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APR 28 1971

Honorable John G. Dow
House of Representatives

Dear Mr. Dow:

Thank you for your letter of March 15, 1971 in which you expressed concern about several atomic energy matters, including the need to present information about nuclear power in terms that a layman can better understand. An enclosure addresses itself to the latter point first and then continues in response to your more specific inquiries.

I am very much aware of the confusion that technical complexities, and particularly technical jargon, can cause the layman. Expressing complex technical issues in simple terms is a constant challenge in our program to develop better public understanding of nuclear energy. We are working diligently to help provide members of the public with the information they need, and to which they are entitled, concerning the nation's nuclear power program, and to do so in language that they can understand. We have, for example, published a variety of booklets in what we call our "Understanding the Atom" series. I am enclosing one entitled "Atomic Energy Basics" and another called "Atomic Power Safety," not only as illustrative of the series but also to provide information of the type requested in your letter. We also have a variety of educational movies, filmed for the non-technical viewer. A catalog listing of these is also enclosed. Both the catalog of films and the "Understanding the Atom" booklets indicate how and where these and related informative materials can be obtained. For those of your constituents who seek more sophisticated information, the record of the Joint Committee on Atomic Energy Hearings on the Environmental Effects of Producing Electric Power, October, November 1969 and January, February 1970 represents a significant and invaluable resource.

You asked that your remarks be added to the record of the hearings being held on proposed construction of additional atomic plants at Indian Point, New York. The hearing in the Indian Point 2 matter and its record is a quasi-judicial matter now under the cognizance of an Atomic Safety and Licensing Board. Accordingly, I am forwarding your request that your remarks be made a part of the record to Mr. Samuel Jensch, the Chairman of this Board.

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While we have tried to address all of the specific points you raised in your letter, we realize that often a personal exchange of inquiries and responses is more helpful in clarifying matters of technical complexity. As I indicated in my previous letter of acknowledgment of your inquiry, Commissioner Larson would be glad to meet with you to discuss these matters further. If we can be of further assistance, we would be pleased to hear from you.

Sincerely,

/s/ Glenn T. Seaborg

Chairman

Enclosures:
1. General Comments and Response to Specific Statements
2. "Atomic Energy Basics"
3. "Atomic Power Safety"
4. USAEC Combined Film Catalog

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AEC STAFF STUDY PERTAINING TO LETTER FROM CONGRESSMAN JOHN G. DOW DATED MARCH 15, 1971

General Comments

A. Definitions

Different units are used in everyday life to express different entities, e.g., miles per hour for speed, calories for energy, etc. Likewise, different units are used in expressing nuclear energy concepts. In brief, the curie indicates how rapidly a given amount of a radionuclide disintegrates. As these atoms disintegrate, they emit radiations which may be absorbed, in whole or in part, by living tissue. The amount of absorbed energy is expressed in rads. Finally, since different types of radiations may produce different degrees of biological effects for the same amount of energy absorbed by living tissue, it is necessary to use the unit rem. Thus, the rem probably is the best single indicator of potential biological effects.

In attempting to clarify the meanings and uses of different radiation units, definitions of three key units will be given followed by some explanatory statements.

Curie - the basic unit used to describe the rate at which atoms decay (disintegrate). One curie equals 37 billion disintegrations per second, or approximately the radioactivity of 1 gram of radium. A "picocurie" is a trillionth of a curie, i.e., 0.037 disintegrations per second.

Rad - an acronym for "radiation absorbed dose". The basic unit of absorbed dose of ionizing radiation. By definition, one rad is equal to the absorption of 100 ergs of radiation energy per gram of absorbing material. (An "erg" is a unit of energy. It is a small quantity. For example, a 100 watt electric light bulb utilizes a billion ergs of energy every second.)

Rem - an acronym for "roentgen equivalent man". A unit of absorbed radiation dose in biological matter. It is equal to the absorbed dose in rads multiplied by what is known as a "modifying factor" (which will be explained later). Another commonly used unit is the millirem. One rem is equal to 1000 millirem; it is like changing a one thousand dollar bill (rem) into 1000 one dollar bills (millirems).

