50-293

Chairman Selin
Boston Edison
P.R. Meeting
Nov 1, 1992

Chairman Selin,

It is very nice to see you again, especially in our neighborhood. I want to thank you and especially Boston Edison for this very gracious invitation to the public. I know you support a policy of openness but this is a rather newly developed attitude for Pilgrim. We do welcome the opportunity to address you personally, with our concerns.

In this area, concerns fall into two broad categories: HEALTH and SAFETY.

Health concerns have been discussed heavily lately with Mass. Dept. Of Public Health. I wish you were present at the Public Health Meeting last night to hear first hand some of the concerns we the Public have. I will leave with you a copy of the testimony that at least I presented, perhaps you could pass it on to your staff members who are currently preparing the NRC's testimony concerning the State's Air Emissions Standards.

Last night we did receive a tentative commitment from MDPH to consider setting forth a standard that may help reduce emissions from Pilgrim and in the long run may help reduce the elevated numbers of cancers we experience in this area.

As you know my first allegiance is to safety, Emergency Planning in particular. The Chairman and Commission did graciously extend to me the privilege of addressing the full Commission on this topic last fall. I did so in the form of a 2.206 petition, which you did accept as such. I am happy to report the NRC is giving a great deal of attention to this petition.

There are two updates regarding that petition I would like to personally inform you of:

First: The recent commitment I have received from George Davis, Vice-president of BECo, to secure either Letters of Agreement or signatures verifying agreement from all Emergency Planning Support Groups. This action will bring the Utility in compliance with NUREG 0654 A.3. This, to my knowledge, will be the first time ever in the History of Pilgrim's Emergency Planning that we will have documented proof of real and actual commitments from the necessary support groups. No more will we have to rely upon the supposed secret agreements only whispered to a select few.

Ltr. Encl. DFO1

ACD: Madeiy Cashbrook 1 1

Had BECo done this years ago they would not have faced the embarrassing National Guard issue.

The Second Issue are the problems that surfaced during the Dec. Exercise -namely the onsite - offsite communication link. The NRC through Jim Taylor, Tim Martin and especially Ebe McCabe has identified a multitude of problems in this critical area. Essentially what I am discussing, is the utilities ability to develop the necessary information concerning accident status and being able to disperse that information to the proper State agency , MDPH, so they in turn can have the ability to make a proper protective action guideline for the EPZ public. This is the most essential and basic area of planning. Without a proper PAG we have nothing. This area was riddled with flaws.

It is my understanding that the NRC and the Utility have agreed upon the corrective actions in both planning and training that must be taken. This is being initiated by the Utility and will be followed up on by the NRC. MDPH is not yet cooperating fully but I am sure now that we have a new and willing BECo Bob, they will come along.

These two areas alone strongly indicate that there is NO REASONABLE ASSURANCE. When you and the rest of The Commission voted on the Task Force Recommendation or Jim Taylor's recommendation to be accurate. Not to set the 120 day clock; you had not been made fully aware of these problems. Yet, I had identified both these areas to the Task Force.

I am only one person, without power, yet, I initiated the actions to bring about correction of both these areas. You, Chairman Selin have the power to correct all the hundreds of flaws that still exist in planning. Please, when my 2.206 Petition comes before you for consideration, set the 120 day clock and give to us the public the planning that the Federal Regulation 10 CFR 50:47 mandates we should have.

Jane A Fleming

DRAFT

BOSTON EDISON
Executive Offices
800 Boylston Street
Boston, Massachusetts 02199

George W. Davis
Executive Vice President

April 21, 1992

Mrs. Jane Fleming
30 Oceanwoods Drive
Duxbury, MA 02332

Dear Jane:

Thank you for the enjoyable lunch. The Windsor House is special and will be added to my very limited list of the area's "good places to eat". I was disappointed that time did not permit a tour of the house. Another reason to return.

As you suggested, more formal, and binding arrangements with EP participants than currently exist are desirable. I will work to that end -- both through Mr. Rodham and the BECo. EP organization.

