergency.

NOTIFICATION

Guidelines for notifying State or local authorities of radiological emergencies are contained in the Federal Radiological Emergency Response Plan (FRERP) of 1985. This plan was developed by the Federal Emergency Management Agency (FEMA) in cooperation with eleven other federal agencies. It responded to Executive Order 12241 which provided for federal agencies to discharge their responsibilities during a wide range of peacetime radiological emergencies. All twelve agencies concurred prior to its publication as an operational plan.

The FRERP's scope covers any peacetime radiological emergency that would require a significant response by several federal agencies. The plan defines the effective period as from notification through providing State and local assistance to recover from an emergency and demobilization of the federal response. Types of incidents specifically covered are (1) fixed nuclear facilities incidents, (2) transportation incidents and (3) other incidents (nuclear powered satellite re-entry). The latter category sounds like a "catch all" grouping, but the plan specifies that responses to radiological emergencies do not necessarily depend on the initiating event. The exact cause of a problem may not become known until post-accident investigations are completed, therefore, the plan is designed to accommodate all types of peacetime radiological emergencies.

With regard to notification, the FRERP directs owner/operators of a troubled facility or radiological activity to notify the appropriate state and federal authorities of a radiological emergency. Appropriate federal authority includes the Cognizant Federal Agency (CFA). There are three federal agencies designated to perform in the CFA role: Nuclear Regulatory Commission (NRC), Department of Energy (DOE), and Department of Defense (DOD). The NRC and DOE have cognizance of facilities which they regulate and license to operate. The DOD has cognizance of military installations, facilities, and lands that may be temporarily designated as a National Defense Area or National Security Area. If there are no clear-cut reasons to designate one of these three agencies as the CFA, FEMA will make the federal notification required of a CFA.

Following CFA notification by an owner/operator of a radiological emergency, the CFA will notify FEMA through the FEMA Emergency Information Coordination Center of the following:

- Location and nature of the accident;
- Assessment of the problem's severity;

- Description of the CFA's response; and,
- Description of CFA's anticipated follow-up actions.
- Following its notification, FEMA is instructed to verify that the State has been notified by contacting the State; therefore, the plan provides for a State to be notified twice, once by the owner/operator, and again by FEMA.

Turning to the subject of State agency responsibilities, these are spelled out in a 1982 Memorandum of Understanding (MOU) between DHSS, DMVA, DEC, and DOL concerning emergency response to peacetime radiation incidents and accidents. The MOU assigns DHSS lead agency responsibility in response to peacetime radiation incidents and accidents. Each of the MOU signatories is responsible to serve as contact with their federal counterparts as follows:

Alaska Agency	Federal Counterparts
DHSS	FDA & NRC
DMVA	FEMA
DEC	EPA
DOL	OSHA

With regard to notification, the MOU stipulates that any State agency receiving notification of a radiation emergency is to notify the lead agency, DHSS. DHSS is to inform other parties to the agreements when a problem exists, or there is a potential problem within their area of responsibility. DMVA/ADES is identified as an alternate contact for notification and response coordination.

For local government notification, the primary responsibility rests with the owner/operator. Owners/operators are generally acknowledged as the first to become aware of a radiological emergency and are responsible for notifying local and State authorities so they may fulfill their primary roles in determining and implementing any measures to protect life, property, and the environment in areas outside the boundaries of fixed nuclear facilities or otherwise not under control of a federal agency.

International response coordination and notification is addressed in the FRERP only from the standpoint of U.S. domestic radiological emergencies posing a threat to neighbor nations such as Canada or Mexico. In such cases, the plan makes it incumbent on the CFA and FEMA, in consultation with the State Department and other appropriate federal agencies, to coordinate and cooperate with the affected countries. Radiological emergencies originating in neighboring countries are not specifically mentioned in the plan, but there seems little doubt that if such events were to pose a danger to the U.S., its territories, possessions, or territorial waters, the federal response to such events would utilize FRERP guidelines.

The example which defines "other incidents" within the plan's scope is a nuclear powered satellite re-entry. That statement suggests that whether a radiological hazard arrives from outer space, or is borne on the wind or ocean currents, the FRERP has application for peacetime radiological emergency response.

As in the case of domestic events, where owner/operators are expected to have earliest awareness of an emergency, in the international arena host nations should be the first to know of an internal problem. The onus, therefore, is on them to assess situations and inform those who might be threatened. For the purpose of developing this paper, ADES made a telephone inquiry to the State Department's Office of Nuclear Technology and Safeguards.

That office identified the International Atomic Energy Agency (IAEA) as having responsibility for notifying governments of nuclear releases into the atmosphere which could pose a public danger, however, the State Department could provide no information on any international agency with similar involvement in nuclear material released into the ocean.

Information which came out of a mid-October international meeting in Lulea, Sweden to discuss environmental emergencies did not differ from the information provided by the Department of State. The meeting's draft report asserted that there was no international convention on the safety of nuclear power plants or other nuclear installations, although recommendations issued by IAEA are generally recognized. The report further stated the need for a global convention on radiological accident prevention and considered it of utmost importance to assess the situation caused by the dumping of radiological wastes in the Arctic area and to consider measures to be taken. One recommended measure provided for each country to collect nationally and provide to the USA and Canada, acting as lead countries, information concerning activities capable of causing major accidents. This information would provide a beginning inventory of hazardous activities in the Arctic which could have trans-boundary effects or require international response.

Following is a list of international maritime organization instruments and other agreements to which the U.S. is a party. Some of these instruments appear to deal primarily with oil, but the complete list is furnished because current and future application can not always be determined from their present titles.

INTERNATIONAL AGREEMENTS TO WHICH THE UNITED STATES IS A PARTY

International Maritime Organization Instruments

Title	Date of Deposit
International Convention for the Safety of Life at Sea, September 7, 1974 (SOLAS 74)	September 7, 1978
Protocol of 1978 relating to the International Convention for the Safety of Life at Sea, 1974, as amended	August 12, 1980
Protocol of 1988 relating to the International Convention for the Safety of Life at Sea, 1974	July 1, 1991
Convention on the International Regulations for the Preventing of Collisions at Sea, 1972, as amended	November 23, 1976
The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978, relating thereto (MARPOL 73/78)	August 12, 1980 - with exception of Annexes December 30, 1987 for Annex V. July 1991 for Annex III
Convention of Facilitation of International Maritime Traffic, 1965, as amended	March 17, 1967

International Convention of Load Lines, 1966	November 17, 1966
Protocol of 1988 relating to the International Convention on Load Lines, 1966	July 1, 1991
International Convention of Tonnage Measurement of Ships, 1969	November 10, 1982
International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969	February 21, 1974
Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil, 1973	September 7, 1978
International Convention for Safe Containers, 1972, as amended	January 3, 1978
Convention on the International Maritime Satellite Organization (INMARSAT), as amended	February 15, 1979
Operating Agreement (COMSAT)	signatory
1989 amendments to INMARSAT Convention	September 7, 1980
1989 amendments to COMSAT Operating Agreement	
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978	July 1, 1991
International Convention on Maritime Search and Rescue	August 12, 1980
International Convention on Salvage	March 27, 1992
International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990	March 27, 1992
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, as amended	April 29, 1974
1978 amendments	October 24, 1980
International COPAS-SARSAT Programme Agreement	July 1, 1988
International Convention for the Safety of Life at Sea 1948 (SOLAS 48)	denunciation - May 26, 1966
International Convention for the Safety of Life at Sea, 1960 (SOLAS 60)	September 8, 1961
International Convention for the Prevention of the Sea by Oil, 1954, as amended	September 8, 1961

OTHER INSTRUMENTS

Title	Date of Signature
Protocol on Environmental Protection to the Antarctic Treaty	October 4, 1991
Arctic Environmental Protection Strategy	June 14, 1991

Agreement Between the Government of the United States of America and the Government of Bermuda Concerning Assistance to be Rendered on a Reimbursable Basis by the United States	July 13, 1976
Agreement of Cooperation in the Field of Environmental Protection Between the United States of America and the Union of Soviet Socialist Republics	May 23, 1972
Agreement Between Canada and the United States of America on Great Lakes Water Quality, 1978	November 22, 1978
Agreement Between the Government of the United States of America and the Government of Japan on Cooperation in the Field of Environmental Protection, 1975	August 5, 1985; amended July 31, 1985; extended "5 years and thereafter" on November 13, 1990
Convention for the Protection of the Natural Resources and Environment of the South Pacific Region	July 10, 1991
Convention for the Protection and Development of the Marine Environment of the Wider Caribbean, 1983	October 11, 1986
Agreement of Cooperation between the United States of America and the United Mexican States regarding Pollution of the Marine Environment by Discharges of Hydrocarbons and other Hazardous Substances	July 24, 1980
Protocol Concerning Cooperation in Combatting Oil in the Wider Caribbean Region, 1983	July 10, 1991
United States - France Cooperation in Oceanography	1968

Section V. Monitoring Capability

INTRODUCTION

This section was provided by Gerry Guay, Department of Environmental Conservation, Division of Environment Quality, Air Quality Management Section, with contributions by Deena Henkins, Wastewater and Water Treatment Section. The State's current capabilities to monitor or detect the presence of radiation in the environment is described.

CURRENT MONITORING CAPABILITIES

The current scope of ambient monitoring for sources of radiation in Alaska is limited. The National Oceanographic and Atmospheric Administration (NOAA) has been participating in a global, arctic research project for several years and has been documenting the existence of low level radiation near Point Barrow for the past five to ten years. The University if Alaska, Fairbanks has also identified the presence of radioactive fallout in the Arctic regions of the State. No health threatening concentrations of radioactive fallout have been detected in the State to date.

The Department of Environmental Conservation currently manages one statewide radiation monitoring network consisting of three sampling sites. These sites are part of the U.S. EPA funded ERAMS (Environmental Radiation Ambient Monitoring System) national radiation monitoring network for Alaska, which is designed to collect airborne particulate and rain water samples in the major population centers of Anchorage, Fairbanks, and Juneau. Each site consists of one particulate sampler and one rain gauge which collect one, three day and one, four day samples each week. The particulate filter under goes an initial screening for gross beta radiation and then, along with the water samples, are sent to the EPA National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama. At NAREL the samples under go additional radiation testing. If the initial field evaluation for gross beta radiation indicates a beta level above 1 picocurie that sample is further tested for gross gamma radiation. In addition, particulate samples are tested for Plutonium and Uranium (alpha and alpha/gama emitters) twice a year. The water samples are tested for Tritium, gross alpha and gross beta radiation. Once a year, usually in the spring, the water is tested for Plutonium and Uranium. All of the test results are published in a quarterly report. If a specific sample has elevated levels of radiation, the NAREL will provide immediate notification - a 30 - 60 day delay from occurrence.

Limitations of Existing System

The ERAMS monitoring stations are limited in their ability to examine potential sources of radiation. Current monitoring sites can only evaluate radioactive particulate which settle out through gravitation, are re-entrained by strong surface winds or are deposited in rainfall.

The Department does not have any method for evaluating exposure to radioactive nuclides which make their way into the food chain and are eventually consumed by the Alaskan public.

One of the biggest limitations of the present monitoring network is its inability to provide a rapid evaluation of a radiation threat. Each monitoring system must operate for three or four days before an initial screening is performed. Samples are mailed to NAREL for complete analysis once per month, with normal results available 30-60 days after initial detection. A special problem arises in the case of radionuclides with short half-lives. Iodine-131, a fusion by-product which can be found in rainfall and surface waters, has a half-life of 8 days, By the time a sample is analyzed the Iodine is no longer radioactive.

Network Improvements

To improve the State's radiation monitoring capability and provide an early warning notification, the State would need to augment the present monitoring network with the latest Pressurized Ion Chamber (PIC) monitoring systems. These monitors are designed to detect low-level gamma radiation and are being used in several other states as the backbone of their radiation compliance monitoring networks. These monitors can be set up in any location in the State which has AC power available and are designed to provide real-time measurements. Data is retrievable through telephone and satellite communication.

The Illinois Department of Nuclear Safety currently operates a network of 92 PIC monitors. Mr. Roy Wight, the radiation monitoring network manager with over nine years of experience in the radiation monitoring field, felt that the PIC monitors would meet the State's radiation monitoring needs, but indicated that there were several other radiation monitoring systems that the State might also want to consider. Mr. Wight offered an on-site orientation of his monitoring network and his staff's assistance.

The PIC radiation monitoring systems are not available through the U.S. EPA and would need to be purchased by the State. Each monitor would cost approximately $15,000. Peripheral equipment and monitoring shelters could raise these costs to over $25,000. Installation costs would run between $1,500 to $3,000 per installation and at least one full time employee would be required to manage and maintain the monitoring network.

Future Considerations

To best evaluate the radiation threat to Alaska, the State must conduct a baseline radiation study to identify the present level of contamination statewide. This process would include collecting biota, vegetation, soil sediment, and water samples from all regions of the State. Depending on the number of samples collected, the NAREL has indicated they may be able to assist in the analysis at a minimal cost to the State. If the State desires to perform its own laboratory radiation analysis, the NAREL is willing to train our chemists.

In addition to the ERAMS monitoring network there may be some other monitoring being done by the Defence Department, the University of Alaska Fairbanks, and some arctic research groups. We were not able to determine the exact nature of there sampling networks or the availability of the data they produce.

WATER MONITORING

The Department of Environmental Conservation, Drinking Water program has requirements for routine monitoring of 700 Class A public water systems. These requirements include a screening for gross alpha once every four years for each of these class A drinking water systems. The screening consists of the average of 4 quarterly samples or a composite sample. If the analysis exceeds 5 picocuries/liter of gross alpha radiation, an additional analysis for Radium 226 and 228 must be run. Surface water systems serving greater than 100,000 people (only Municipality of Anchorage) are required to monitor for manmade radioactive contaminants (gross beta, strontium-90 and tritium) quarterly for a year every four years.