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The curie is a useful unit to describe certain physical characteristics of radioactive substances (called radionuclides), but it provides no direct measurement of the effects the radiation emitted will have on people or things. The reason is largely that different kinds and strengths of radiation are given off by different radioactive materials. While by definition, a curie of one material will be disintegrating at the same rate as a curie of another, the radiations emanating as a result of those disintegrations may vary markedly.

The units used as a measure of radiation effects are the rad and the rem. The term rad is generally used for comparing the non-biological effects of different radiation exposure doses such as the effects on steel or insulating materials, for example. The rad, however, is not an effective measure of the effects of radiation on biological material since different forms of radiation* cause different amounts of biological damage for the same amount of energy absorbed. For example, the energy absorbed in living tissues from one type of radiation (alpha particles*) may produce a greater degree of biological effects than the same amount of energy absorbed from other types (beta particles or gamma radiation*). Thus, there are in accepted use "modifying factors" for different radiations which when multiplied by "rad" (radiation absorbed dose) gives "rem" (roentgen equivalent man).

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*Types of Radiations

There are three principal types of radiations (alpha, beta and gamma) that emanate from atoms when they disintegrate. Alpha particles are like the nuclei of helium and have very limited range, i.e., even an ordinary piece of paper will stop them. Thus, radionuclides that emit alpha particles, such as plutonium-239, are of no significant health consideration when they are outside of the body (since the horny layer of the skin will stop essentially all of them). Beta particles are merely high speed electrons. They are more penetrating than alpha particles and, if present in large number outside the body, can produce biological effects on the skin, "skin-burns". However, this potential effect is encountered only in exceptional situations such as handling high radioactive materials with the barehands. Both alpha and beta particles may be a health hazard if they are emitted in sufficient quantities from radionuclides within the body. The energies of gamma rays vary depending upon what radionuclide is their source but, in general, are considered to irradiate the whole body even when the radionuclide is outside of the body.

B. Radionuclides and Biological Effects

Each radionuclide is specific as to the type or types of emissions emitted and to its "half-life", the time for one-half of the remaining atoms to disintegrate. These "half-lives" for different radionuclides range from millionths of a second to over billions of years.

Different radionuclides not only have wide ranges of values for their radioactive "half-lives" but also for the amounts that may be deposited in different organs of the body, if ingested or inhaled, and for their rates of elimination from the body. To determine biological effects requires not only knowledge about the curie quantities of the specific radionuclide involved but also the type of radiation emitted as the atoms disintegrate, the total amount of radiation energy absorbed, the rate at which it was absorbed and the specific biological tissue involved. Very precise data are known for the physical and chemical characteristics of all of the key radionuclides and for their production rates in nuclear reactors and other nuclear activities. Less precise information is available on biological behavior and effects of radionuclides as would be expected when dealing with living organisms owing to their complexity and variability. However, a very great fund of knowledge on the biological effects of radiation has been accumulated over more than a half century of research. In fact, even back in 1960 the National Academy of Sciences stated:

> "Despite the existing gaps in our knowledge, it is abundantly clear that radiation is by far the best understood environmental hazard. The increasing contamination of the atmosphere with potential carcinogens, the widespread use of many new and powerful drugs in medicine and chemical agents in industry, emphasize the need for vigilance over the entire environment. Only with regard to radiation has there been determination to minimize the risk at almost any cost."

C. Natural Radiation

Definitions for the "rad" and "rem" have been given, but it is recognized that these may lead to little understanding for the layman. There are two alternate courses that may be followed

to explain their meaning: one, a detailed technical discussion* or two, a comparison with naturally occurring phenomena. The second course will be followed here.

Man has always been subjected to radiation from natural sources - cosmic rays, radioactive materials in the ground, in the air we breathe and the food and water we ingest.

As far as known, man always has and always will live in an environment filled with nuclear radiation from natural causes. To these natural radiations will be added those from man-made nuclear activities such as nuclear energy programs - but these radiations are no different in kind from those emanating from natural sources. Nor is there any evidence they produce any fundamentally different biological effects. Nuclear energy programs will not introduce a new and strange agent into our environment with completely unpredictable results.

In short, man-made nuclear activities will produce only more of the same types of radiation to which man has been subjected ever since he first appeared on this earth.

But how much more?