Although I have moved my office to Boston, my wife and I continue to reside in Plymouth. We enjoy the area and the many friends we have made here. As you can appreciate, being a part of Pilgrim during the short 3 years we have been here has posed some unusual challenges. I am satisfied, however, that the plant is being operated and maintained professionally. And good progress is being made in realizing the goal of Pilgrim as a good neighbor. Obviously, more needs to be done in both of these imperatives -- and it will be done.

Your daughter's swimming prowess is impressive -- reflecting a lot of dedication and persistence on her part -- and sacrifice on yours. I wish her the best of luck in the weeks ahead.

Sincerely,

G. W. Davis

GWD/mg

Duxbury Nuclear Advisory Committee
Duxbury, Massachusetts
April 30, 1992

Commissioner David Mulligan
Mass. Dept. Public Health

Attn: Robert Hallisey
Radiation Control Program
State Laboratory Institute
305 South Street
Jamaica Plain, MA 02133

Re: Proposed Draft Regulation For Emission Standards For Radionuclide Emissions From Commercial Nuclear Power Plants (105 CMR 123.000).

Dear Commissioner:

We are writing to express our concerns regarding the draft regulation (123 CMR 123.000). The regulation proposed by DPH has three aspects, which conceptually can be compared to an automobile speed limit:

- The Emission Standard (comparable to a 55 mph limit)
- Compliance (comparable to a police radar trap)
- Penalties (is there a fine or loss of license)

I. THE EMISSION STANDARD

The proposed emission standard is **10 millirem per year.** It is based on what DPH feels is an acceptable risk to a selected segment of the public -- **3 fatal cancers per 10,000** people; 6 incidences of cancer for every 10,000 people.

A. The Level of Risk

The level of risk DPH proposes for airborne radionuclides is much higher than that permitted for other carcinogens. For airborne chemicals, DEP's acceptable standard is a lifetime cancer incidence risk of 1 in 1,000,000 for any one chemical. (DPH Memorandum dated December 3, 1991, entitled "DEP's CHEM/RAD risk assessment-- See Appendix A). Yet, according to a recent

assessment by DPH of the risk from radionuclide emissions, the mortality risk allowed by the "standard" set in the proposed DPH regulation is 3 in 10,000, and the allowed risk of cancer incidence that is about 1.5 to 2 times higher.

According to the DPH assessment, radionuclide emission standard would have to be reduced to 0.015 mrem per year to reduce the lifetime cancer incidence risk to the same level, 1 in 1,000,000, as that permitted for chemicals and many other carcinogens.

B. The Population at Risk

An advisory committee appointed by DPH to work on the proposed radionuclide emission regulation voted that the "safe" emission standard should protect the portion of the population that was most exposed, i.e., those who live nearest the Pilgrim nuclear plant.

The proposed regulation appears not to follow this vote. Instead, it adopts a definition and method of calculation (Sec. 123.03. Definitions ... Effective Dose Equivalent) that determines the risk to a hypothetical "reference man" from radionuclides dispersed and diluted over a 50 mile radius. Quite obviously, any given level of emissions from Pilgrim will present a substantially greater risk to those living in Plymouth, Kingston and Duxbury than to the populations of Boston, Providence and Provincetown, all of which are less than 50 miles from the plant.

C. Pilgrim's Operations

In April and December of 1991, Mr. Tom Sowden of Boston Edison told the DPH Advisory Committee that, since 1980, the emissions from Pilgrim I, measured at the boundary of the plant site, have been at or below 1 mrem per year 90% of the time, and at or below 0.2 mrem per year 70% of the time. (And, additionally, see a copy of the emissions summary chart from Boston Edison's testimony on this proposed regulation, dated 3/15/92- Appendix B).

D. Doses (Rems) Versus Actual Measures of Radioactivity (Curies)

The proposed draft regulation defines the standard in terms of dose limits. This poses difficulties. This is because what a facility emits is not a "dose" per se (which is measured here in terms of millirems) but "radioactivity" (as measured in a unit such as curies). It is a close to impossible task to make a

reliable connection between what Pilgrim emits and the dose it causes. The "dose" that might result to a person living in nearby towns from a given emission depends on a host of factors, including:

* the kind of radioactive material emitted (whether it is cesium-137 or strontium-90, and what chemical form it is in),

* the level of dilution it experiences in the environment,

* the behavior of the people near the facility- how much water they drink, where the water comes from, how much time they spend outdoors near the facility, where they were during batch releases, etc.