While there is a specified schedule for routine monitoring of these drinking water systems, few have fully complied. In order to assist, DEC, in conjunction with EPA, has made an attempt to sample each system at least one time, although some systems may have been missed during this effort. To date, only one system (in Haines) has exceeded the gross alpha level, requiring further analysis for radium. Radium was not found, the sample was further analyzed (although not required), and the source determined to be radon. EPA is currently contemplating regulations that may require routine sampling of public drinking water systems for radon and uranium within a few years, however, neither the current monitoring requirements, nor those contemplated by EPA will be useful for detecting acute radiological releases.

The DEC laboratory has the capability to run the gross alpha analyses. If the 5 picocurie/liter threshold level is exceeded, samples would need to be sent outside for radium analyses.

Section VI. Response Capability

INTRODUCTION

This sections was prepared by John Hensley, the State Radiological Defense Officer at the Department of Military and Veterans Affairs, Division of Emergency Services. The section describes the capability of federal, state and local emergency response agencies to respond to a radiological release or emergency in Alaska.

EMERGENCY RADIOLOGICAL RESPONSE

The Radiological Defense (RADEF) Program is managed within the Department of Military and Veterans Affairs, Division of Emergency Services (ADES). The present Program Manager has been in charge of the program since 1982. The Program Manager also carries the title of State Radiological Defense Officer (RDO). He supervises, and is assisted by, a Radiological Instrument Technician. The technician operates the State's Maintenance and Calibration Facility which services all radiological civil defense instruments stored at the facility or pre-positioned with various local, State, and federal agencies throughout Alaska.

The RADEF Program's primary orientation is toward nuclear attack preparedness. Program management adheres to federal guidelines developed for nationwide application. This is 100% federally funded program; it has never received any supplemental funding from the State. The federal funds cover salaries and benefits for the two employees, operations and maintenance costs of the maintenance facility, a prorated share of the Division's administrative expenses and overhead, and a small travel budget, considering Alaska's great size and distance between local communities which the Division must service.

With respect to development of an in-state capability for radiological response, the RADEF Program has been augmented by another 100% federally funded program: Emergency Management Training (EMT). The training program, also managed within ADES, has provided all in-state emergency management training of a general and professional development nature, as well as specialized training relating to civil defense activities, of which radiological defense is a part. Funding for both the EMT and RADEF programs are renegotiated each year, along with statements of work as part of an annual Comprehensive Cooperative Agreement between the Federal Emergency Management Agency (FEMA) and the Alaska Division of Emergency Services.

The RADEF Program is made up of several components. A brief description of each follows, along with a few summary statements of achievements through the years.

Technical and Planning Assistance

Technical assistance is provided in the form of consultations and advice on mitigation, response, and recovery measures for application by State and local government agencies.

Technical assistance also includes active participation, when required, in actual field operations. Planning assistance is offered primarily to local communities in the development of Radiological Defense/Protection Annexes for inclusion in their emergency operations plans. These annexes normally cover such subjects as: Operational Control, Field Reporting, Radiological Network Communications, Shelter Safety, Instrumentation, Exposure Control, Radiation Countermeasures, Peacetime Emergency Response, and Evaluation Guides. Radiological defense/protection annexes have been drafted for approximately thirty political subdivisions. Most of them have incorporated them into their Emergency Operations Plans.

Radiological Training

Although funding for radiological training has been provided through the EMT Program, training delivery is a function of the RADEF Program Manager. He is the course manager and, in most cases, lead instructor for all radiological courses. He is often assisted by adjunct instructors such as the Radiological Instrument Technician, or specialists from other State or local government agencies, such as health physicists and experts in fire and rescue techniques. There is an ordered delivery of radiological training with the lowest level course, Radiation Monitor, considered a prerequisite to the Radiological Response Team Course. Those two courses ultimately lead to higher level courses such as Radiological Defense Officer (RDO), or Radiation Instructor. There is also a specialty course in the series entitled Aerial Radiation Monitoring. Here, techniques learned in the Radiation Monitoring Course are combined with pilot skills to enable a light aircraft and pilot to overfly remote, unpopulated areas to record existing radiation levels which result from the spread of radioactive fallout. Since 1986, 382 students have completed the Radiological Monitor Course, 312 have completed the Radiological Response Team Course, and 104 have completed the Radiological Defense Officer Course. The State RDO has also been the focal point for coordinating attendance by Alaska's State employees to the Radiological Emergency Response Operations Course, offered by FEMA and conducted by a contractor in Nevada. This is a top-notch training opportunity for state responders, and 14 State employees have attended since 1986.

Radiological Instruments

A number of changes are in progress, which will affect the posture of State managed civil defense radiological instruments. Most of the equipment is quite old, and it is becoming increasingly difficult to obtain repair parts. Whereas the RADEF Program used to oversee over 3,000 radiological instrument kits, this number has been reduced to approximately 2,200 and may even drop to 1,600 due to shortages of dosimeters and dosimeter chargers. To accomplish these reductions, the old kit types which were used for sheltering and pure radiological monitoring operations are being phased out and, where possible, their component parts used to form Hazardous Materials (HAZMAT) Response kits containing low range instruments and dosimeters as well as Emergency Worker Self-Protection Kits. These kits enable critical workers with risk exposure, to measure their accumulated dosages and to employ necessary countermeasures before acceptable exposure levels are exceeded. When these changeouts are completed, Alaska will have approximately 700 HAZMAT kits and 700 Self-Protection kits. Approximately one-third of these kits will be pre-positioned in those communities considered to be most at risk and having plans, procedures, and trained personnel to make effective use of them. There will also be approximately 200 specialty kits for unique radiological monitoring, such as Aerial Radiological Monitoring and other special applications. Most of these specialty kits will be retained in the maintenance facility and only deployed in support of increased readiness, or actual response situations.

Data Base Management

The RADEF Program Manager utilizes two FEMA developed software programs to manage information. One program, RADPRO, sections radiological protection information according to: general data, instrument inventory, personnel data, miscellaneous data, and capability assessment. The other program, Field Certification Tracking System (FCTS), compiles listings of personnel who have been trained in specific courses. Every Alaskan receiving radiation protection training since 1986 has been entered into FCTS. The database does not, however, identify which of these individuals are still in the state, which have kept their knowledge current and are available to respond to an emergency.

OTHER COMMENTS CONCERNING RESPONSE CAPABILITY

Local Government

With the assumption that all the persons that have been trained by RADEF are in place, the response to low level radiation is directly possible. If those persons are not available, the governments have in their possession checklists which outline the procedures upon which to gain technical support.

Should an incident in transportation and storage occur within the local government jurisdiction, the statewide Emergency Services (ES) System has the initial reaction and would judge on when and where to ask for help. All ES persons who have had training with RADEF would follow a pattern of responding to an incident and could call the State Health Physicist or ADES for assistance. The Department of Environmental Conservation has recently been reactive to requests for assistance in surveying for radioactive sources.

State Government

Technical support in the subject of radiation response is available from the State Health Physicist (H&SS) and from the State RAD Defense Officer (RDO).

There exists three air particulate monitoring devices in Fairbanks, Anchorage and Juneau, respectively. These devices are in place to monitor particulate matter for empirical evidence as it pertains to the "Clean Air Act". The latest status obtained verbally on the equipment, is that the Fairbanks unit is the only one fully operational. The only other particulate monitoring equipment known to RADEF is that filtration equipment operated by the University of Alaska, Fairbanks. The functional operation of that equipment has been off and on depending on maintenance support.

ADES/RADEF has provided training for government persons using the civil defense monitoring equipment and have made it available to local government response personnel as well as storage for nuclear war shelter operations. Other equipment is available in DEC, H&SS, and DOT&PF, but is only available in limited quantities. The capability is generally the same as the low level civil defense meters, except within the new kits, an alpha monitoring capability is available.

Federal Government

Within the State of Alaska, RADEF has no knowledge of training levels, equipment and locations of federal response resources. The requests for federal capability have been made to the regional office of the EPA with the following verbal reply; the only large scale capability for radiation protection that they have seen is in the FEMA supported State RADEF system.

Outside of Alaska the federal capability for radiation protection becomes quite extensive. Specific hard core response capability rests with the Department of Energy and the Military. Procedures for tapping that resource are specific and are listed in the Federal Radiological

Response Plan. This plan is extensive and will not be explored in this document, however, to reach the Department of Energy they have prepared and distributed the procedures in the document "Federal Radiological Monitoring and Assessment Program Response Procedures". Two controlled copies are in the hands of ADES and H&SS. The military capability is extensive in the lower 48, but is directed towards nuclear weapons accidents.

In discussion with the Federal Emergency Management Agency, as a Federal response coordinator, we find they promote the idea that local government and state governments should exhaust their capabilities to respond to incidents where radioactive elements are involved prior to asking for help. This position requires local and state government to generate a response capability.

The following are the federal documents that are primary in the management of radiation protection:

Function	Document
Radiation Protection	Federal Radiological Emergency Response Plan (FRERP)
Power Industry	NUREG 0654/FEMA REP 1
Transportation	FEMA REP 5
Environment	FEMA REP 12 and 13
Military Weapons	NARP/DOD 5100.52-M

Secondary documents abound on various side elements of radiation protection concerning support by federal department and will not be listed here as there are consolidated publi- tion lists available.

Recommendations

The Conference of Radiation Control Program Directors Inc. (CRCPD) interviewed officials in Alaska during the week of November 2, 1992. The conference was established to exchange information and form a collective of states with the federal government. The CRCPD formulates suggested state regulations and will suggest individual state profiles encompassing: Organization structure, budget, personnel, equipment, computers, emergency response, environmental surveillance and x-ray compliance. In addition, suggestions on a radiation health communications network will be made.

Suggestions

Based upon the results of the CRDPD report, update the following legislation:

Title 18	Health and Safety
Article 5	Radiation Protection
Section 475	Powers and duties of the Department of Health and Social Services
(1) Implement Regulations	
Title 46	Water, Air, Energy and Environmental Conservation
Chapter 3	Environmental Conservation
Article 5	Radiation and Hazardous Waste
Protection	
Title 26	Military and Veterans Affairs
Chapter 20	Civil Defense
Chapter 23	Alaska Disaster Act.

- Create local government authorities and responsibilities to respond to radiation incidents.
- Create state single managership of response to radiation incidents.
- Have the State generate funding support for RADEF to supplement its limited budget.

Section VII. Legal Analysis

INTRODUCTION

This sections was prepared by Marie Sansone, Department of Law, Civil Division, and describes the regulation of nuclear facilities and materials by the U.S. Nuclear Regulatory Commission, the problem of radioactive waste, and legal responsibility for emergency response preparedness.

The report addresses a broad spectrum of issues involving radiation, from the safety of dental x-ray machines to the safety of nuclear submarines operating off our coastline, from federal facilities to fallout from activities in the former Soviet Union. Given this range of issues, a comprehensive treatment of the law related to radiation is impossible. The following discussion, therefore, highlights the regulation of nuclear facilities and materials by the U.S. Nuclear Regulatory Commission, the problem of radioactive waste, and emergency response planning and preparedness. In addition, the appendices to this section consist of annotated reference lists of state and federal statutes, judicial decisions, and legal treatises and journal articles to assist with further legal research.

ATOMIC ENERGY ACT OF 1954

Congress first authorized civilian application of atomic power with the Atomic Energy Act of 1946, ch. 724, 60 Stat. 755, at which time the Atomic Energy Commission was created. The use, control, and ownership of nuclear technology, however, remained a federal monopoly until 1954, when Congress passed the Atomic Energy Act of 1954. Ch. 1073, 68 Stat. 919, as amended, 42 U.S.C.S. §§ 2011 — 2296 (1989 & Supp. 1992). The primary purpose of the 1954 Act was to promote the technological development of nuclear power. The Act allowed the private construction, ownership, and operation of commercial nuclear power reactors under the strict supervision of the Atomic Energy Commission. The Act gave the Commission exclusive jurisdiction to license the transfer, delivery, receipt, acquisition, possession, and use of nuclear materials.

In 1959, Congress amended the Atomic Energy Act to provide the states a role in regulating nuclear materials. Pub. L. No. 86-373, 73 Stat. 688, as amended 42 U.S.C.S. § 2021 (1978 & Supp. 1992). Section 274(b) authorizes the Atomic Energy Commission (now the Nuclear Regulatory Commission) to enter into agreements with state governors to transfer authority to the states for control over byproduct and source materials and special nuclear materials in quantities not sufficient to form a critical mass.[1] Throughout the duration of the agreement, the state, known as an "Agreement State," maintains the authority to regulate the materials covered by the agreement for the protection of the public health and safety from radiation hazards. State programs are required to be "coordinated and compatible" with those of the the Nuclear Regulatory Commission. Under section 274(c), the Commission retains authority with respect to the construction and operation of any production or utilization facility and the disposal of byproduct and source materials and special nuclear materials. 42 U.S.C.S. § 2021 (1978 & Supp. 1992).

In 1974, Congress reorganized the Atomic Energy Commission by dividing its safety and promotional responsibilities, authorizing the Energy Research and Development Administration (ERDA) to develop the efficiency and reliability of all energy sources, and creating the Nuclear Regulatory Commission to perform the regulatory and licensing functions of the Atomic Energy Commission. The 1974 Act also expanded the number and range of the Commission's safety responsiblities. Pub. L. No. 93-438, 88 Stat. 1233, 42 U.S.C.S. §§ 5801 — 5891 (1982). ERDA's functions were transferred in 1977 to the Department of Energy. 42 U.S.C.S. § 7151a (1989).

NUCLEAR WASTE POLICY

With the Nuclear Waste Policy Act of 1982, 42 U.S.C.S. §§ 10101 — 10270 (1989 & Supp. 1992), Congress sought to address the many problems associated with the generation of nuclear waste by commercial power plants and military reactors. The Act specifies the federal responsibility and policy for the disposal of high-level waste and spent nuclear fuel, and defines the relationship between the federal government and state governments with respect to such waste and spent fuel. It also provides for the safe stabilization and long term protection of sites for the disposal of low-level radioactive wastes.