First, let us take a look at the radiation exposure man receives from natural sources. In round figures, persons in the United States receive about 125 millirems of radiation each and every year from natural sources - broken down approximately as follows:

Terrestrial sources	60 millirem
Cosmic rays	40 millirem
Radioactive materials within our bodies	25 millirem

But the amount of radiation exposure can vary depending upon where we live. Living in Denver, for example, about doubles the yearly exposure over that at the seashore because the cosmic rays are more intense at higher altitudes and there are larger amounts

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*Further information is available in AEC "Understanding the Atom" booklets entitled "Your Body and Radiation" by Norman Frigerio and "The Natural Radiation Environment" by Jacob Kastner.

of radioactive materials naturally in the ground. In fact, the amounts in the ground are so great in parts of the world that the radiation levels have remained ten to a hundred times higher than the 125 millirems per year. Incidentally, there have been no demonstrably harmful biological effects to the population who have lived for generations in these areas of high background radiation. But one does not have to look far to find greater concentrations of naturally occurring radioactive materials than the average. Granite, bricks, concrete, etc., are examples; living in buildings constructed of these materials can increase the radiation levels over those found in wooden structures from 10 percent to more than 200 percent.

D. Medical Exposures

Medical irradiation accounts for the major portion of the average dose received by persons in the United States from man-made radiation. The National Council on Radiation Protection and Measurements has stated that the average genetically significant radiation dose to persons in the United States from medical uses is probably 50 to 70 millirems per year.

E. Radiation Exposures from Nuclear Power Plants

How do such numbers compare with the radiation exposure that persons might receive if they lived near a typical nuclear power plant? Experience with licensed power reactors to date shows that it is possible to design and operate reactors such that the public living in the vicinity of these plants will not be exposed to radioactivity from plant effluents which will be much more than a few percent of the natural background. Extrapolating to the year 2000, it has been estimated that the effluents from all of the nuclear power plants, even without any further reduction in effluents from present day practices, would result in an average radiation exposure to the general population of less than one millirem per year.

It may be seen that these radiation exposures are quite small compared with those from natural sources and medical uses. They are indeed small when compared with the variations only of background radiation from locality to locality in the United States. It has been estimated, for example, that the gamma radiation dose from igneous rock on the island of Manhattan exposes people to about 15 millirem/yr more than they would receive from the sandy terrain of Brooklyn, another borough of the city of New York.

F. Radiation Exposure Standards

In addition to comparing potential radiation exposures from nuclear power programs with natural radiation, another comparison may be made with radiation protection standards. The framework for controlling levels of radioactivity in effluents from nuclear power plants is set forth in regulations Part 20 and Part 50 published under Title 10 of the Code of Federal Regulations. Part 20 sets the general standards for protection against radiation, including limits on levels of radioactivity released to the environment. Part 50 establishes general design, construction and operating requirements for nuclear power plants. These standards are based on guidance from the International Commission on Radiological Protection, the National Council on Radiation Protection and Measurements and the Federal Radiation Council (whose functions now have been assumed by the Environmental Protection Agency).

In brief, the radiation protection standards for whole body exposure (exclusive of natural background radiation and medical uses) are:

1. Individual in the general population should not exceed 500 millirems per year
2. General population (average) should not exceed 170 millirems per year
3. The radiation dose to persons should be kept as low as practicable.

G. Regulation of Releases from Nuclear Power Reactors

Thus, the objectives of the regulations and the regulatory program are not only to keep effluent releases within the protection standards but also to see that appropriate efforts are made to keep releases of radioactive materials in effluents to unrestricted areas as far below limits specified in the regulations as practicable.

Experience has shown that the radioactivity in water and air effluents from licensed power reactors has generally been kept at less than a few percent of the limits specified in Part 20. Measurements of radioactivity in the environs of nuclear power plants have in most cases revealed little or no increase in

environmental radioactivity resulting from plant operations. In cases where increases were measured, the levels were barely detectable above background. This observation is supported by unusually detailed studies of the environs of three power reactors that have operated from eight to ten years. The Bureau of Radiological Health of the U. S. Public Health Service jointly with the Atomic Energy Commission conducted an investigation at the Yankee Atomic Power Reactor in Rowe, Massachusetts, and the Dresden Nuclear Power Station Unit I in Illinois. Indian Point Unit I on the Hudson River has been studied extensively by a team from the Institute of Environmental Medicine at New York University Medical Center. Periodic surveys have also been made by the New York State Health Department. (Reports of these studies can be attained direct from these agencies.)