In order to make actual dose estimates, therefore, assumptions have to be made about these and other factors. Obviously, subjective judgement and uncertainty is involved in making such estimates. Thus, even a reasonable range of assumptions could result in a wide disparity in the resulting dose calculation. This problem makes a simple dose-based standard (such as that proposed by DPH) fuzzy and vague because there is no clear or precise objective limit on how much radioactivity (in curies) Pilgrim would be allowed to emit, either in total or from each stack or pipe.

This is undesirable. A good standard should provide a clear-cut way to tell whether it is being violated or not. From the perspective of enforceability, a clearer standard would be one which places a specific, concrete limit on allowable emissions of radioactivity, rather than simply on dose. Practically no other industry emitting any other pollutant is allowed this dose-based approach followed in the nuclear area and in this draft regulation; instead, industries must comply with environmental-health standards that set specific numerical limits. (See Appendix C).

Comment

The Committee's view is that DPH's decision to allow radionuclide emissions at a level that creates a risk 450-600 times greater than that permitted from any single airborne chemical is <u>not</u> reasonable. In this respect, it is important to note the following:

a. There is a growing body of scientific literature, including DPH's own recent report on the incidence of leukemia in the areas adjacent Pilgrim I, indicating (i) that low-level radiation presents a much greater risk of cancer,(ii) that even less may cause autoimmune disease, chromosomal damage and reproductive disorders, and (iii) that there is no known "safe" level of radiation. (See, Appendix C).

b. According to the former Chairman of the Nuclear Regulatory Commission, Kenneth Carr, and as was discussed in detail at the 21st DOE/NRC Nuclear Air Cleaning Conference, held in San Diego, California on August 13-16, 1990, the technology needed to reduce airborne emissions essentially to zero is readily available. The technology is discussed in the published three volume Proceedings of that conference. (See, Appendix D).

c. The effects of radiation are cumulative. The proposed standard deals only with future airborne radionuclide emissions. It does not take future liquid radionuclide emissions into Plymouth-Duxbury Bay into account; neither does it consider either the past or future effects of previous releases of radionuclides (many of which have extremely long half-lives) into the water or the air.

2. In determining what risk is "acceptable", one of the critical questions is "risk to whom?" In its proposed regulation, DPH ignored the advisory committee's vote that the "safe" emission standard should protect the portion of the population that was most exposed. This decision, the effect of which is to allow Pilgrim to release far more radiation than would otherwise been permitted, is particularly open to question since Boston Edison's statements to DPH about Pilgrim's actual emission levels (at or below 1 mrem per year 90% of the time, and at or below 0.2 mrem per year 70% of the time) referred to emissions as measured at the site boundary, not 50 miles away.

3. Particularly in view of available technology, the position of the Duxbury Nuclear Advisory Committee regarding the emission standard is clear:

a. The emission standard should be set at 0.015 millirem per year. There is no justification for allowing a greater risk of cancer <u>incidence</u>, not only death, than in the case of other carcinogens.

b. The definition of "Effective Dose Equivalent" must be changed to reflect the Advisory Committee's vote that the "maximally exposed person" is protected, rather than permitting emissions based on the dose experienced by the diluted/dispersed 50 mile "reference man."

4. The Duxbury Nuclear Advisory Committee feels, from the perspective of enforceabilty, the standard should include in addition to the current dose-based one, a standard limiting (and requiring reporting of) radioactivity of specific isotopes measured in curies.

II. DETERMINING COMPLIANCE

Once the emissions standard is set, the next question is how the state is to determine if a nuclear power plant has complied. All the proposed regulation provides is that:

1. The utility may "estimate radionuclide emissions" rather than making any actual measurements (Sec. 123.09(1));

2. If the utility chooses to measure emission rates, periodic rather than continuous measurements are allowed if the flow rate is "relatively constant" (Sec.123.09(2)(a)(3));

3. Any release point that does not have a "potential to discharge radionuclides into the air in quantities which could cause an effective does equivalent in excess of 1% of the standard" may be ignored. (Sec.123.09(1)(d)); and,

4. The utility must submit annual reports "covering the emissions of a calendar year by March 31 of the following year" (Sec.123.06).