Subchapter I of the Act, which is divided into four parts, concerns the disposal and storage of radioactive waste. Part A authorizes the Department of Energy to construct a permanent, deep geologic disposal repository for high-level waste and spent nuclear fuel. In 1987, Congress designated Yucca Mountain, Nevada, as the sole repository site in the United States. Part B provides for an interim storage program for temporary storage of limited amounts of spent nuclear fuel. Part C authorizes the Department of Energy to study the Monitored Retrievable Storage (MRS) concept and to develop MRS as an alternative plan to the long-term storage of nuclear waste. The MRS concept calls for the repackaging and continuous monitoring of nuclear waste stored at an MRS facility until it is retrieved for transfer to a permanent repository. Part D authorizes the Nuclear Regulatory Commission to require the licensees of low-level radioactive waste sites to provide bonds, sureties, or other financial arrangements for the completion of decontamination, decommissioning, site closure, and reclamation of sites, structures, or equipment used in connection with the waste.

Subchapter II of the Act concerns research, development, and demonstration projects for high-level radioactive waste and spent nuclear fuel. Subchapter III contains various administrative provisions. It creates an Office of Civilian Radioactive Waste Management in the Department of Energy to administer the Act. It also creates a Nuclear Waste Fund, funded by fees assessed commercial nuclear power plants, to pay the costs of implementing the Act. This subpart also requires the Secretary of Energy to prepare a comprehensive report, known as the "Mission Plan," on the repository program and the research projects authorized by the Act.

LOW-LEVEL RADIOACTIVE WASTE

Each year, the United States produces millions of cubic feet of low-level radioactive waste; yet, since 1979, only three disposal sites — those in Nevada, South Carolina, and Washington — have been in operation. Waste generated throughout the rest of the country must be shipped to one of these three sites for disposal. In 1979, both the Nevada and Washington sites were forced to shut down after serious transportation-related incidents, leaving only the

South Carolina site in which to dispose of all the low-level radioactive waste produced in the country. The governor of South Carolina ordered a 50 percent reduction in the amount of waste that his state's plant would accept for disposal. Similarly, the governor of Washington threatened to close the Washington facility entirely unless some progress was made toward the development of a regional disposal solution. Faced with the prospect that the nation might be left without any disposal sites, Congress in 1980 enacted the Low-Level Radioactive Waste Policy Act (1980 Act), Pub. L. No. 96-573, 94 Stat. 3347. As a result of the 1980 Act, three regional compacts formed around Nevada, South Carolina, and Washington were approved. The 1980 Act would have allowed the compacting states to exclude waste from non-member states, and by 1985, 31 states were left with no assured outlet for their wastes. In response to this continuing problem, Congress passed the Low-Level Radioactive Waste Policy Amendments Act of 1985 (1985 Act), 42 U.S.C.S. §§ 2021b — 2021g (Supp. 1992). See New York v. United States, ___ U.S. ___, 112 S.Ct. 2408, 120 L.Ed.2d 120 (1992).

The 1985 Act declares a federal policy of holding each state "responsible for providing, either by itself or in cooperation with other states, for the disposal of low-level radioactive waste generated within the state," including certain waste generated by the federal government and waste generated outside the state, but accepted for disposal within the state. 42 U.S.C.S. § 2021c.

The States of Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, and Wyoming have entered into the Northwest Interstate Compact on Low-Level Radioactive Waste Management. In Alaska, the compact was enacted into law in 1983 at AS 46.45.010. Under AS 46.45.020, the commissioner of environmental conservation is authorized to adopt regulations and perform all other acts necessary or incidental to carry out the compact.

Apart from the provisions relating to the states' obligation to provide for the disposal of low level radioactive waste, the 1985 Act provides that an Agreement State has authority to regulate the disposal of low-level radioactive waste under the terms of the agreement. "Low-level radioactive waste" consists of radioactive material that is not high-level radioactive waste, spent nuclear fuel, or byproduct material as defined in the Atomic Energy Act of 1954, and that the Nuclear Regulatory Commission classifies as low-level radioactive waste. 42 U.S.C.S. § 2021b. The State of Alaska is not an Agreement State. The requirements to become an Agreement State are found in the Atomic Energy Act of 1954, described above.

EMERGENCY PREPAREDNESS AND RESPONSE

The Federal Radiological Emergency Response Plan (Federal Plan), published by the Federal Emergency Management Agency (FEMA), in 1985, assigns 12 federal agencies[2] principal roles in responding to peacetime radiological emergencies at fixed nuclear facilities, transportation accident sites, and other incidents such as nuclear-powered satellite re-entry. 50 Fed. Reg. 46,551 (1985). For activities outside the boundaries of fixed nuclear facilities and for the area affected by a transportation accident involving radioactive materials, FEMA regulations published at 44 C.F.R. 351 control. These regulations establish federal agency roles, and assign the federal agencies tasks regarding federal assistance to states and local governments in their emergency response planning and preparedness.

The Federal Plan assigns a Lead Federal Agency responsibility for protecting the public and the environment at the accident site, and assigns the state and local governments responsibility for protecting the public and the environment beyond the site. Nonetheless, the state governor is responsible for the health, safety, and welfare of individuals within the territorial limits of the state during periods of emergency and crisis, and is expected to direct measures to be taken to meet that responsibility. In the State of Alaska, the Department of Health and Social Services, the Department of Environmental Conservation, the Department of Labor, and the Division of Emergency Services in the Department of Military and Veterans' Affairs are primarily responsible for responding to radiological emergencies.

Under the Federal Plan, for a fixed nuclear facility owned, authorized, or regulated by a federal agency, or for a transportation accident involving materials shipped by a federal agency, the onsite emergency response is the responsibility of that federal agency. For example, the Department of Defense is charged with the safe handling, storage, and transportation of nuclear weapons, nuclear weapon components, and other radioactive material in the department's custody. The Department of Defense is also responsible for the safe operation of its facilities, including nuclear facilities and installations such as missile bases, nuclear submarines, and weapons storage sites. The Department of Energy owns and contracts for the operation of a variety of fixed nuclear facilities throughout the United States, such as research and weapons production facilities. The Department of Energy is responsible for emergency response involving these facilities, or any nuclear weapons, materials, or devices in its custody. The Nuclear Regulatory Commission regulates the use of byproduct, source, and special nuclear material, including activities at commercial power plants, research nuclear facilities, and fuel processing centers, and therefore, is the lead federal agency for emergency response at those facilities. In an Agreement State, the state agency with regulatory authority assumes the onsite role normally assigned a federal agency for all the activities that the state regulates.

When radioactivity originating in a foreign country poses an actual or potential threat in the United States, such as during the Chernobyl accident or during nuclear testing by foreign countries, the Environmental Protection Agency (EPA) leads the federal response. EPA also directs the federal response for emergencies involving domestic sources of radiation that are not regulated by the Department of Defense, the Department of Energy, the Nuclear Regulatory Commission, or Agreement States.

CONCLUSION

The state statutes and regulations pertaining to radiation hazards have not been updated in some time. In many instances, they date back to the late 1970s and early 1980s. There have been many developments in federal law, as well as in nuclear science since that time. As a result of the Alaska State Emergency Response Commission's review of the radiation hazards in the State of Alaska, it may prove necessary or helpful to propose amendments to state law. We would be happy to assist in preparing any revisions or in answering any questions related to specific areas of concern.

NOTES

[1] "Byproduct material" means "(1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." 42 U.S.C.S. § 2014(e)(Supp. 1992).

"Source material" means "(1) uranium, thorium, or any other material which is determined by the Commission pursuant to the provisions of section 2091 of this title to be source material; or (2) ores containing one or more of the foregoing materials, in such concentration as the Commission may by regulation determine from time to time." Id., § 2014(z) (1978).

"Special nuclear material" means "(1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 2071 of this title, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material." Id., § 2014(aa).

[2]The 12 agencies are the Departments of Commerce, Defense, Health and Human Services,

Appendices to Legal Analysis section

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County of Esmeralda v. United States, 925 F.2d 1216 (9th Cir. 1991) (denial of county's request to be designated nuclear waste repository project).

Kerr-McGee Chemical Corp. v. City of West Chicago, 914 F.2d 820 (7th Cir. 1990) (city had power to reject certain aspects of chemical company's project that violated city's erosion and sedimentation code, if they did not directly involve radiation hazards, including those Inextricably intermixed with nonradiation hazards, and that were not selected by city for scrutiny to frustrate project as a whole).

Nevada v. Burford, 918 F.2d 854 (9th Cir. 1990), cert. denied, Nevada v. Jamison, 111 S.Ct. 2052, 114 L.Ed.2d 458 (1991) (site characterization studies under Nuclear Waste Policy Act).

Nevada v. Watkins, 914 F.2d 1545 (9th Cir. 1990), cert. denied, 111 S.Ct. 1105, 113 L.Ed.2d 215 (1991) (high-level radioactive waste repository, state's rights).

Public Citizen v. Nuclear Regulatory Commission, 901 F.2d 147 (D.C. Cir. 1990), cert. denied, Nuclear Management and Resources Council, Inc. v. Public Citizen, 111 S.Ct. 536, 112 L.Ed.2d 546 (1990) (NRC required to promulgate regulations compelling nuclear power plant licensees to create personnel training programs).

Amoco Oil Co. v. Borden, Inc., 889 F.2d 664 (5th Cir. 1989) (radioactive materials are hazardous substances under CERCLA).

Natural Resources Defense Council v. United States, 824 F.2d 1258 (1st Cir. 1987) (EPA standards for long-term disposal of high level radioactive waste found inadequate).

Nevada v. Herrington, 827 F.2d 1394 (9th Cir. 1987) (state's independent evaluation of nuclear waste siting activities).

Allen v. United States, 816 F.2d 1417 (10th Cir. 1987), cert. denied, 484 U.S. 1004, 108 S.Ct. 694, 98 L.Ed.2d 647 (1988) (Atomic energy Commission, in planning and conducting open-air atomic bomb tests in Nevada in the 1950s and 1960s, was making policy judgments protected by the discretionary function exception to the Federal Tort Claims Act).

Tennessee v. Herrington, 806 F.2d 642 (6th Cir. 1986), cert. denied, 480 U.S. 946, 107 S.Ct. 1604, 94 L.Ed.2d 790 (1987) (state participation in selecting sites for monitored retrievable nuclear waste storage facility).

Maine v. Herrington, 790 F.2d 1 (1st Cir. 1986) (state's comments on nuclear waste storage sites).

Nevada ex rel. Loux v. Herrington, 777 F.2d 529 (9th Cir. 1985) (state's statutory rights under Nuclear Waste Policy Act).

Jersey Cent. Power & Light Co. v. Lacey, 772 F.2d 1103 (3d Cir. 1985), cert. denied, 475 U.S. 1013, 106 S.Ct. 1190, 89 L.Ed.2d 305 (1986) (township ordinance prohibiting importation of radioactive waste for purposes of storage preempted by Hazardous Materials Transportation

Act).

Duke Power Co. v. United States, 770 F.2d 386 (4th Cir. 1985) (nuclear safety and the Nuclear Regulatory Commission).

Brown v. Kerr-McGee Chemical Corp., 767 F.2d 1234 (7th Cir. 1985), cert. denied, 475 U.S. 1066, 106 S.Ct. 1378, 89 L.Ed.2d 604 (1986) (Atomic Energy Act preempts state law injunction to remove nonradioactive hazards when nonradioactive and radioactive materials are inseparable).

Texas v. United States, 764 F.2d 278 (5th Cir. 1985), cert. denied, 474 U.S. 1008, 106 S.Ct. 531, 88 L.Ed.2d 463 (nuclear waste repository sites).

County of Suffolk v. Long Island Lighting Co., 728 F.2d 52 (2d Cir. 1984) (responsibility to regulate and enforce safety aspects of nuclear energy power plants sole province of Nuclear Regulatory Commission).

Pennsylvania v. General Public Utilities Corp., 710 F.2d 117 (3d Cir. 1983) (property damage resulting from radioactive air contaminants).

County of Rockland v. United States, 709 F.2d. 766 (2d Cir. 1983), cert. denied, 464 U.S. 993, 104 S.Ct. 485, 78 L.Ed.2d 681 (Nuclear Regulatory Commission emergency preparedness regulations).

McKay v. United States, 703 F.2d 464 (10th Cir. 1983) (private civil actions for damages incurred upon property bordering manufacturing facility allowed).

Washington State Building and Construction Trades Council v. Spellman, 684 F.2d 627 (9th Cir. 1982), cert. denied, Don't Waste Washington Legal Defense Foundation v. Washington, 461 U.S. 913, 103 S.Ct. 1891, 77 L.Ed.2d 282 (1983) (state statute that closes borders of state to entry of low-level radioactive waste originating outside state is invalid as violation of Commerce Clause and Supremacy Clause).

Illinois v. Kerr-McGee Chemical Corp., 677 F.2d 571 (7th Cir. 1982), cert. denied, 459 U.S. 1049, 103 S.Ct. 469, 74 L.Ed.2d 618 (failure of state to enter into agreement with Nuclear Regulatory Commission under Atomic Energy Act does not lessen state regulatory authority over non-radiation hazards).

Susquehanna Valley Alliance v. Three Mile Island, 619 F.2d 231 (3d Cir. 1980), cert. denied, General Public Utilities Corp. v. Susquehanna Valley Alliance, 449 U.S. 1096, 101 S.Ct. 893, 66 L.Ed.2d 824 (1981) (discharge of intermediate level radioactive waste following nuclear power plant incident, NEPA and Clean Water Act).

Akron, C. & Y. R. Co. v. Interstate Commerce Comm'n, 611 F.2d 1162 (6th Cir. 1979), cert. denied, 449 U.S. 830, 101 S.Ct. 97, 66 L.Ed.2d 34 (1980) (DOT and NRC have exclusive authority to promulgate industry-wide standards for carriage of radioactive materials; ICC may allow individual carriers to make more stringent rules for their own carriage).

Minnesota v. Nuclear Regulatory Comm'n, 195 U.S. App. D.C. 234, 602 F.2d 412 (1979) (nuclear waste disposal).

Natural Resources Defense Council, Inc. v. Nuclear Regulatory Comm'n, 582 F.2d 166 (2d Cir. 1978) (given progress toward development of disposal facilities and availability of interim storage, NRC could continue to license new reactors).

York Committee for Safe Environment v. United States, 174 U.S. App. D.C. 29, 527 F.2d 812 (1975) (level of radioactive material in effluent).