The AEC has published amendments to regulations set forth in Part 50 that will help to assure that radioactivity in effluent releases is indeed maintained as low as practicable with available waste treatment equipment and procedure technology. These revisions give added assurances that radiation doses from nuclear power plant effluents will continue to be only small percentages of the dose from background radiation.

RESPONSE TO SPECIFIC STATEMENTS

Statement:

"I am frightened when I read some of the data recently published on this subject. For instance, Senator Gravel last year said in the Senate: 'Each 1,000 megawatt nuclear power-plant will produce, every year that it operates at 75 percent capacity, as much radioactivity as the explosion of several hundred Hiroshima-size bombs. That could mean the equivalent of 250,000 bombs every year, if there were 500 plants operating'."

Response:

Although nuclear reactors do produce in their operation very large quantities of radioactive material, this should not be taken to imply that large quantities of such materials are released, or are available for release, to the environment. On the contrary, great care is taken to assure that the great bulk of radioactive materials produced in nuclear fission (called fission products) are retained within the nuclear reactor fuel elements. Further, the structural characteristics of nuclear reactors, which include several inherent or specially provided steel or concrete barriers, assure there will be no untoward release of fission products outside the plant. During normal operation, it is true that very small amounts of radioactive materials are released from nuclear power plants under carefully controlled and monitored conditions. However, the effect of these small releases represents only a few percent of natural background radiation, and current designs are further reducing this very low level.

Statement:

"Does this mean that so much radioactivity will be contained within the power-plant, will it be released into the air, or will it be captured and deposited somewhere as waste? Can that amount of radioactivity be contained permanently in a burial ground?"

Response:

In the process of generating electricity in a nuclear power plant, large quantities of radioactivity are safely contained within the uranium fuel elements by a high-integrity cladding.

After a certain operating time, the reactor fuel, still protected by the metal cladding, is removed from the reactor. Because there remains valuable unused uranium in the spent fuel, the fuel is shipped intact in a shielded cask to a chemical reprocessing plant. During the chemical processing operation to recover unused uranium, high concentrations of radioactivity are produced in a liquid form.

These highly radioactive liquid wastes are not released to the environment but are safely contained in specially designed underground tanks. Recognizing, however, that this method is not a final solution to handling these wastes for long periods of time, extensive research and development programs have been supported for many years. During the past 15 years, with the advice and guidance of the National Academy of Sciences, practical systems have been developed for converting these wastes to a solid form with storage in a suitable dry geologic formation, such as salt. The AEC is seeking Congressional authorization of a project in FY 1972 to store radioactive wastes in a salt repository near Lyons, Kansas. In this manner, large quantities of radioactive waste materials can be contained permanently in a salt burial repository, which is completely isolated from man's biological environment.

Statement:

"Senator Gravel's statement includes the following: 'It should be remembered... that a single "hot particle" of radioactive plutonium lodged in the lung is capable of causing a lethal cancer.' What is a single 'hot particle' of radioactive plutonium like? Is it a cinder that one can see? Is it an invisible atom or molecule floating through the air? Can it penetrate the body unbeknownst to us? How many would be released by a Hiroshima bomb?

"Dr. Edward A. Martell, another authority, who is cited in the December 15, 1970 issue of Look magazine, is quoted as saying, 'The estimated total plutonium deposited in off-site areas which we have examined so far is in the range from curies to tens of curies.' He was speaking of soil samples near the Dow Rocky Flats plant where plutonium triggers are made for hydrogen bombs. So my questions include these: Is a curie a lot or a little? What is its relation by measure to Senator Gravel's 'hot particle' of radioactive plutonium? How many curies are lethal? If they are in the soil, how many curies were found in a cubic foot of soil? What would be their life there? Are the curies floating from the Dow Rocky Flats smokestack dangerous when in the air and how many parts are found in a cubic foot of air? Is that number lethal and how is it lethal after the smokestack shuts down for any reason?"