Comment

In the opinion of the Duxbury Nuclear Advisory Committee, the proposed regulation falls far short of the most fundamental essential requirements. To insure that airborne radionuclide emissions from a nuclear power plant comply with an air emission standard there must be:

1. Continuous, real-time monitoring of all potential radionuclide release points;

2. Continuous reporting, by a direct, real-time computer link with DPH, of the output of all the release point monitors.

3. Continuous reporting, in curies, of each isotope released, as well as reporting in m/rems.

Laws or regulations providing for this type of real-time monitoring and reporting are already in effect in a number of states, including Maine, New York, Pennsylvania and Illinois.

Since 1987, Massachusetts Commissioners of Public Health have supported legislation that would require it in Massachusetts.

The testimony of Boston Edison Company has submitted on this very Draft Regulation, on page one, states, "...administering these regulations would create additional paperwork, expand bureaucracy, and increase the cost of doing business...". This is ridiculous. The regulation only requires the utility to fill out the very same NRC forms it is already required to fill out for the NRC. Indeed, a duplicate copy would seem to suffice.

To the extent that Boston Edison's complaint has any currency at all, a direct data line from its existing real-time monitors would obviate the need for any paperwork, and would place the onus of any extra work, not on the utility, but on DPH.

III. EFFECT OF NON-COMPLIANCE

The proposed regulation provides only one penalty if a nuclear power facility fails to meet the required emission level -- "If the facility is not in compliance ... the facility must report to the Director on a monthly basis" (Sec. 123.06(3)), rather than only once a year (Sec. 123.06(1)).

Comment

There is one fundamental reason for an airborne radionuclide emission standard - protection of the public health. If a utility fails to comply with the standard, "monthly reporting" does not provide the necessary protection.

We feel the proposed regulation must be changed. At the very least, it should require:

1. The facility to be closed until the reason for too-high emissions has been determined

(The statement I quoted on my personal testimony due to the fact EPA Clean Air act can not delegate enforcement power which belong solely to NRC)

2. Corrective action to eliminate the cause of the too-high emissions prior to re-start.

3. Limits on emissions during continued operation to whatever level is required to insure that the total emissions during the calendar year in question do not exceed the annual level permitted

4. An appropriate fine in an amount sufficient to (a) deter future violations and (b) cover any costs incurred by the state or local towns as a result of the impermissibly high emissions.

IV. ADDITIONAL COMMENTS

Finally, DPH should initiate a "Memorandum of Understanding" with all border states with the goal of developing uniform standards. There are no lead shields at the borders to protect our Massachusetts fellow citizens. Furthur, the regulation should apply to Yankee Rowe. Although not operational, Yankee Rowe will remain able to emit radionuclides into the air during the upcoming and lengthy decommissioning process.

We thank you, Commissioner Mulligan, for initiating this process. We hope you will give serious consideration to our comments, so the final regulation will be both protective of our health and act as a model for the nation.

Sincerely,

Presented by Janet A Fleming Pres -

The Duxbury Nuclear Advisory Committee

Apr 30 1992

APPENDIX A

NATIONAL EMISSION STANDARDS for HAZARDOUS AIR POLLUTANTS, (NESHAPS) FOR RADIONUCLIDES

SEPTEMBER 1989

United States Environmental Protection Agency
Office of Radiation Programs (ANR-459)

Risk Assessment Methodology
Environmental Impact Statement
NESHAPS for Radionuclides
Background Information Document - Volume 1 — EPA/520/1-89-005

Risk Assessments
Environmental Impact Statement
NESHAPS for Radionuclides
Background Information Document - Volume 2 — EPA/520/1-89-006-1

Economic Assessment
Environmental Impact Statement
NESHAPS for Radionuclides
Background Information Document - Volume 3 — EPA/520/1-89-007

RISK ASSESSMENT BOILING WATER REACTORS (BWR)		References
Highest Incidental Lifetime Fatal Cancer Risk	5×10^{-6}	Vol. 3 p. 1-8
Dose Dates for Model BWR	0.2 mrem/yr.	Vol. 2 p. 4-56
Atmospheric Radioactive Emissions Assumed for Model BWR	1415 Ci/yr.	Vol. 2 p. 4-53
Distance at Predominant Wind Direction	750 meters	Vol. 2 p. 4-55
Total Cancer Incidence Resulting From Whole Body Exposure	1.5-2.0 times the mortality risk	Vol. 1 p. 3-9