Northern States Power Co. v. Minnesota, 447 F.2d 1143 (8th Cir. 1971), aff'd, 405 U.S. 1035, 92 S.Ct. 1307, 31 L.Ed.2d 576 (1972) (federal government has sole authority under doctrine of preemption to regulate radioactive waste releases from nuclear power plants to exclusion of states).

Federal District Courts

O'Conner v. Commonwealth Edison Co., 748 F. Supp. 672 (C.D. Ill. 1990) (federal safety standards at nuclear plants).

Borough of Maywood v. United States, 679 F. Supp. 413 (D.N.J. 1988) (local planning boards decisions to deny subdivision and site plan approval for private conveyance of land to United States for use as temporary repository for radioactive waste preempted).

Tennessee v. Herrington, 626 F.Supp. 1345 (M.D. Tenn. 1986) (cooperation of state in selecting monitored retrievable storage system).

Citizens for an Orderly Energy Policy, Inc. v. Suffolk County, 604 F. Supp. 1084 (D.N.Y. 1985) (school district and nonprofit corporation had standing to challenge county's lack of participation in off-site emergency evacuation planning for nuclear power facility).

Legal Environmental Assistance Foundation, Inc. v. Hodel, 586 F. Supp. 1163 (E.D. Tenn. 1984) (RCRA applies to nuclear weapons plant, except as to nuclear and radioactive materials).

United Nuclear Corp. v. Cannon, 553 F. Supp. 1220 (D.R.I. 1982) (Atomic Energy Act preempts state statute requiring nuclear power company to post bond with state for 20 year period to cover any costs expended by state to decontaminate area surrounding company's facilities, since statute is attempt at simultaneous versus seriatim regulation).

State Courts

Northern California Ass'n to Preserve Bodega Head & Harbor, Inc. v. Public Utilities Comm'n, 390 P.2d 200 (Cal. 1964) (federal government has not preempted the question of safety of location of atomic reactors).

Marshall v. Consumers Power Co., 237 N.W.2d 266 (Mich. App. 1975) (state is preempted from regulating those matters that deal with radioactive hazards but not from regulating nonradiological hazards).

Maryland Heights Leasing, Inc. v. Mallinckrodt, Inc., 706 S.W.2d 218 (Mo. App. 1985) (owners of property adjoining plant that produces nuclear and radioactive pharmaceuticals and medical supplies denied state court injunctive relief against plant for radiation hazards, since, under the Atomic Energy Act, public protection from radiation hazards is exclusively a federal concern).

Bennett v. Mallinckrodt, Inc., 698 S.W.2d 854 (Mo. App. 1985), cert. denied, 476 U.S. 1176, 106 S.Ct. 2903, 90 L.Ed.2d 989 (1986) (federal law does not preempt state law remedies for radiation injuries, and does not preclude state law actions for negligence, assault and battery, and strict liability resulting from exposure to radioactive emissions).

Public Interest Research Group of New Jersey, Inc. v. State, 377 A.2d 915 (N.J. Super. 1977), certification denied, 384 A.2d 517 (given comprehensive nature of federal legislation and regulations, state commissioner had no authority under state Coastal Area Facility Review Act to make independent judgment as to ability of plant facility to protect against radiation hazards either from operation of plant or from handling of radioactive waste).

State v. Jersey Cent. Power & Light Co., 351 A.2d 337 (N.J. 1976) (state does not have right to seek damages for destruction of fish by thermal pollution due to alleged negligence in operation of nuclear power plant pump).

Wyatt v. Kundert, 375 N.W.2d 186 (S.D. 1985) (low-level radioactivewaste, federal versus state authority).

STATE STATUTES AND REGULATIONS

AS 11.46.490(8)	Defines "widely dangerous means" to include radioactive material. This term is used in AS 11.46.480(a)(2), establishing the elements of criminal mischief in the first degree, a class B felony, and AS 11.46.482(a)(3), criminal mischief in the second degree, a class C felony.
AS 18.45	Atomic energy; U.S. licenses or permits required; facilities siting permits; transportation of nuclear waste material; atomic industrial development; injunctive proceedings; intergovernmental cooperation; definitions.
AS 18.60	Radiation protection; powers and duties of Department of Health and Social Services; radiation sources; notification of violation and order of abatement; authority of department in case of emergency; assisting other agencies; exceptions; penalties; definitions.
AS 21.69.650	National emergency provisions to allow continued operation of domestic insurers in the event of a nuclear disaster.
AS 26.23.120 26.23.130	Interstate Civil Defense and Disaster Compact.
AS 29.35.500	Municipal reporting programs for hazardous chemicals, materials, and wastes include radioactive materials.

AS 36.30.735	Restriction on contracting with or employing experts on radiation hazards.
AS 41.98.110	Western Interstate Nuclear Compact. 41.98.150
AS 44.99.120 —	Nuclear Freeze Policy. 44.99.125
AS 46.03.250	Authorizes DEC to adopt regulations relating to low level radioactive materials.
AS 46.03.260	DEC permit for discharge of low level radioactive materials.
AS 46.03.865	Authority of DEC in cases of emergency resulting from actual or imminent discharge of low level radioactive materials.
AS 46.03.900	Defines atomic radiation and low level radioactive materials.
AS 46.45	Northwest Interstate Compact on Low Level Radioactive Waste Management.

REGULATIONS

8 AAC 05.120	Minors excluded from occupations involving exposure to radioactive substances and ionizing radiations.
13 AAC 04.250	Vehicles transporting radioactive materials.
18 AAC 60.910	Solid waste management regulations definitions of hazardous waste and low level radioactive waste includes radioactive materials; definition of solid waste excludes source, special nuclear or byproduct material as defined in the Nuclear Waste Policy of 1982, Pub. L. No. 97-425.
18 AAC 63.900	Siting of hazardous waste management facilities. Definition of release excludes release of source, byproduct, or special nuclear material.
18 AAC 78.005(f)	Underground storage tanks containing radioactive material. Certain provisions apply; UST exempt from others.
18 AAC 80	Drinking water standards, sections 70, 230, 240, 250, 260, 310, and 990.
18 AAC 85	Radiation protection.

FEDERAL STATUTES

7 U.S.C.S. § 450j (1992) (contamination of milk).

15 U.S.C.S. § 272 (1992) (National Institute of Standards and Technology may investigate ionizing and non-ionizing radiation and radioactive substances, their uses, and ways to protect people, structures, and equipment from their harmful effects).

21 U.S.C.S. § 342 (1984) (adulterated food).

21 U.S.C.S. § 453(g) (1984) (adulterated poultry).

Nuclear Non-Proliferation Act of 1978, 22 U.S.C.S. §§ 3201 — 3282 (1982 & Supp. 1992) (international cooperation to ensure worldwide development of peaceful nuclear activities).

Occupational Safety and Health Act of 1970, 29 U.S.C.S. §§ 653, 655, 657 (1990) (occupational health and safety standards include standards for ionizing radiation and nonionizing radiation; hazardous waste operations and emergency response).

Clean Water Act, 33 U.S.C.S. § 1311(f) (Supp. 1992) (discharge of radiological agents and high level radioactive waste into navigable waters illegal).

Marine Protection, Research, and Sanctuaries Act of 1972, 33 U.S.C.S. §§ 1401 — 1445 (1987 & Supp. 1992) (regulates ocean dumping of radioactive materials and radioactive waste).

42 U.S.C.S. § 241 (Supp. 1992) (research on biological effects of ionizing radiation).

Radiation Control for Health and Safety Act of 1968, 42 U.S.C.S. §§ 263b — 263n (1989 & Supp. 1992) (electronic product radiation control).

Safe Drinking Water Act, 42 U.S.C.S. §§ 300f et seq. (1991) (contaminants include any radiological substance in water).

Atomic Energy Act of 1954, 42 U.S.C.S. §§ 2011 — 2296 (1989 & Supp. 1992) (atomic energy and atomic weapons control).

42 U.S.C.S. § 2021a (Supp. 1992) (nuclear waste storage or disposal facilities, state participation).

Low-Level Radioactive Waste Policy Amendments Act of 1985, 42 U.S.C.S. §§ 2021b — 2021g (Supp. 1992) (disposal of low-level radioactive waste).

Energy Reorganization Act of 1974, 42 U.S.C.S. §§ 5801 — 5891 (1989) (establishes Nuclear Regulatory Commission).

Federal Facilities Compliance Act of 1992, Pub. L. No. 102-386, ___ Stat. ___, amending scattered sections of the Solid Waste Disposal Act, 42 U.S.C.S. §§ 6901 et seq. (1982 & Supp. 1992) (mixed hazardous and radioactive wastes at federal facilities, compliance with the Solid Waste Disposal Act (Resource Conservation and Recovery Act)).

42 U.S.C.S. § 7133 (1989) (U.S. Department of Energy responsibilities, including environmental responsibilities, international programs, national security functions, and nuclear waste management).

42 U.S.C.S. § 7158 (1989) (naval reactor and military application programs).

Clean Air Act, 42 U.S.C.S. §§ 7412, 7422 (1989 & Supp. 1992) (lists radionuclides as hazardous substances; radioactive air pollutants).

Uranium Mill Tailings Radiation Control Act of 1978, 42 U.S.C.S. §§ 7901 — 7942 (1989 & Supp. 1992).

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C.S. §§ 9601 — 9677 (1989) (radioactive materials are hazardous substances under CERCLA; definition of "release" excludes release of source, byproduct, or special nuclear material as defined in Atomic Energy Act of 1954 and special nuclear material from any processing site designated under the Uranium Mill Tailings Radiation Control Act of 1978).

Nuclear Safety Research, Development, and Demonstration Act of 1980, 42 U.S.C.S. §§ 9701 — 9708 (1989) (establishes federal program to improve safety of nuclear powerplants).

Consumer-Patient Radiation Act Health and Safety Act of 1981, 42 U.S.C.S. §§ 10001 — 10008 (1989 & Supp. 1992) (safety of medical and dental radiologic procedures).

Nuclear Waste Policy Act of 1982, 42 U.S.C.S. §§ 10101 — 10270 (1989 & Supp. 1992) (disposal and storage of high-level radioactive waste, spent nuclear fuel, and low-level radioactive waste; defines relationship between federal government and state governments with respect to such waste and spent fuel).

Hazardous Materials Transportation Uniform Safety Act of 1990, 49 U.S.C.S. §§ 1801 — 1819 (1990 & Supp. 1992) (transportation of radioactive materials).

Federal Civil Defense Act of 1950, 50 U.S.C.S. § 2251 (Supp. 1992) (civil defense from attack and natural disasters) (Atomic Energy Act of 1946 unaffected, 42 U.S.C.S. § 2262 (1989).

Radiation Exposure Compensation Act, Pub. L. No. 101-426, 104 Stat. 920, as amended, Act of Nov. 5, 1990, Pub. L. No. 101-510, 104 Stat. 1835, 1837 (compensation for individuals exposed to radiation during government's atmospheric nuclear tests).

Omnibus Low-Level Radioactive Waste Interstate Compact Consent Act, Pub. L. No. 99-240, 99 Stat. 1859 (1986) (congressional consent to interstate compacts; section 221, Northwest Interstate Compact on Radioactive Waste Management includes Alaska).

MULTILATERAL TREATIES

Convention on early notification of a nuclear accident. Done at Vienna, Sept. 26, 1986; entered into force, Oct. 27, 1986; for the United States, with declarations, Oct. 20, 1988. TIAS.

Convention on assistance in the case of a nuclear accident or radiological emergency. Done at Vienna, Sept. 26, 1986; entered into force, Feb. 26, 1987; for the United States, with declarations, Oct. 20, 1988. TIAS.

Convention on the physical protection of nuclear materials, with annex. Done at Vienna, Oct. 26, 1979; entered into force, Feb. 8, 1987. TIAS.

Treaty on the prohibition of the emplacement of nuclear weapons and other weapons of mass destruction on the seabed and the ocean floor and in the subsoil thereof. Done at Washington, London, and Moscow, Feb. 11, 1971; entered into force, May 18, 1972. 23 UST 701; TIAS 7337; 955 UNTS 115.

Treaty on the Non-Proliferation of Nuclear Weapons. Done at Washington, London, and Moscow, July 1, 1968, entered into force, Mar. 5, 1970. 21 UST 483; TIAS 6839; 729 UNTS 161.

Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space, and Under Water. Done at Moscow, Aug. 5, 1963; entered into force, Oct. 10, 1963. 14 UST 1313; TIAS 5433; 480 UNTS 43.

Statute of the International Atomic Energy Agency. Done at New York, Oct. 26, 1956; entered into force, July 29, 1957. 8 UST 1093; TIAS 3873; 276 UNTS 3.

Appendices

LETTER FROM GOVERNOR WALTER J. HICKEL

Included is a copy of the letter from Governor Walter J. Hickel to the State Emergency Response Commission requesting a review of radiological threats and release response preparedness in Alaska.

REVIEW OF ALASKA'S RADIATION PROTECTION ACTIVITIES BY THE CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS, INC.

Coincident with the Governor's request for this review of radiological threats and release response preparedness, the Conference of Radiation Control Program Directors sent a team of federal and state radiation control practitioners to Alaska to perform a review of Alaska's radiation control program. Their review and recommendations are included in this appendix.

COMMENTS BY JESLIE KALEAK, SR., MAYOR NORTH SLOPE BOROUGH

The State Emergency Response Commission requested of Mayor Jeslie Kaleak, Sr. that the North Slope Borough review and comment on a draft of this report. Their review and recommendations are included in this appendix.

LETTER FROM GOVERNOR WALTER J. HICKEL

Copy of letter dated September 25, 1992 from Governor Walter J. Hickel to the State Emergency Response Commission requesting a review of radiological threats and release response preparedness in Alaska.

WALTER J. HICKEL
GOVERNOR

P.O. Box 110001
Juneau, Alaska 99811-0001
(907) 465-3500

STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

September 25, 1992

Commissioner John A. Sandor, Chairman
Major General Hugh Cox, Vice Chairman
State Emergency Response Commission
410 Willoughby Avenue, Suite 105
Juneau, Alaska 99801-1795

Dear John and Hugh,

In your role as chairman and vice-chairman of the State Emergency Response Commission, I'm writing to ask you and the Commission to lead an immediate review of radiological threats facing Alaskans, and the preparedness of our federal, state, and local agencies to respond to these threats.