Response:

General Comments

Plutonium-239 is found in soils throughout the country as a result of fallout from past atmospheric nuclear explosive tests. About 500,000 curies of plutonium-239 have been released to the atmosphere from these tests. Based on assumptions that maximize the estimations, it has been calculated that, as an upper limit, a total of about five to six additional curies of plutonium-239 are present in the soils around the Rocky Flats Plant as a result of the plant's operations. The sector showing the highest concentrations is downwind (east southeast) from the area where there has been a leakage from storage drums of plutonium-contaminated oil over a period of time, 1955-67. Following this leakage, the plutonium was resuspended from the soil and carried off-site by the winds. The storage area has now been covered with asphalt to preclude any further movement of the plutonium from the plant site.

After extensive monitoring around the plant in 1970, the Colorado State Department of Health stated "It is our conclusion that no public health hazard now exists from past releases from the Rocky Flats Plant."

When metallic plutonium reaches the air, it quickly oxidizes forming insoluble oxide. Plutonium oxide is of very little consequence while in the soil since it is very poorly taken up by plants. If ingested in small amounts, plutonium also is of little significance since its absorption through the gastro-intestinal tract is exceedingly low, i.e., it is merely eliminated from the tract in the feces. Potential health problems for the public are thus limited essentially to inhalation of plutonium oxide. If inhaled, plutonium oxide may be deposited in the lungs (if the particles are of appropriate size) and is then eliminated with a half-time of about one year, i.e., half of the remaining particles in lungs will be moved up from the lung by natural body processes then swallowed. Most of these particles are eliminated from the body through the gastro-intestinal tract and some may be translocated to other organs of the body such as the lymph nodes, bone and liver.

Particles of plutonium most likely to find entry into the lungs by inhalation can range from few microns (a millionth of a meter) in diameter to small fractions of a micron. Such particles are too small to be seen by the naked eye. A curie of plutonium activity represents about 3 trillion particles whose diameters are one micron.

During the time that any plutonium remains in the lung, it will, of course, irradiate the lung tissue. Naturally occurring radioactive nuclides in the air also irradiate the lungs. So to evaluate the potential hazard from plutonium in the air, it is necessary to compare the concentrations observed to the established radiation protection standards. For plutonium oxide the standard for the general population is 0.33 picocuries per cubic meter of air. This standard is based on the assumption that one breathes the air containing this concentration of plutonium for a lifetime - although for control purposes the averaging of concentration data is limited to a period of one year.

Specific Comments

Single highly radioactive particles of plutonium oxide placed in the lungs of rodents and rats during research studies have not

produced lung cancer, nor is there any evidence that a single particle in the human lung would produce cancer. In fact, no biological effects have been observed in human subjects who accidently inhaled substantial quantities of plutonium particles more than 24 years ago. The exact numbers of particles in the lungs were, of course, not known but based on the total plutonium activity inhaled; the numbers probably were many millions. Incidently, measurements have been made of the amount of plutonium (in terms of total radioactivity) in the lungs of several hundred persons in the United States as a result of inhalation of fallout from past atmospheric nuclear explosive tests. If this amount of plutonium were in particles one micron in diameter, then we have on an average about one particle in our lungs. If the particles are smaller than one micron, which is more likely, then the estimated number of particles increases. For example, if the particles are one-tenth of a micron in diameter, then the number of particles in our lungs would be about 1,000.

The precise amount of plutonium, either in curies or number of particles, that may be lethal to man is not known since there have been no deaths from this radionuclide. Relatively large amounts of plutonium have been inhaled and ingested during animal experiments that have led to cancer production. Extrapolation from animal research suggests that 1-10 millionths of a curie of plutonium in the lungs may produce deleterious effects at some time in the life-span of man, although, on a statistical basis, the possibility cannot be ruled out that lesser amounts of plutonium may produce deleterious effects. This corresponds to about 3 million to 30 million particles assuming they are all 1 micron in diameter. The most likely size would be less than 1 micron in which event the number of particles would be correspondingly greater.

As indicated before, there are at most about five to six curies of plutonium in the soils around the Rocky Flats Plant resulting from plant operations. In addition, there are about three curies of plutonium in the same areas from fallout from past atmospheric nuclear explosive tests. Since these nine curies are spread over many square miles, the average number of curies per cubic foot of soil is very small. There may be some translocation of the plutonium in the soil owing principally to winds but, in general,

the material will remain in place indefinitely. Plutonium-239 has a radiological half-life of 24,400 years.