Lifetime Cancer Risk		Lifetime Exposure (mrem/yr.)
Fatal	5×10^{-6}	0.2
Fatal	1×10^{-6}	0.03
Incidence	1×10^{-6}	0.015
Fatal	3×10^{-5}	1
Fatal	3×10^{-4}	10
Fatal	3×10^{-3}	100
Fatal	1.5×10^{-2}	500

Elizabeth Anne Bourque, Ph.D. August 16, 1991

TO: Bob Hallisey

FROM: Liz Bourque

RE: DEP's CHEM/AAL risk assessment

DATE: December 3, 1991

The following are responses to the questions on Department of Environmental Protection's (DEP's) Chemical Health Effects Assessment Methodology and the Method to Derive Allowable Ambient Levels (CHEM/AAL) of air contaminants raised at the 11/21/91 meeting of the Advisory Committee on Radionuclide Air Emissions Standards.

1. For each air contaminant DEP calculates:

   a. THRESHOLD EFFECTS EXPOSURE LIMIT (TEL) value developed for non-carcinogenic effects that is a quantifiable level, threshold level, which produces the adverse effect, e.g. skin irritation et al.
   In determining the TEL DEP uses a 24-hour average level.

   b. ALLOWABLE AMBIENT LIMIT (AAL) value developed for nonthreshold effects such as carcinogenicity.
   In determining the AAL DEP uses an annual average level.

According to DEP the TEL and AAL values for each chemical must be used together to be protective of public health for both threshold and nonthreshold effects.

It is obvious that DEP does not use an instantaneous release level as a criteria for air contaminant levels.

2. DEP's risk level goal for a mixture of chemicals is:
   lifetime cancer incidence risk of 1×10^{-5}
   but even in mixtures they try to limit the risk as much as possible.

   DEP's risk level goal for one chemical is:
   lifetime cancer incidence risk of 1×10^{-6}

cc: Nancy Ridley

181:RADCHAAL

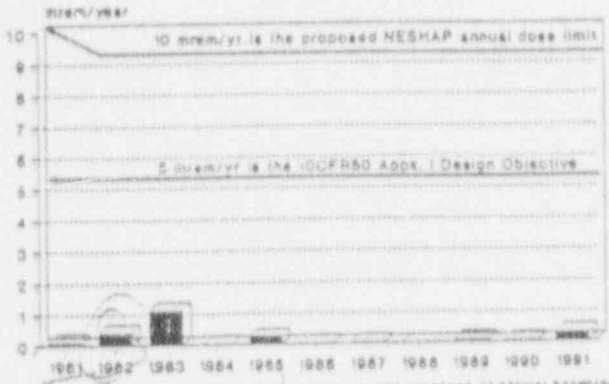
.54 TEL 24 $\bar{x}$ level
.04 AAL annual $\bar{x}$ level

annual whole body dose to the maximally exposed individual of less than 5 millirem/year. , This Design Objective is based on the concept of ALARA (As Low As Reasonably Achievable) and is the de facto standard for emissions from commercial nuclear power plants.

In addition, existing EPA regulation 40CFR190 limits the total annual dose from the entire uranium fuel cycle including milling, conversion, enrichment, fuel fabrication, and generation of electricity to only 25 millirem/year. This limit corresponds to the 10CFR50 design objective of 5 millirem/year to a person living near a commercial nuclear power station. PNPS operates well within both existing NRC and EPA standards and the proposed NESHAP.

As you can see from figure 3, over the last 10 years, calculated annual doses from Pilgrim Station to the most exposed member of the general public (usually the person living at or near the Pilgrim Station property boundary) have been much less than the NRC Design Objective of 5 millirem/year and very much less than the proposed state limit of 10 millirem/year. Actual doses are too small to reliably measure in the presence of natural background radiation.