I would like a status report in 90 days so that if state legislation is necessary, we can propose it in January.

I am asking for this review because of the recent revelations in the hearing held by Senator Murkowski and the Senate Select Committee on Intelligence concerning Arctic radiation as well as the discovery of a 30-year old radioactive waste dump at Cape Thompson near Point Hope. In addition, it was news to me and many Alaskans that Radioisotope Thermal Generators (RTG's) are employed by the U.S. Air Force and the Navy on Alaskan soil without any consultation with state agencies.

We cannot say today what effect, if any, radiation from nuclear testing, operations, or waste disposal may have had on Alaskans' health or the environment. We deserve to know. Some activities have taken place in secret, or have been forgotten. We deserve to know those facts as well. Given the fears I have heard voiced by many Alaskans around the state, we must act quickly to identify risks and to respond to them. We must also communicate these risks with the public in a trustworthy, understandable way.

Because the SERC includes representation from every state agency directly concerned with health and radiological protection, including your departments and the Departments of Health and Social Services and Labor, I believe this Commission is well constituted to undertake this charge. I recently appointed Pt. Hope Mayor Ray Koonuk to the Hazardous Substance Spill Technology Review Council, which met this week, and he may be able to support your efforts where new tools are necessary or research is needed.

In further support of improved preparedness, I intend to follow up on our request for better notification and joint response plans with Russia for nuclear incidents that may arise in the Arctic. A nuclear power plant operating in the Chukotka Peninsula is closer to some parts of Alaska than those places are to Juneau. Past waste disposal practices and possible resumption of underground nuclear testing in the Russian Arctic may also be a cause for concern.

As you are already aware, The Northern Forum and the Arctic Environmental Protection Strategy have projects underway to expand environmental monitoring and to increase emergency response capability. We want to encourage both our federal government and the Russian government to better support these international agreements. We may need to push to speed up monitoring efforts, for example. Your review will help define exactly what the state should ask for from these efforts and from U.S. implementation of the Russian Aid package.

I've asked Dr. Luis Proenza, vice president of the University of Alaska, a member of the U.S. Arctic Research Commission, and my science advisor, to explain to the SERC the research program the University has proposed to better define the threats from Russia. Senator Murkowski has worked successfully to see these concerns are included in the Russian Aid package. I've asked Mr. John Katz, in our Washington office, to brief our congressional delegation and appropriate federal agencies on this review, and to gain further support.

Thank you for taking on this task. We look forward to your report.

Sincerely,

Walter J. Hickel
Governor

Issues to be reviewed by the SERC

Threats/Risk Assessment

International sources of radiation for Alaskans: what research is ongoing to tell us of past practices, current practices, and future radiation threats? What additional research is necessary?

National sources of radiation for Alaskans: what research is necessary to tell us of past practices, current practices, and future radiation threats? Are there more Project Chariot disposal sites or other sites we do not know of? Are there more RTG's?

What are the risks to Alaskans of accidental detonation, accident in a nuclear submarine, accident in an RTG, or accident in the transfer of material?

Cumulative radiation: what levels are of concern to health and the environment? What has the environment received already? What have humans received already?

Government Preparedness

Should Alaska become an "Agreement State" with the Nuclear Regulatory Commission?

What role are state and local agencies expected to have in a radiological response? Are we prepared now? What do we have to do to get prepared?

Are the international notification agreements on nuclear radiation effective? Are the links tested? Are there any improvements to links between the federal and state government that are appropriate? Are direct communications also appropriate? What kind of monitoring is necessary to provide warning should notification agreements fail?

Does Alaska need any additional legislation, in state, to bring about better notification of the use of nuclear material, better oversight of private or federal activity, or better prevention and response requirements in the use of radioactive materials?

Ongoing Federal Activities On Radiation

International

- --*U.S. Arctic Research Commission (attached resolution)*
- --*Pending Russian Aid Package*
- --*The Northern Forum Environmental Health and Emergency Response Project; Environmental Monitoring Project*
- --*Arctic Environmental Protection Strategy activities on Emergency Response and AMAP, Arctic Monitoring and Assessment Program*
- --*Bilateral U.S.-Russian efforts on disarmament*
- --*Bilateral, multilateral efforts with Russia on health*
- --*Bilateral Scandinavian efforts on identifying radioactive waste*
- --*Bilateral U.S.-Russian agreements on emergency response, environment*

National

- --*Nuclear Regulatory Commission oversight*
- --*Report by the CIA to Senator Murkowski; intelligence committee*
- --*U.S. participation in International Atomic Energy Agency*
- --*U.S. Department of Energy cleanups, monitoring at Cape Thompson, Amchitka*
- --*U.S. Army cleanup at Ft. Greely*
- --*U.S. Navy response plan at Ketchikan submarine facility*
- --*U.S. Radiological Response Plan*

REVIEW OF ALASKA'S RADIATION PROTECTION ACTIVITIES BY THE CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS, INC.

Coincident with the Governor's request for this review of radiological threats and release response preparedness, the Conference of Radiation Control Program Directors sent a team of federal and state radiation control practitioners to Alaska to perform a review of Alaska's radiation control program. This appendix contains the report of their review and recommendations.

Conference of Radiation Control Program Directors, Inc.
Office of Executive Director 205 Capital Avenue Frankfort, Kentucky 40601 (502) 227-4543

December 15, 1992

John Sandor, Commissioner
Department of Environmental Conservation
410 Willoughby Avenue
Juneau, Alaska 99811

Dear Mr. Sandor,

On behalf of the Conference of Radiation Control Program Directors, Inc. (CRCPD), we wish to thank you for the invitation for us to perform an independent review of the radiation protection activities in Alaska. We met many dedicated and talented state people during our review, and appreciate the hospitality shown us during our visit. Our discussions were very productive due in great part to the forthright, candid and complete cooperation from you and your staff. It is clear there is a knowledgeable, "can do" spirit expressed both up and down the chain of command, as well as across departments.

While a full list of program administrators and technical people with whom we spoke are shown elsewhere in this report, we do want you to know we were pleased to visit with Lieutenant Governor Jack Coghill; Pat Ryan, Chief of Staff for Governor Hickel; and Kris Lethin, Legislative Liaison for the Governor. We gave them each a general briefing relating to our visit.

Enclosed is the final report of our comprehensive review of the radiation protection activities in the State of Alaska. This report is basically the same as the Preliminary Draft sent to you on December 2, 1992. We wish to recognize our report does not directly address some of the issues with which the State has recently expressed concern, since these issues were not within the scope of our review.

As noted in the report, we recommend Alaska consider becoming an "Agreement State" with the NRC, making note of the small increment of staff which would be required for such an Agreement, but which would enable the State to regulate its existing radioactive sources not regulated by the NRC, as well as those regulated by the NRC, and enable the State to respond more completely to incidents which may occur within the State boundary and beyond.

Again, thank you for the opportunity to conduct the review. We sincerely hope our recommendations will be of benefit to the State of Alaska.

Sincerely,

Charles M. Hardin

Charles M. Hardin
Executive Director

CMH/sah
Enclosure

REPORT

ON

REVIEW OF THE ALASKA RADIATION PROTECTION PROGRAM

Date of Report: December 15, 1992

INTRODUCTION

A multitude of radiation sources, both ionizing and nonionizing, exist in every state. These sources, when improperly used, or allowed to enter the environment, can unnecessarily expose the population causing a variety of illnesses, such as cancer and cataracts. Radiation exposure can also cause birth defects and a shorting of life span.

At the request of Dr. Katherine A. Kelley, Chief of the Section of Laboratories, Department of Health & Social Services (DHSS), the Conference of Radiation Control Program Directors, Inc. (CRCPD), conducted a comprehensive review of the radiation protection activities in the State of Alaska. This review was performed November 2 through November 5, 1992. A verbal review of the findings were discussed with management on the afternoon of November 5, 1992.

The objective of the comprehensive review was to assist the state in identifying areas where improvements can be made, as related to radiation protection for the citizens of Alaska.

The review was performed by a team of individuals having a diverse background in radiation protection. A list of the review team is shown on Attachment I.

Several major radiation protection concerns were brought to the attention of the Review Team prior to the review. These concerns were:

1. Potential environmental contamination from a 30-year old radioactive dump site near Point Hope.

2. The use of Radioisotope Thermal Generators (RTGs) used by the U.S. Air Force and Navy in parts of Alaska.

3. Exposure of Alaska citizens from radioactive fallout from past Russian nuclear weapons testing, and the possible continuation of underground testing of nuclear weapons, in the former Soviet Union.

4. Potential exposure of Alaskan citizens in the event of an accident from the nuclear power reactor operating in the Chukotka Peninsula in the former Soviet Union.

5. Past waste disposal practices in the Russian Arctic.

6. Potential population exposure from microwave energy from the transmission of electricity by a microwave tower at the Bradley Lake Hydroelectric Project.

Although these specific concerns may have merit, and should be thoroughly investigated by Alaskan officials, these issues were not within the scope of this comprehensive review. In particular, there are no established CRCPD criteria which address these specific concerns. However, the NRC representative on the review team did set up meetings and contacts with NRC officials for Alaskan officials to pursue.

Several Alaskan officials were interviewed during the review. A list of those interviewed are shown on Attachment II.

The basic elements of a comprehensive radiation control program (RCP) are contained in Attachment III. The findings of the review were compared with criteria contained in five CRCPD documents, and recommendations will be made, based on the criteria contained in these documents. These documents are:

1. *Criteria for Adequate Radiation Control Programs (X-Ray)*, A Report of Task Force 2A, HHS Publication FDA 81-8160, printed April, 1981,
2. *Criteria for Adequate Radiation Control Programs (Radioactive Materials)*, A Report of Task Force E-3, CRCPD Publication #82-2, printed November, 1982,
3. *Criteria for Adequate Radiation Control Programs (Nonionizing)*, A Report of Task Force H-2, CRCPD Publication #85-2, printed April, 1985,
4. *Criteria for Adequate Radiation Control Programs (Environmental Monitoring and Surveillance)*, A Report of Task Force E-10, CRCPD Publication 86-4, printed May, 1986, and
5. *Interim Criteria for Adequate Radiation Control Programs (Radon)*, A Report of Task Force E-16, CRCPD Publication 90-8, printed September 1990.

An overview of the Alaska radiation protection program, and general comments and recommendations are found in Attachment IV.

FINDINGS AND RECOMMENDATIONS

Listed below are specific criteria, findings from the review and recommendations, based on the above referenced CRCPD Criteria documents.

Recommendation #1

CRITERIA: Radiation control activities in state governments should be within one single agency. The RCP should be a separate government entity, and should be easily identifiable and visible to the public. The public's concern with radiation exposure should be easily translatable from a radiation expert who can provide competent risk based answers to their concerns. The program should be located within the state organizational structure so that it is parallel with comparable health and safety programs unit with a single person responsible for directing the work of the program.

FINDINGS: Radiation responsibilities in Alaska government are severely fragmented, being place in at least five different agencies. In some cases, these responsibilities are over-lapping and duplicative, and in some cases, the responsibilities are not clear.

Reccmmendation #1

The State of Alaska should consolidate the major radiation protection activities within one agency, assigning leadership responsibility to a single individual. The RCP should be elevated so that the program is visible to the public and have the necessary status to successfully compete with other governmental entities having similar comprehensive responsibility. It should be, at a minimum, at the Division level in Alaska's organizational structure.

Comment

Should consolidation occur, the number of staff commensurate for the program to be a Division should be resolved. Due to the multiple interest and responsibilities currently in the Department of Environmental Conservation (DEC), it would appear that the primary responsibility for a single RCP should be placed in this Department. If consolidation cannot be performed, then Memoranda of Understanding (MOU) should be developed between each agency which clearly identifies the responsibility of each.

Recommendation #2

CRITERIA: The RCP should be funded from sources that insure continuity of the program, and that are adequate to provide a comprehensive protection program for the citizens. Fees should be collected to provide the major funding of the RCP. Fee schedules to provide funding should be through regulation rather than through legislation. There should be a funding mechanism for agency use of contractual services.

FINDINGS: The current funding for radiation protection in Alaska is not adequate to provide a comprehensive radiation protection program for the public health and safety of the citizens.

Recommendation #2

Funds which are adequate to provide total radiation protection to the citi Alaska should be obtained and expended. Consideration should be given establishing a stable funding program by:

a. Raising machine user fees.
b. Initiate NARM and general license fees.
c. Seek matching funds from the EPA radon programs.
d. Seek industrial user support (e.g., five cents per barrel of oil).
e. Pursue monies from grants, contracts, etc.
f. Increase support from the State's General Fund.

Comment

An analysis of the number of sources in Alaska indicates that more than funding necessary to provide a comprehensive RCP can be obtained through for licensing, registration and inspection of sources, funding from feder conduct x-ray performance and mammography surveys and funding fi implementing a radon awareness program.

Recommendation #3

CRITERIA: A RCP should have adequately trained staff to provide the necessary service for a comprehensive program in radiation protection.

FINDINGS: Alaska has only one radiation physicist, with comprehensive radiolc training and experience. This individual is located in the DHSS. Other state emplc with radiation protection responsibilities have only limited training and ex radiological health practices.

Recommendation #3

Alaska should have nine (9) Professional/Technical Full-Time Equivalent and two (2) Clerical FTE[1] devoted to radiation protection activities.