A curie of plutonium has a mass of about 16 grams. Thus, in terms of mass, a curie is small; in terms of radioactivity, it represents 37 billion disintegrations per second; and by definition, any radionuclide that disintegrates at this rate represents a curie of radioactivity. In terms of the radiation protection standard, a curie of plutonium-239 is very large compared to the amount in the lungs that would be a health hazard. It would not be a valid analysis, however, to relate a curie of plutonium in the soil to that in the lungs for an evaluation of health consequences anymore than it would be to, in imagination, sweep up either the naturally occurring radionuclides or the non-radioactive chemicals in the soil and place them into the lungs.

Specifically, the most meaningful way to evaluate the potential health hazard of plutonium oxide is to analyze the data on concentrations in the air as a result of resuspension from the soil into the air or from releases of plutonium into the air from ongoing operations. Monitoring programs have shown average levels of plutonium in the air in the sector most likely to have the highest concentrations away from the Rocky Flats Plant site to be about 0.003 picocuries per cubic meter. This is about 100 times less than the radiation protection standard for the general population. A major factor in keeping the concentrations of plutonium in the air to low values is the several banks of high efficiency air filters, which remove almost all of the plutonium from the exhaust air. Periodically, these filters are packaged in special containers and shipped to a Federal repository for permanent and safe storage.

Some plutonium-239 from fallout from past atmospheric nuclear explosive tests and from the Rocky Flats Plant operations finds its way into water supplies and vegetation. The highest measured concentration of plutonium-239 (for 1970) in the water was in a pond on Walnut Creek, where the average (off-site) value was about 0.9 picocuries per liter. The highest measured concentration of plutonium-239 in a municipal water supply for 1970 was at Thornton, Colorado, where the average value was about 0.16 picocuries per liter. The average concentration of plutonium in vegetation around the Rocky Flats Plant was about 0.02 picocuries per gram. The health standard for the general population is 1670 picocuries of plutonium-239 per liter of water and when applied to foodstuffs represents 1.7 picocuries per gram.

The quantities of plutonium that may be associated with any single nuclear bomb are classified information. If you so desire, we will be pleased to arrange a classified briefing for you on this subject.

Statement:

"The Look article speaking about uranium says, '...the Animas River below uranium mills in Durango, Colorado contained almost 300 percent of the maximum daily intake for radium.' What is the maximum daily intake? What is the measure that is? Is it stated in curies or rems? How much water would one have to drink from the Animas River in order to equal the maximum daily intake? Could one acquire equal exposure by swimming in the Animas River?"

Response:

In the late fifties, there were high concentrations of radioactivity in the Animas River below Durango, Colorado. These were primarily due to suspended solids discharged with liquid effluents from milling operations rather than from erosion or leaching of tailings. Corrective steps were taken to eliminate this problem in 1959; and since 1960, the Animas River has been well below the previous levels and well within the radioactivity standards. The mill ceased operations in March 1963. The Colorado River Basin Water Quality Control Project, Federal Water Pollution Control Administration (FWPCA), reported in 1968 that the radium-226 content of the Animas River averaged 0.07 picocuries per liter. The radiation protection standard for the general population is 10 picocuries per liter.

The daily intake of water by an average adult is assumed to be 2.2 liters. At a concentration of 0.07 picocuries per liter the daily intake of radium-226 would be about 0.15 picocuries. If the concentration were as high as the radiation protection standard, the daily intake would be 22 picocuries. Thus, one would have to drink about 140 liters (more than 140 quarts) per day - a physical impossibility - at a concentration of 0.07 picocuries per liter to equal the maximum daily intake. Further, the radiation protection standards of concentrations of radioactivity in water are established on the basis that there will be no detectable biological damage even if that water were consumed for a lifetime.

Swimming in the water containing radium-226 would result in very little exposure when compared to drinking water at the same concentrations. This because most of the biologically significant

radiation energy from radium-226 is emitted in the form of alpha particles which have an extremely short range and generally cannot penetrate the outer layers of skin.

Statement:

"Further along in the Look article it is said, 'El Paso Natural Gas Company uranium tailings in Tuba City, Arizona on Navaho land, showed radium radiation levels up to 1,000 times the average background. Gamma radiation was 12 times the level... Tailings at the empty A-Z Minerals Corporation mill in Mexican Hat, Utah, in May, 1968, also Navaho land, had radon-gas concentrations around the pile up to five times the maximum level.'