Figure 3
Calculated Annual Offsite
Whole Body Doses



Personal Note of J.A.E

I strongly doubt the validity of any of this especial 1982

In order to comply with the reporting requirements of the proposed regulation, additional manpower will be necessary to provide the reports on the frequency and in the format required. The information in these reports is redundant to that already required by

APPENDIX E

Boston Edison 3/13/92

APPENDIX C

I. Significant Findings on Child Health Risks of Low-Level Radiation.

Gardner et al. Results of case-control study of leukaemia and lymphoma among young people near Sellafield nuclear plant in West Cumbria. BMJ Vol. 300, 17 February 1990.

In February of 1990 Martin Gardner and his research team discovered strong associations between paternal occupational exposures and subsequent childhood cancers in the village of Seascale, England, close to the site of the British nuclear reprocessing plant, known as Sellafield. Gardner's finding suggests that father receiving as little as 1 rem exposure to radiation, (less than six months before conception) may be passing on a mutation to their offspring that increases the offsprings' subsequent risk of cancer. The village, Seascale, had 12 times as many childhood cancers as expected. A dose-response relationship was observed, the association being strongest in the highest paternal dose group. Gardner demonstrated in a case/control study that a high proportion of these cancers were linked to father's occupation at the Sellafield plant.
(Exposures; 1 rem or more)

Hatch et al. Background Gamma Radiation and Childhood Cancers Within Ten Miles of a US Nuclear Plant. International Journal of Epidemiology, Vol. 19, No. 3, 1990.

A study by Hatch and Susser of Columbia School of Public Health in New York published in the International Journal of Epidemiology found a positive correlation between background gamma radiation and childhood cancers in census tracts within ten miles of the Three Mile Island Nuclear Facility. For childhood cancers, as a whole, incidence rates relate significantly to background radiation; the association is strongest in children ages 10-14 years. Their data indicate a 50% increase in risk of cancer for children under 15 with ever 0.1 mgy increase in estimated annual background gamma ray dose rate.

Stevens, et al. Leukemia in Utah and Radioactive Fallout from the Nevada Test Site. A Case-Control Study. JAMA, Vol. 264, No. 5, August 1, 1990.

A study published in JAMA in August 1990 showed an excess risk of acute lymphatic leukemia for those individuals who were younger than 20 years of age when exposed to fallout from nuclear testing at the Nevada Test Site between 1951-55. Estimated doses to the population ranged between 2.9 mGy to 30 mGy.

Forman, et al. Cancer Near Nuclear Installations. Nature, Vol. 329, 8 October 1987 (Commentary).

Published in Nature in 1987 was a study of cancer near nuclear installations in the United Kingdom, conducted by Forman et al. This detailed study analyzed childhood and adult cancers in local authority areas that had one-third of its population living with a 6-10 mile proximity to a nuclear installation. The age group of 0-24 years had excess cases of lymphoid leukemia and brain tumors. Particularly high excesses were noted around Sellafield and two nuclear installations in Scotland (Dunreary and Hunterston).

Knox, Stewart, Gilman and Kneale. Background Radiation and Childhood Cancers. J. Radiol. Prot. 1988, Vol. 8, No. 1 9-18.

In early 1988, Knox et al. published a study on background radiation and childhood cancers in the Journal of Radiological Protection. These investigators matched outdoor levels of terrestrial gamma radiation with local childhood cancer rates for every 10 KM square in Great Britain. A statistically significant positive correlation was found between exposures to background radiation levels and rates of childhood cancer mortality. The finding suggests that radiation might be a primary cause in the majority of all childhood cancers. Increases in overall fetal radiation exposures, from whatever cause, would then be expected to result in a near proportional increase in the subsequent cancer rate. Average absorbed fetal dose is .2[illegible] mGy (220 millirems).

Sever and Gilbert. The Prevalence at Birth of Congenital Malformations in Communities near the Hanford Site. American Journal of Epidemiology, Vol. 127, No. 2, 1988.

Sever and Gilbert. A Case-Control Study of Congenital Malformations and Occupational Exposure to Low-Level Ionizing Radiation. American Journal of Epidemiology, Vol. 127, No. 2, 1988.