1. An FTE is a unit of measure which is equivalent to one person-year given area.

Comment

Of the eleven FTE's recommended, three (3) Professional/Technical, and one (1) Clerical currently exists. A break down of the recommended FTE's is as follows:

Program Area	Recommended	Existing	Needed
Administration	1	1	0
Radioactive Material	1	0	1
X-Ray	2	0	2
Environment	2	0	2
Radon	0.5	0	0.5
Nonionizing	0.5	0	0.5
Emergency Response	2	2	0
Clerical	2	1	1
Total	11	4	7

Recommendation #4

CRITERIA: The state should have enabling legislation essentially in conformity with the Council of State Governments', *Suggested State Legislation*, 1983 Edition, Volume 42. A State which has regulatory authority over sources of ionizing radiation should have authority for responding to the indoor radon issue under the general radiation protection mandate of a State's enabling legislation. An environmental surveillance program should have specific legislation as a basis for its authority and evaluations. The legislation should authorize the RCP to provide, through regulation where appropriate, the following:

1. Provisions to register or license radiation producing machines.
2. Provisions to register or license radioactive material source.
3. Provisions to register all nonionizing radiation sources.
4. Provisions to inspect and enforce radiation protection standards for all radiation source users.
5. Provisions to set fees for registration, certificates and/or licenses, and to set fees for inspections and surveys or monitoring.
6. Provisions to establish surety arrangements with certain types of radiation users.
7. Provisions to issue civil penalties.
8. Provisions to appoint advisory committees.
9. Authority to license or credential identified users of radiation sources.
10. Authority shall provide for prompt correction of items of noncompliance.
11. Authority to enter into interstate and federal/state arrangements for the control of radiation hazards. Such arrangements should include training, travel, joint inspections, equipment loans, etc.
12. Provisions for reciprocity with other states for coverage of radiation hazards.
13. Authority to set qualifications for private consultants or radiation safety officers when the survey reports of such individuals are used by the agency to evaluate continuing compliance with its regulations in lieu of installation inspections by program staff.

FINDINGS: Legislative authority is fragmented in various statutes, and provides for some overlap and duplication of responsibilities. Current legislation does not provide for all the provisions and authority identified above.

Recommendation #4

The State should consider consolidating existing legislation radiation and updating such legislation to provide the authority identified above. The Council of State Governments "Suggested State Legislation", Vol 42, 1983 Edition, should be used as a guide for the development of Alaskan Radiation Legislation.

Recommendation #5

CRITERIA: The RCP should have regulations essentially in conformity with the *Suggested State Regulations for the Control of Radiation*, (SSRCR), which are published by the CRCPD. These regulations should address, but not be limited to, the following areas:

1. Setting registration and/or licensing fees.
2. As related to radioactive material, such regulations should be compatible with the provisions of Part C, titled, *Licensing of Radioactive Material*, of the SSRCR's.
3. Should embrace reciprocal state cooperation for licensing, inspection and enforcement of the shipment, manufacture, and product usage of radioactive materials, and the exchange of monitoring data and reports from neighboring States.

Regulations should be completely reviewed at least every two years and the revision adopted within one year thereafter. At least every five years, regulations should be critically reviewed and [illegible]ated as necessary.

[illegible] opriate affected groups should be provided an opportunity to review and comment on proposed changes in regulations.

Provisions should be made for public hearings to allow review and comment by affected groups, and a review and comment period of at least sixty days prior to changes in the regulation should be provided.

FINDINGS: The existing radiation control regulations are significantly outdated; last being amended in 1978. These regulations are not comprehensive, and do not provide the necessary provisions contained in the *Suggested State Regulations for the Control of Radiation*.

Recommendation #5

Immediate steps should be taken to update existing radiation control regulations to conform with the CRCPD *Suggested State Regulations for the Control of Radiation.*

Comment

The *Suggested State Regulations for the Control of Radiation* can be obtained from the CRCPD on computer floppy disk, which should expedite the development of Alaska regulations.

Recommendation #6

CRITERIA: The priorities for an Electronic Products program must be clearly focused and designed to mitigate the public health effects by reducing unnecessary radiation exposure.

FINDINGS: Alaska has a registration and inspection program for x-ray tubes. There are currently approximately 1265 x-ray tubes registered and located in roughly 459 facilities. An inspection frequency has been established for the various types of facilities (i.e., dental, hospitals, industrial etc.) However, due to recent problems in recruiting staff and due to the limited number of staff, inspections are far behind schedule. There was no evidence of an overall plan to try and resolve this problem. The instrumentation that the State used for inspections appears to be adequate.

Recommendation #6

The State's X-ray Program should develop a plan to inspect facilities at the established frequency. As noted in Criteria 3, additional staff are needed to meet these requirements. In the interim of adding staff, a designated amount of time should be devoted each month for doing as many inspections as possible.

Comment

An assessment of the population radiation exposure, made by the National Council on Radiation Protection and Measurements (NCRP 93) in 1987, found that healing arts uses of radiation (x-ray and nuclear medicine) represent approximately 83% of the total man-made exposure to the U.S. population. In contrast, occupational exposures were less than 2% and exposure to the entire nuclear fuel cycle was less than 0.5% of the total man-made exposure. Not only is diagnostic x-ray by far the single largest source of exposure to man-made radiation, it is also the source for which the biggest dose reduction gains can occur without having a negative impact on the benefits for the public. In other words, the greatest source of "unnecessary risk to human health" are in diagnostic x-ray. It is recognized that staff are extremely limited and that travel distances are great, but the health benefits for reducing unnecessary radiation exposure are worthy of pursuing vigorously.

Recommendation #7

CRITERIA: The U.S. Nuclear Regulatory Commission (NRC), under the 1974 Atomic Energy Act, has responsibility to regulate the use of most radioactive material. However, radioactive material not regulated by the NRC is the responsibility of each individual state. Radium and other Naturally Occurring or Accelerator Produced Radioactive Material (NARM) are the materials that every state must regulate, independent of the NRC. Therefore, every state should have a Radioactive Material Program.

FINDINGS: Alaska is not an NRC Agreement State. The radiation protection activities within the DHSS does not appear to have an adequate program to properly regulate the use of naturally occurring and accelerator produced radioactive material. There was evidence of several radiation sources, not under NRC jurisdiction, that should be licensed, inspected and regulated on a routine basis.

Recommendation #7

Notwithstanding limited resources the State RCP should pursue licensing and regulating all NARM sources not covered by the NRC. Fees could be assessed to offset expenses incurred by this activity. Initial phases of the licensing process could be done by mail, thus saving time and travel costs. After a NARM program has been established, including an updating of the regulations, Alaska should consider becoming a CRCPD "Licensing State" for NARM.

Comment

If the state should assume the responsibility to regulate radioactive material under the Atomic Energy Act (i.e., become an NRC Agreement State) the Program would be larger. In either case the Program should obtain information from those using the radioactive material to assure that they can operate safely and in compliance with rules and license conditions. The information should encompass such areas as; facility structure, equipment, training of personnel, radiation safety officer, operating and emergency procedures and quality assurance with As Low As Reasonably Achievable (ALARA) exposure control principles.

Inspection and enforcement procedures should be in place along with appropriate legal authority. It would be prudent for Alaska to pursue becoming an Agreement State with the NRC. The State would be able to assess the same cost recovery fees that the NRC charges. Agreement State status would provide Alaska the privileges of training programs offered by NRC and technical help in all phases of radiation protection activities. It was noted that the State's NRC Liaison Officer and the Low Level Waste Compact representative were in the DEC. This adds support to the concept to locate the primary

RCP in DEC.

Recommendation #8

CRITERIA: Environmental Monitoring Issues

An environmental program should have specific legislation and regulations as a basis for its authority and evaluations. However, several states have used the authority identified in general public health statutes to proceed in developing their environmental radiation programs. The environmental unit should report directly to the Director of the RCP. The responsibilities for sample collection and analysis as well as report writing should be in this unit. The program should characterize the State's general radiological profile, be capable of verifying radiation releases from man-made or natural sources and evaluate the public health or environmental impact of such releases. Reports should be published and distributed regularly so the public recognizes who to notify in case of any concerns. The analytical laboratory should participate in national quality assurance programs sponsored by the Environmental Protection Agency (EPA) to ensure that all measurements being performed are precise and accurate. This provides for legally defensible data should the need arise.

CRITERIA: Radon Issues

Radon programs are frequently organized within environmental units among the states. Since radon problems vary widely and are dependent largely on soil parameters, the program activities are commensurately variable. Notwithstanding this, every state should have a program to identify potential radon problems. The EPA has made grant money available for states to scope out radon issues. They also provide informational brochures for public distribution. It has been said that radon is the second leading cause of lung cancer, therefore public health programs should address that concern. A radon program should have a strategy to assess the potential for high and low risk areas within the state. Problem response activities should be well defined; this includes mitigation, building codes and real estate transactions. Public information is also a vital part of a radon program. Testing firms and mitigators should be publicized and public meetings held to inform and address concerns of the citizens.

FINDINGS: Environmental Monitoring Issues

Environmental radiation monitoring is very limited in Alaska. The EPA has established three Environmental Radiation Air Monitoring Stations (ERAMS). The analyses are done by their labs in Las Vegas, Nevada or Montgomery, Alabama. The primary function of these stations is to detect any abnormal ambient radiation levels. The major threat would be from nuclear reactors in the Soviet Republics. The DEC has some laboratory capability. The existing radiation counting equipment was not routinely used and was said to be inoperable. In essence the State would not be able to immediately analyze samples for radioactive contaminants if the need should arise. There was no evidence of a plan to get samples analyzed in case of an emergency.

FINDINGS: Radon Issues

The State has completed around 3000 tests of schools, homes and daycare centers. The University of Alaska has a Grant from the EPA for radon testing activities. About 9% of the homes tested have levels greater than 4 pico curies per liter (Pci/l).

Recommendation #8

Environmental Monitoring Issues:
The State should, at minimum, develop a plan to have environmental samples analyzed for radioactive contaminants in case of an emergency. The analyses could be done by the public or private sector. Preferably they should be done by the State's own laboratory. The State should enhance their current analytical capability to include gamma spectroscopy along with gross alpha and gro. beta analyses.

Radon Issues:
The activities associated with Radon should be more focused. A plan should be developed for informing the citizens about radon. There should also be information available who to contact for mitigating identified problems.

Comment

Environmental Monitoring Issues:
A concern surfaced during the interviews regarding possible radiation releases from Russian nuclear reactors impacting the State. There was also some concern about radioactive waste buried near Point Hope and the impact it might have on citizens living there. To address these concerns the State could develop an environmental sampling strategy of the food chain media in that area. This would establish a "baseline" to compare with future intrusions of radioactive contaminants to the area. It would also identify if current problems exist. The analyses could be done by contracting laboratories until the capability is developed to do them internally. With this information State agencies could answer questions of the people in that area.

Radon issues:
Continue working with the EPA and apply for Grants to enhance public information and mitigation activities.

Recommendation #9

CRITERIA: A state should have general emergency plans which addresses transportation accidents, spills, incidents at fixed radioactive material licensed facilities, accidental overexposures, and contaminated material from such places as steel mills, scrap yards or landfills. The emergency plan key components should include: 1) Possible sites where emergencies could happen along with the specific location of the material; 2) On-site authorities and responsibilities; 3) Off-site agency contacts including an up-to-date call list of all applicable responders and decision makers; 4) Action guideline levels; 5) Emergency equipment; 6) Training programs for first responders and those nearest the sites as appropriate; and 7) Public information services. There are several Federal Agencies who could provide assistance over the long term, but local personnel must be prepared to take action immediately.

FINDINGS: Alaska does not have any nuclear power generating facilities, nor are there facilities close enough to the borders to warrant emergency response plans commensurate with the Federal Emergency Management Agency criteria for ingestion zone planning. However, there is radioactive material in the State and/or passing through via aircraft that merits the need to have plans to respond if an incident happens. The State does not have a written plan to respond to radiation emergencies. The Department of Emergency Services (DES), Military Affairs, in Anchorage, maintains some equipment that could be used in cases of emergencies. The equipment is primarily designed to be used for nuclear war purposes (Radiological Defense), but some is applicable for peace time needs such as transportation accidents. The DEC has an emergency response program with the main focus on spills of hazardous materials (not including radioactivity). This agency desires to develop the capability to respond to radiation emergencies.

Recommendation #9

The State should designate one agency with responsibility to develop a comprehensive Radiological Emergency Response Program. That agency should coordinate with all other applicable state and local agencies with writing a plan covering the key components listed above. Based upon the information gathered during the review it appears the DEC would be the best agency to assume this responsibility.

Comment

Emergency response tends to be thought of in terms of nuclear power generating facilities. However, there are several crucial areas of an emergency response program, as identified above, that have no ties to nuclear power generation. Emergency response responsibilities cannot be "contracted out". The State has the ultimate responsibility to protect the health and safety of the public, workers the environment. Adequate plans must be in place. Authority to use a portion of the 470 Funds to support radiological emergency response planning should be pursued.

Recommendation #10

CRITERIA: A state should consider the establishment of a nonionizing program to assure that the citizens are not unnecessarily exposed to the various nonionizing sources that are in use. The type of sources are discussed in the comment portion of this criteria.

FINDINGS: Alaska, like many other states, has not fully addressed the potential for health and safety problems with nonionizing radiation sources. No contact agency has been identified and extremely limited resources or efforts have been devoted to addressing nonionizing concerns.

Recommendation #10

The State should designate a responsible agency for nonionizing radiation issues. It should be within the same agency as the RCP. Rules should be promulgated to regulate these sources and a program developed to adequately respond to health and safety needs of the public and workers.

Comment

Nonionizing radiation concerns are becoming more prevalent. Research data is beginning to show some evidence of possible health effects for persons living near power transmission lines, children living or playing for extended periods near transformers, and men exclusively using electric razors. There is also some concern for the safety of workers using industrial radiofrequency (RF) heat sealers. There is an increasing use of powerful lasers in the medical arena and other industrial settings. Many states have promulgated rules for the regulation of Tanning devices. This was prompted by the many medical reports of sever skin burns and eye damage by the improper use of these units.

If the 0.5 FTE listed in Criteria 3 is devoted to nonionizing activities, the States needs in this area should be met. The priority for resources devoted to this program may vary with the perceived needs among the applicable agencies. However, it would be prudent to seriously consider developing some expertise within the designated agency to answer inquiries from the public, workers and the media.