"This sounds very fearsome, and undoubtedly it is. Yet it has no significance under any scale of cognition that the normal layman is used to--or Congressman, either."

Response:

The Atomic Energy Commission does not have regulatory jurisdiction over uranium tailings piles containing less than 0.05% uranium at mills that are closed down, which would include both those at Tuba City, Arizona, and Mexican Hat, Utah. The Arizona State Atomic Energy Commission has jurisdiction over the piles at Tuba City, Arizona, and the Utah State Division of Health at Salt Lake City has jurisdiction over those at Mexican Hat, Utah. In cognizance of the radioactive content of these tailings piles, however, surveillances have been made and the results are summarized below.

The data on concentrations of radium-226 in air on and near the uranium tailings piles at the Tuba City mill do show some measurements up to 1000 times average background. The same U. S. Public Health Service Report[1] that contains these data goes on to say: "The average radium-226 concentration for samplers 2, 3, and 4, located in the housing area was 0.02 pCi/m^3. This represents a level equal to 1/100 of the recommended concentration guide." (emphasis added)

The report states:

"External gamma radiation on the tailings area averaged 0.7 mR/h at 3 feet above the surface, which calculates

[1]Radiological Health Data and Reports, November 1969.

to an average dose of 6.0 rem/a (year) for continuous exposure. This exceeds by a factor of 12 the currently recommended Radiation Protection Guide of 0.5 rem/a for continuous whole body exposure to individuals in the general population. These findings serve to preclude the release of the tailings area for public use. Action which would permit release of said area would be to cover the tailings with uncontaminated dirt to an extent that would diminish the external radiation to an acceptable level and to stabilize the covering against wind erosion. Otherwise, the area should be fenced and controlled as a radiation area. (emphasis added)

"The average radiation exposure [rate] at 3 feet above the surface around the mill area was 0.1 mR/h.... The average dose to an individual having a 24-hour per day residency in this area, on the basis of the average value of 0.1 mR/h is 0.9 rem/a (year). Although this dose is approximately twice the RPG* of 0.5 rem/a (year), it represents a highly unlikely condition of continuous occupancy. With reasonable occupancy assumptions it would not be expected that an annual dose in excess of 0.5 rem would occur." (emphasis added)

Finally, the same U. S. Public Health Service Report stated:

"The recommendations herein were presented to the Navajo tribe and to the State of Arizona in October 1967. In November 1967, the State of Arizona directed the El Paso Natural Gas Company to stabilize the pile against wind erosion and to fence and post the property to prevent access by unauthorized people.

"El Paso Natural Gas Company, in cooperation with the U. S. Bureau of Mines' Metallurgy Research Center, regraded, fenced and chemically stabilized the pile against wind erosion in May 1968. The housing area was released to the Navajo tribe and is presently occupied.

"An inspection of the tailings area in May 1969 indicated that the chemical binder had maintained its integrity."

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*Radiation Protection Guide.

As to radon gas concentrations at the A-Z Minerals Corporation mill in Mexican Hat, Utah, the U. S. Public Health Service Report[2] on the study made in May 1968 at the request of the Navajo Tribal Council states:

> "Radon gas concentrations on and about the tailings area .... exceed the concentration guide.... It should be pointed out, however, that this guide is applicable to radon-222 and its daughters 'as they occur in unfiltered air.' This may be interpreted as meaning radon in equilibrium with its daughter products in air. Since it was demonstrated that equilibrium did not exist between radon and its progeny, at least at the time of daugher product sampling, it does not appear that the concentration guide has been exceeded. Levels of radon-222 in the mill area and housing area are substantially below the recommended guide." (emphasis added)

The report states that the housing area, located approximately 0.5 mile southwest of the tailings area, showed essentially background levels of radon-222. The surrounding land is unpopulated, and at present is not used either for farming or grazing. The nearest community, Mexican Hat, Utah, is about one mile to the northeast.

The recommendations contained in the report are as follows:

> "On the basis of the data gathered in this survey, it is recommended that the mill tailings be properly stabilized against wind erosion. This action would preclude further transport of tailings material into the surrounding environment and would minimize the potential long-term hazard to anyone inhabiting the area downwind from the mill property. If the tailings area is not stabilized, periodic surveillance will be necessary to insure that significant wind carriage does not occur.

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[2] Radiological Health Data and Reports, January 1971. SWRHL-68 Environmental Survey of Uranium Mill Tailings Pile, Mexican Hat, Utah, October 1969.

"As a result of the external radiation levels on the tailings area itself, this area should not be released for public use in its present state. Action which would permit release of the area would be to cover the tailings with uncontaminated dirt to an extent that would diminish the external radiation to an acceptable level and to stabilize the covering against wind erosion."

In March 1970, A-Z Minerals and the Navajo Tribal Council terminated the company's lease on the Mexican Hat property, returning it to the Tribal Council.

Statement:

"A 1957 AEC study predicted that an explosion in a nuclear reactor would kill 3,400 people up to 15 miles away, injure 43,000 up to 45 miles, contaminate up to 150,000 square miles--about the size of California--and damage property up to $7 billion. Since I live within 20 miles of the three Indian Point plants that the Consolidated Edison Company of New York is building on the Hudson River--and thousands of my constituents live closer to it than I do--I am opposed to the building and operation of those plants.

Response:

The study referred to (known as the Brookhaven Report, or WASH-740) was performed for the Atomic Energy Commission by the Brookhaven National Laboratory in early 1957 at a time when the technology of central station power reactors was in its infancy and even before the Shippingport reactor, which was the first central station power reactor, went into operation. WASH-740 reports the results of a study done by Brookhaven National Laboratory in which the completely hypothetical assumption was made that large amounts of fission products were released from a reactor in some unspecified manner into the atmosphere in a highly dispersible form. This study was made at the Commission's request in order to establish an upper limit on potential consequences in connection with consideration of the Price-Anderson indemnity legislation. Since that report was written, many power reactors have been designed, built, and operated, and in this process the technology of reactor design and nuclear power plant construction, and provisions of engineered safety features, have made very great advances.

In 1965, the AEC staff, in consultation with some of the Brookhaven staff members, reconsidered WASH-740 at the time the extension of Price-Anderson indemnification was being considered. With complete disregard of the greatly improved safety precaution system, it was concluded that, with current reactors being substantially larger than those considered in the Brookhaven study, and assuming the same type of hypothetical releases of fission products as those in the 1957 study, the theoretical damages would not be less and under some circumstances would be more than those assumed in the earlier study; however, it was further concluded that the positive safety factors that had developed during the ensuing years were sufficient to support the firm conviction that the likelihood of major accidents such as posed in the Brookhaven study is extremely low -- in fact, even lower than the remote probability that had been estimated in the 1957 study. These factors include the favorable safe operating experience accumulated by power reactors as shown by the safety record since 1957, the substantial advances in reactor technology since that time, the safety incorporated in the design of each vital component and system, and the successive defenses built into safety features designed both to prevent accidents and to limit the consequences in the highly unlikely event that they should occur. These conclusions were communicated in a letter to Congressman Holifield which in turn were published in the record of the JCAE hearings in July 1965.

There has never been an "accident or near accident" at any licensed power reactor where the consequences even remotely approached the situation postulated in WASH-740. The significant factor from the viewpoint of public safety is that a "defense-in-depth" concept has been built into licensed nuclear power plants, which assures in the event of a malfunction of a system or component which is important to safety that alternate systems or components will meet the safety requirements, and that backup containment barriers are provided. As a result of this "defense-in-depth" approach, no malfunctions, misoperations, or equipment failures at licensed facilities have constituted a public safety problem in the United States. We know of no instance where their operations have resulted in exposure of any member of the public to radiation exceeding annual limits specified in nationally and internationally recognized standards for protection of public health and safety.

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

RECEIVED
MAY 4 1971
U.S. ATOMIC ENERGY COMMISSION
Regulatory Mail Section

In the Matter of)
)
CONSOLIDATED EDISON COMPANY OF)
NEW YORK, INC.) Docket No. 50-247
(Indian Point Nuclear Generating)
Unit No. 2))

4-28-71.

CERTIFICATE OF SERVICE

I hereby certify that copies of a letter dated April 28, 1971 from Chairman Seaborg to Congressman John G. Dow with attachment in the captioned matter have been served on the following by deposit in the United States mail, first class or air mail, this 3rd day of May 1971:

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