Attachment I

Review Team Members

The individuals listed below, as a combined unit, have extensive training and experience in the following areas of radiation protection:

1. Radiation control administration
2. X-ray use (medical, dental and industrial)
3. Radioactive material use (medical, industrial and academic)
4. Environmental surveillance and monitoring
5. Emergency planning and response
6. Radon awareness programs
7. Nonionizing radiation use (microwave, laser, ultra-violet and electric and magnetic fields)

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Heidersdorf, Sid	Radiological Health Specialist (Retired)
Hensley, John	Emergency Management Specialist, Division of Emergency Services, Department of Military & Veteran Affairs
Kelley, Katherine, Ph.D.	Chief, Section of Laboratories, Department of Health & Social Services
Kent, Lynn	Chief, Spill Prevention & Planning Section, Department of Environmental Conservation
Lowe, David	Environmental Scientist for BP Exploration
Mala, Theodore, M.D.	Commissioner, Department of Health & Social Services
Martz, Karen	Administrator, Health Facilities Licensing & Certification, Department of Health & Social Services
Miller, Glen	Environmental Specialist, Section of Hazardous & Solid Waste, Department of Environmental Conservation
Nakamura, Peter, MD.	Director, Division of Public Health, Department of Health & Social Services
Powell, Jim	Acting Deputy Director, Environmental Quality, Department of Environmental Conservation
Sandor, John	Commissioner, Department of Environmental Conservation
Short, Eric	Assistant Chief, Occupational Safety and Health of the Alaska Department of Labor
Tedford, Charles	Chief, Radiological Health Program, Department of Health & Social Services
Treadwell, Mead	Deputy Commissioner, Department of Environmental Conservation

INDIVIDUALS BRIEFED DURING OR AFTER THE REVIEW

Coghill, Jack	Lieutenant Governor
Ryan, Patrick	Chief of Staff for Governor Hickel
Lethin, Kris	Legislative Liaison for Governor Hickel
Mala, Theodore, M.D.	Commissioner, Department of Health & Social Services
Sandor, John	Commissioner, Department of Environmental Conservation
Nakamura, Peter, M.D.	Director, Division of Public Health, Department of Health & Social Services
Treadwell, Mead	Deputy Commissioner, Department of Environmental Conservation

ELEMENTS OF A BASIC RADIATION CONTROL PROGRAM

The components of a radiation control program (RCP) are generally broken into the following areas:

A. Legislation
B. Regulations
C. Program Organization
D. Federal/State Arrangements
E. Program Planning and Evaluation
F. Budgeting and Funding
G. Staffing
H. Training
I. Inspections
J. Enforcement
K. Instrumentation
L. Record Keeping
M. Radiological Incident Response
N. User Education
O. Public Education
P. Regional/Local Agencies
Q. Special Studies
R. Operational Programs, which include the following:
   1. Radiation Machine Control
      a. X-Ray
      b. Accelerators
   2. Radioactive Materials Control
      a. Atomic Energy Act (AEA) Material
      b. Naturally Occurring and Accelerator Produced Radioactive Material, given the acronym "NARM."
   3. Environmental Monitoring and Surveillance
      a. Contamination from Man-made Radioactive Material
      b. Contamination from Naturally Occurring Radioactive Material, given the acronym "NORM."
   4. Emergency Planning and Response
      a. Nuclear Power Facilities (Off-site)
      b. Non-Nuclear Power Accidents
   5. Radioactive Waste Management
      a. Low-level
      b. High-level
   6. Nonionizing Radiation Control
      a. Microwave
      b. Laser
      c. Ultra-Violet
      d. Ultra Sound

    e. Electric and Magnetic Fields (EMF)
7. Radon Reduction Programs
    a. Private Homes
    b. Public Buildings
8. User Certification or Credentialing
9. Consumer Education and Information

A complete and comprehensive RCP will have an adequate program in all of the above areas when appropriate for their respective jurisdiction.

Outside supporting areas which may be necessary for most comprehensive programs will include the following:

1. Legal
2. Personnel
3. Electronic and Maintenance
4. Education
    a. Radiation Control Staff
    b. Public
5. Printing

The comprehensiveness of a RCP for a given state or local government entity will depend on several factors, including, but not limited to the following:

1. Type of radiation sources within the jurisdiction of responsibility. For example, there may not be a nuclear power facility within, or surrounding, the governmental entity, and therefore no need for a program for off-site emergency planning for nuclear power facilities.

2. The number of radiation sources, both ionizing and nonionizing, within the jurisdiction of the governmental entity.

3. Whether the governmental entity has an agreement or not with the U.S. Nuclear Regulatory Commission.

4. The comprehensiveness of legislative authority.

5. The economic conditions of the state or local entity.

If a state or local entity has one or more radiation sources which pose a potential hazard or treat to the public health and safety, to the safety of the radiation worker, or as a potential source for radioactive contamination of the environment, a governmental RCP should exist to assure proper and adequate protection.

OVERVIEW OF RADIATION PROTECTION ACTIVITIES IN ALASKA

The current number of x-ray tubes in Alaska is 1,265. There is an estimated 60 Naturally Occurring or Accelerator Produced Radioactive Material (NARM) sources registered. Approximate 9% of homes or other buildings in Alaska which have been tested for radon accumulation exceed recommended limits for corrective action. Radioactive materials use in Alaska, and which are covered by the Atomic Energy Act, are licensed and inspected by the U.S. Nuclear Regulatory Commission. However, approximate 60 NARM sources exist in the State, and which are not regulated by the NRC.

Because of its size, lack of roads, limited transportation systems and harsh winters, Alaska offers inspection problems not found in other states. For example, the retired radiological specialist explained that 140 on-site inspections for X-ray tubes was a good year. For comparison, 700 tube inspections per year are considered an average workload in Oregon. Similar overhead should be anticipated in inspecting radioactive materials licensees or registrants. The cost of travel ranges from 50 to 100 percent more than in the Continental United States.

Radiation protection activities are being performed by several governmental agencies in the State of Alaska. Many of these activities are overlapping with other agencies. These activities and the agencies that perform some function for the identified activity are:

1. Registration and Inspection of X-ray sources.
   Department of Health & Social Services (DHSS)

2. Registration of Naturally Occurring Radioactive Sources.
   DHSS

3. Radon Public Awareness Program
   DHSS

4. Environmental Surveillance and Monitoring
   Department of Environmental Conservation (DEC)
   DHSS

5. Emergency Planning and Response
   DEC
   DHSS
   Department of Military & Veteran Affairs (DMVA)
   Department of Labor (DOL)

6. Protection for the Radiation Worker
   DOL

7. Licensing & Certification of X-ray Facilities
DHSS

8. Low Level Waste Siting
DEC

One Memorandum of Understanding (MOU), dated 1982, which relates only to emergency response, exists between the DHSS, the DMVA, the DEC, and the DOL. However, the MOU does not assign authority or responsibility for actions in accordance with the various laws and regulations, nor is the jurisdiction clearly defined.

A variety of statutes have various requirements relating to radiation control in the state of Alaska. These are:

AS 11.46.490 (8), AS 18.45.020 through AS 18.45.900, AS 18.60.475, AS 18.60.545, AS 21.69.650, AS 26.23.120 thru AS 26.23.130, AS 29.35.500, AS 41.98.110 through AS 41.98.150, AS 44.65.060, AS 44.83.170, AS 44.83.990, AS 44.99.120 through AS 44.99.125, AS 45.88.010, AS 45.88.500, AS 46.03.250 through AS 46.03.296, AS 46.03.865, AS 46.03.900, AS 46.11.900, AS 46.45.

Under authority of some of the above statutes, various departments have adopted specific regulations relating to radiation control.

DEPARTMENT OF LABOR

Under AS 18.60 the DOL is responsible for occupational radiation exposure resulting from both ionizing and nonionizing radiation sources. The Department's day to day activities are conducted in accordance with the methods and priorities of Federal OSHA guidelines. The Department's operation is 50% federally funded, and is a "State Plan" State with step 18e independence from OSHA. The Department's efforts are directed to a OSHA supplied list of most hazardous industries, none of which included radiation concerns.

During the last few years, no inspections of ionizing source records have been performed. Reviews of occupational ionizing radiation exposures are not conducted as part of normal business. The Department has no radiation detecting instruments, and there are no staff with formal training in radiation matters. No consideration of As Low As Reasonably Achievable (ALARA) principles were noted.

Some investigations have been performed of a potentially significant exposure to nonionizing radiation from a radar.

NATURALLY OCCURRING OR ACCELERATOR PRODUCED RADIOACTIVE MATERIAL (NARM)

The 1978 Alaska regulations require registration of all sources of radiation brought into the State, except for some specific small quantities and those under the jurisdiction of the NRC. Review of ten years of registrant files (1982-1992) identified between 50 - 60 sources above the exempt quantities located in the State. These discreet sources, referred to a NARM, are not regulated by the NRC. According to the records and interviews, there have been no attempts to inspect or verify the current location or existence of these radioactive materials.

David Lowe, Environmental Scientist for BP Exploration who spoke for the joint operators of the north slope oil operations, and the NORM Task Force of the Alaska Oil and Gas Association, provided the following information relative to the NORM conditions in Alaska. According to him, the authority to regulate the practice of the management of NORM, appears to be contained in the DEC's, Sec. 46.03.260. According to Mr. Lowe, DEC deferred to the Alaska Oil and Gas Conservation Commission for regulation of the practice as pipe scale, a material permitted in class II injection wells.

He indicated that the tendency for pipe to scale was largely the result of water injection in depleted oil deposits. According to him, the north slope deposits are still relatively young, and that significant amounts of produced waters, and therefor scale, are only now beginning to be produced. Mr. Lowe stated that the specific activity of the scale on the north slope was less than 2,000 Pci/g. He had little information about the oil operations in southeastern Alaska, but noted that they were much smaller than the north slope.

According to literature provided by Mr. Lowe, "According to Alaska's state radiation health physicist, who has been to the North Slope to monitor the situation in the past, no health hazards from low-level gamma rays have been identified."

Mr. Lowe indicated that there were about 3,500 joints or lengths of pipe with external gamma rates over 50 μR/h, a threshold he called NORM contaminated. They propose to de-scale these using a proprietary water blast device in a closed cabinet. Some number of fittings or vessels have or will be de-scaled. The resulting slurry will be injected in Class II injection wells several thousand feet underground.

Mr. Lowe did express a desire for specific regulations covering NORM in Alaska. He stated that they followed what guidelines he knew to exist, but felt that specific NORM regulations would provide a higher level of assurance to the State and would be desirable to the operating firms.

NRC LICENSES

The NRC sends the State copies of all new licenses, amendments and terminations pertaining to Alaska licensees. The State file these documents without maintaining an up-to-date list of current licensees or tracking the amount and location of radioactive material within the State. The State's list shows 116 active NRC licenses, however, there are only 62 active licenses.

NRC also provides the State with copies of all Alaska inspection reports and enforcement actions. They also notify the State prior to an inspection with an invitation to join the NRC inspector. The purpose of this practice is to allow the State to gain knowledge of radioactive material within the State and to provide training in regulating new uses of radioactive material.

ENVIRONMENTAL SURVEILLANCE AND MONITORING

The State has created a task force to assess the radiation sources and their routes of exposure, but the head of this task force lacks training and experience in radiation protection. It would be more effective for a professional staff to review the tremendous volume of data which already exists. This data should be built upon, and used to evaluate current results.

There are many reasons for a monitoring network in Alaska. The current interest is in plume phase atmospheric exposures from catastrophic releases in Russia, contaminated water and food webs due to Russian waste handling practices, as well as very localized contaminated sites in Alaska. If a reasonable level of confidence is expected, these are not trivial questions to answer. At the time of the review, Alaska did not perform the required drinking water screening, which also shows the need for a monitoring program.

The DEC expressed a desire to establish a radioisotope laboratory in Juneau, although it appears that careful attention have not been paid to the operational cost of such a laboratory. It is the impression of the review team that the Department feels that a chemist can do the radionuclide laboratory work as a sideline, as well as collect samples. To establish a creditable laboratory, the following equipment, as a minimum, would be recommended: a low background gamma spectrometer, a liquid scintillation detector, an alpha spectrometer, and TLD system. There appears to be several forgotten pieces of radiation detection equipment scattered around, most of which is old civil defense equipment, but nobody knows how to operate it, and there is no current calibration program established for the equipment. In lieu of the State establishing a laboratory in Juneau, consideration should be given to a Memorandum of Agreement (MOA) or contract with the radioisotope laboratory in the State of Washington for the needed laboratory work in Alaska.

HEALTH FACILITIES LICENSING AND CERTIFICATION

The Health Facilities Licensing and Certification (HFLC) Section, Division of Medical Assistance, DHSS, is the state contractor for the Medicare Program in Alaska, and is responsible for annual surveys covering 15 mammography clinics and one mobile radiographic facility which desire Medicare reimbursement for radiological services performed. Since the HFLC Section does not have expertise in Radiological Health, the Section has a Memorandum of Agreement between the Division of Medical Assistance and the Division of Public Health to have the radiation program perform the technical inspections of the mammography equipment. The 15 fixed mammography facilities are to be inspected annually, with the single mobile x-ray facility to be inspected every other year.

A new bill, signed by the president in late October, 1992, will require that all mammography facilities be inspected on an annual basis, whether or not the mammography services are Medicare reimbursable. That will raise the number of fixed mammography facilities to be inspected annually from 15 to 30. If the state decides to perform these required inspections (the state has the option of not performing the inspections) the workload for the RCP will be substantially increased. This workload could be raised even more, should the HFLC Section decide not to survey mammography facilities, and instead give "deemed" status to those facilities inspected and approved under the new bill. HFLC may not have the authority to inspect facilities not asking for Medicare reimbursement. The RCP will, in this case, be left with the entire survey (technical and administrative).

At present the HFLC Section transfers funds, in the form of general funds, between the two Divisions for the technical radiological health inspections. If the new mammography program goes into effect, the RCP will have the authority to charge fees for the inspections, which should cover the costs of the inspections.

HFLC Section also has the responsibility to do hospital surveys which include the x-ray department. A cursory survey is performed which may or may not be valid. The recommendations given by the HFLC Section surveyor to the facility may themselves not be valid, and the RCP may wish to review this survey protocol.

EMERGENCY RESPONSE

Although any agency notified of a radiation emergency is required to notify the DHSS, according to some persons interviewed, that has not always been the case. Confusion exists if an emergency requires Federal notification. DHSS has the responsibility to notify U.S. FDA, and U.S. NRC; the Division of Emergency Services (DES) notifies U.S. FEMA; the DEC notifies U.S. EPA, and the DOL notifies OSHA. In reality, there are only three qualified responders in the State; the chief of radiological health in DHSS and two DES individuals who have received the RERO emergency response course. If these individuals are not available, then the State must depend on first responders from police, fire and hazardous materials teams, who are only minimally trained in radiation protection, and who have no connections to the agencies named in the MOU.

The Division of Emergency Services (DES) has responsibilities for Radiological Defense (RADEF) planning, which is essentially the old Civil Defense operation of planning for a nuclear war. Along with this responsibility, DES has been involved with general Radiological Emergency Preparedness (REP), or planning, for a radiological Incident. Since the demise of the Soviet Union, the role of the DES has been more and more toward REP.

DES has a data base covering the REP resources in the state. There are some 3100 "Civil Defense" type kits for radiation monitoring within the state, 1250 of them in the hands of local governments. There are 882 trained radiation monitors, 312 are on teams. Over 100 individuals have taken a RADEF course. Also in the data base is information on 270 communities with information on instrument location, population exposure, phone numbers, personnel contact and training information.

The DES has not had an emergency exercise in recent years, except for a small one on Adac in 1990. The DES has two individuals working in REP/RADEF, one as a coordinator and one in instrument repair and maintenance.

There would seem to be some value in having a cadre of trained first responders in a state so large in size, although additional training not so centered around nuclear weapons is probably in order. Incorporation of these two REP/RADEF individuals in the overall state radiological health program seems appropriate.

X-RAY

In Alaska, there are 1265 X-ray tubes in 459 facilities. The break down of these tubes/facilities by type of use are as follows:

Type of Use	# of Tubes	# of Facilities
Mammography	27	
Medical	237	104
Dental	873	233
Chiropractic	52	52
Veterinary	35	32
Industrial	35	30
Educational	6	8
Total	1265	459

The CRCPD criteria document calls for an individual surveyor to inspect 500-700 tubes per year. This is not possible in Alaska because of the great distances involved and the lack of road transport to many of the sites. The previous inspector was able to perform approximately 150 tubes per year, travelling from the Juneau area. If inspectors were stationed out of Anchorage, and in an area where the population is concentrated and highway passage to many of the facilities is possible, the efficiency of inspections would be enhanced, with 200-250 tubes per year per inspector being a goal.

Based on the CRCPD Criteria, two inspectors would be needed to carry out the routine x-ray inspections. Assuming that the new Mammography Quality Assurance bill will be carried out by the RCP in it's entirety (without help by HFLC), an additional ½ FTE would be required (30 Facilities x ½ day each for paper inspection + ½ day for the technical + ½ day for the paperwork write-up = 45 days or @¼ person year plus a similar time spent in travel and co-ordination with the facilities, not all of which operate all the time). This adds up to 2½ FTE's for the x-ray program alone.

In Alaska there are only two certified health physicists in the state, one in Juneau (Retired) and one in Anchorage (Fully Employed). Due to the lack of trained radiation physicist in Alaska, the state inspector may be the only trained radiation physicist, having knowledge in the requirements of proper imaging modalities, machine exposure parameters, and quality control procedures in film development, to ever visit the state's facilities with x-ray equipment.

In addition to the need for addition staff in the x-ray program, many other actions are needed in the Alaska RCP to meet the criteria of the CRCPD. These other actions are:

* The regulations covering the x-ray program are 14 years old and desperately need updating. The most recent version of the CRCPD Suggested State Regulations should be used as a guide in re-writing.

* There is no formal survey protocol yet and one will need to be developed along with new regulations.

* There is need for several pieces of x-ray inspection equipment, such as a kVp meter for mammography, and another set of processor Quality Control test instruments.

* A new computer program should be developed to keep track of registration of machines and for the assignment of workloads.

* Although the above estimate of personnel needed was based on an assumed inspection priority system, a formal statement of that system needs to be developed.

NONIONIZING RADIATION

The state has regulations covering several sources of nonionizing radiation. The microwave oven standards are a condensed version of the Food and Drug Administration (FDA) standards of 1971. Since they cover the same ground as those of FDA, and since the microwave oven problem appears to have long ago been solved, perhaps these regulations should be rescinded. The only standard that might be useful here would be one covering the servicing of the ovens, registering the service personnel and making sure that they have meters capable of proper measurement and assuring that the ovens are safe to use following repair.

Laser regulations contained in the statutes are essentially operator and environs protection criteria. As such, they are essentially OSHA type standards. There is a state OSHA agency in Alaska with the authority to regulate the use of lasers in the workplace. OSHA Regulations include provision for controlling the exposure of ancillary personnel which would effectively protect the passerby as well. Unfortunately, OSHA does not have anyone fully trained to perform inspections of laser workplaces. Protection of customers at laser light shows is also covered by FDA regulations with inspections done by FDA inspectors who have received specialized training.

There appears to be no authority to address the radiation exposure concerns of microwave transmission of power, or high exposure around transmitter sites. There is again some authority in OSHA which would relate to the workplace, but there does not appear to be any authority to protect the average citizen who may be inadvertently exposed. If the idea of high power transmitters grows, some control regulations may be needed.

COMMENTS BY JESLIE KALEAK, SR., MAYOR NORTH SLOPE BOROUGH

The State Emergency Response Commission requested of Mayor Jeslie Kaleak, Sr. that the North Slope Borough review and comment on a draft of this report. Their review and recommendations are included in this appendix.

NORTH SLOPE BOROUGH

OFFICE OF THE MAYOR

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Jeslie Kaleak, Sr., Mayor

February 16, 1993

John A. Sandor
Office of the Commissioner
Department of Environmental Conservation
410 Willoughby Avenue, Suite 105
Juneau, Alaska 99801-1795

Re: Draft Report to Governor Walter J. Hickel: "Radiological Threats and Release Response Preparedness in the State of Alaska", December 1992

Dear Mr. Sandor:

The North Slope Borough (NSB) and our technical consultant have reviewed the State Emergency Response Commission (SERC) Report on Radiological Threats and Releases in Alaska. This report covers recommendations made by a number of state agencies and outside reviewers concerning the State preparedness for responding to radiological threats/emergencies. Releases discussed ranged from a minor localized spill of radioactive materials to widespread fallout from atmospheric nuclear testing. The report includes identification of a range of radiological threats (some involving non-ionizing radiation). From the text of the report, it is apparent that there is insufficient response capability for some of the radiation hazard, which must be monitored to protect the population. In addition, it is evident that some initial background information may need to be gathered in several areas before a protocol can be identified for response protection actions.

Our comments to the draft report entitled " Radiological Threats and Release Response Preparedness in the State of Alaska" are presented below.

1. *Report Organization and Presentation -*

A. The title should reflect that this is a preliminary report. For example it might be something like:

"Preliminary Report to Governor Walter J. Hickel: Radiological Threats..."

OR

"Report to Governor Walter J. Hickel: Preliminary Evaluation of Radiological..."

Everyone who reads this report - especially the Governor - must understand that if it is preliminary. Otherwise, it is likely that they will assume it is more comprehensive and complete than it is. Such assumptions could contribute to delay or prevention of further evaluation.

B. There should be clearly stated Goals and Objectives for the project and the report. The Goals and Objectives should be clearly labeled as such, preceded by appropriate background and placed at the very beginning of the report (i.e. in the Introduction).

C. All the recommendations should be listed. They should be accompanied by:

(a) clearly-stated criteria for prioritizing them and rational for these criteria;
(b) timetables for implementation;
(c) statement of additional information needed;
(d) plan for overcoming obstacles to the recommendations.

D. All the recommendations should include how to address the report's limitations - e.g. which ones must be overcome and how, which ones are of minor concern.

E. Pages should be numbered consecutively from beginning to end.

F. The Reference Section should be clearly marked as such.

2. *Comprehensive Planning* - In general, there is a need for the State of Alaska to establish the ability to respond to any radiological condition in a manner that will assure the protection of its citizens. While a number of competent individuals within the State are prepared by both experience and training to provide specific review of and response to emergencies, the overshadowing need is for a single, comprehensive plan that will identify specific individuals-- by title--who will be responsible for each component of the protective action. There must be a sufficient number of professionals available to perform these actions. In addition, these individuals must have the authority of the State behind their actions. To provide this type of plan, agreements must be established among the State's agencies identifying their individual areas of responsibility and specifying their authority to perform these functions. Further, to assure their ability to respond to emergencies, there must be a method to establish that an undesirable or dangerous condition exists and to communicate that information to the appropriate agencies. The important concept is for coordination of the activities. The DEC may well be the best selection for this role; but without oversight and coordination, no agency will succeed. The key will be coordination and cooperation.

3.. *Russian Radioactive Waste Dumping* - A serious concern for the NSB is the potential for marine mammals to be contaminated by the extensive Russian nuclear and hazardous waste dumping programs, then migrate to our waters and be consumed by residents of the NSB. In review of recent information on the Russian dumping program, there are evidently large, highly contaminated areas that exist, and thus we feel that this situation needs to be monitored. DOE recently completed a study of this contamination and quoted an NRC article which stated "although the characteristics and extent of the contamination are not well known, it has been stated that the contamination in the Arctic may range form 1 to 3.5 billion curies. (Inside NRC, June 29, 1992). This is an incredible amount of radiation. We recognize that widespread food monitoring is a difficult program to establish as a blanket project. For locations of known contamination, a monitoring program can be established to reflect and measure hazards presented by the contaminant. However, to attempt to monitor the entire coastline, with its wide variety of ocean life, is a challenge that may not result in any meaningful data. We thus recommend that periodic checks of major food harvesting be performed from the principle villages on the North Slope and other specific identified areas. This would be valuable as an early warning mechanism to identify if more extensive monitoring is needed.

4. ***Preexisting Radiation Sources*** - In the evaluation of radiological hazard, more research must be performed to investigate previous radioactive sources that are present on the North Slope. The recent discovery of the radioactive material near Point Hope and the possibility that Radioisotope Thermoelectric Generators (RTG) are present on the North Slope, indicate that there have not been enough investigations to identify all the existing sources. I understand that a Congressional subcommittee is currently contemplating a thorough investigation of previous activities. Something similar also needs to be done on the State level, so that all known sources can be identified and evaluated for their potential health efforts.

5. ***NORM Monitoring*** - NORM Monitoring is also another very important area, which we must address especially on the North Slope. We feel there is a great need to have a focused, educational program that provides background information on radon, and secondly radon monitoring should be performed in areas likely to be impacted. On the North Slope, the potential presence of high levels of radon in natural gas pumped into Barrow residences could be a significant source of radiation exposure. Clearly, in our borough where buildings are well-sealed to insulate form the cold, the potential for radon in buildings may be significant. Thus a monitoring program to identify if any high levels are present is needed. This program should not only monitor for radon, but other influences on indoor air quality should also be evaluated in this program.

The Recommendations section of this report suggests licensing all NORM sources within the State. This can require a significant staff. At this time, it may be expensive for the State to initiate this regulatory approach. However, we do advise that potential NORM sources be more closely monitored. As noted in this Draft report, a principal NORM source is oil wells and gas production of which we have a significant amount on the North Slope. As this industry matures, oil and gas production will become a progressively larger source of concern. In addition, as the mineral resources of the State are developed (and processed locally) the impact of NORM will also increase. Mining residues resulting from processing activities can have long-term impacts on both the environment and the natural beauty of the State. We thus recommend that increased monitoring of potential NORM sources be performed, so that long-term planning and control can be implemented.

6. ***Airborne Monitoring Network*** - This report also suggests augmenting the present airborne monitoring network. This is an expensive undertaking, given the size of the State. Placing these devices at selected points, with support telemetry for "real time" transmission of the collected data may actually be cost-effective, if the network is designed to reflect levels at known population centers, most frequent wind directions, and known or anticipated sources of radiation. This air monitoring network should include all the principal villages on the North Slope.

7. ***Medical Equipment Monitoring*** - We agree and support the need to improve monitoring of medical radiation equipment. Shortfalls in staffing are argued to have historically precluded the adequate routine evaluation of X-ray machine and radioactive sources used medically. The first step in implementing a more aggressive monitoring program for medical machine sources should certainly receive the top priority, the perspective of a statewide protection program. This will have the highest return for the cost, so increased funding needs to be allocated. This is an area where complacency can result in hazards to the public. Other States have reduced costs for these programs by using screening techniques (distribution by mail of dosimeters to check performance of the units) to establish priorities for on-site visits to verify performance of units.

8. *"Agreement State" Status* - Your preparedness plan discusses the fact that Alaska is not an Agreement State. A number of States have opted not to take that option for control of radioactive materials, since it requires a significant resource commitment. In the event that Alaska chooses to pursue this avenue, all enforcement by NRC will cease, since the only area of control retained by NRC in Agreement States is for regulation of nuclear power plants. Prior to pursuing this option, Alaska should determine what resources NRC has expended to maintain oversight in the State and whether the level of oversight by NRC was adequate. This will reflect the costs Alaska will likely incur as an Agreement State. If the state judges it practical to do so, it should become and "Agreement State". As the CRCPS stated, doing so "... would enable the State to respond more completely to incidents which may occur within the State boundary and beyond". Becoming an Agreement State would allow Alaska to bring home a great deal of control over radioactive materials and allow the State itself to make sure incidents such as the radioactive waste burial at Cape Thompson do not occur.

9. ***Notification Guidelines*** - Notification guidelines for radiological emergencies should be amended to improve communication with local governments - i.e. the borough level. It is not sufficient to give the responsibility for local government notification to only the owners / operators. Local government should be the same as for state agencies other than DHSS.

10. ***Monitoring*** - The baseline radiation study (Section v. Monitoring Capability, Future Considerations) should be a high priority recommendation. If such a study had already been done (and had included the Point Hope region), some of the current Cape Thompson (Project Chariot) questions - such as whether the food chain is contaminated - would likely have been answered. .

I hope you will take my comments under serious consideration in the finalization of this plan. Radiation protection is an area of keen interest on the North Slope, especially after the discovery of the radioactive material neat Point Hope. Please call me if I can provide you with additional information on our comments.

Sincerely yours,

Jeslie Kaleak, Sr.
Mayor North Slope Borough