On the subject of birth defects resulting from increased exposure to radiation, investigators at Battelle, Sever and Gilbert, published studies in 1988 which did find a statistically significant association between parental cumulative radiation exposure and neural tube defects. Congenital dislocation of the hip and tracheoesophageal fistula showed a significant association with employment of the father before conception. These positive findings were downplayed at the time as false positive findings or artifacts because previous studies had shown no similar effect at such low doses. However, due to the recent Sellafield findings by Gardner, these birth defect findings must be explored more thoroughly. The investigators themselves recommended birth defects surveillance in the central Washington state area. Exposures to these workers at Hanford were between 1 - 10 rems over their work experience.

Modan, Baruch, E. Ron, A. Werner. Thyroid Cancer Following Scalp Irradiation. Radiology 123:741-744, 1971.

In the Israeli Scalp-Irradiation Study, Modan and co-workers (Modan77) reported on the excess of thyroid-cancers observed among over 10,000 children in Israel who received x-irradiation for ringworm of the scalp. The estimated thyroid dose per child was 7.5 rads, total.

Thyroid-cancer was observed at five times the expected rate during a limited follow-up period.

SPECIAL NOTE:

In December 1989, the BEIR V (Biological Effects of Ionizing Radiation) Committee, of the United Nations, adopted revisions to the Japanese follow-up of A-bomb survivors. The Committee stated that radiation risks were understimated by three - four times.

For an independent review of A-Bomb Survivor Study, see

Goffman, John - Radiation-Induced Cancer from Low Dose Exposure, Committee for Nuclear Responsibility; 1990, San Francisco.

Stewart, A. - Healthy Worker and Healthy Survivor Effects in Relation to the Cancer Risks of Radiation Workers. Am. J. of Industrial Med. 1990 17, 151-54.

HEALTH EFFECTS FROM NUCLEAR WEAPONS TESTING FALLOUT - RONGELAP (MARSHALL ISLANDS).

Thomas E. Hamilton, MD, PhD. The Health Effects of Radioactive Fallout on Marshall Islanders: Health Policy Issues of Nuclear Weapons Production. PSRQ; 1991; 1:15-23.

The most prevalent long-term health effect in the Marshallese population has been the development of benign and malignant thyroid neoplasms. Approximately 30% of adults on Rongelap (and over 60% of children exposed when younger than 10 years of age) developed thyroid nodules, a small proportion of which were thyroid carcinoma.

Long-term health effects other than thyroid neoplasia have included hypothyroidism, growth retardation in several individuals, and most probably two deaths, one each from acute myelogenous leukemia and gastric carcinoma, among the 86 Rongelapese persons who were highly exposed. In addition, chromosomal aberrations in this group were increased relative to comparison groups 10 years after exposure to fallout radiation.

See also:

Thomas E. Hamilton, MD, PhD; Gerald van Belle, PhD; James P. LoGerfo, MD, MPH. Thyroid Neoplasia in Marshall Islanders Exposed to Nuclear Fallout. JAMA Aug. 7, 1987 - Vol. 258, No. 5.

British Atomic Veterans

EG Knox, T Sorahan, A Stewart. Cancer Following Nuclear Weapons Tests. Letter to the Editor, The Lancet, April 9, 1983.

The South Pacific tests - whose local base was Christmas Island - overlapped in time with other weapons tests. Thus, there were twelve tests in Western and South Australia between 1952 and 1957, and nine South Pacific tests between May, 1957, and November, 1958. The follow-up of the South Pacific population is far from complete but already there is evidence of an abnormally high incidence of leukaemia and other reticulo-endothelial system (RES) neoplasms.

For the men with RES neoplasms the documentary evidence in support of the diagnosis and weapons test involvement is such that a major artifact can be confidently excluded. This leaves as possible explanation of the high incidence of these radiation-related cancers either; (a) far more men at risk than the 8000 we have allowed; (b) much higher radiation doses than has hitherto been supposed; (c) much higher cancer risks from small doses of radiation than has hitherto been supposed; (d) exposure of the men to other causes of RES neoplasms; or (e) a combination of some or all of these factors.

CANCER EXCESSES FROM MEDICAL IRRADIATION.

E. G. Knox, A. M. Stewart, G. W. Kneale, E. A. Gilman. Prenatal Irradiation and Childhood Cancer. Journal of The Society for Radiological Protection, Volume 7, No. 4 (1987).

Estimates of the relative risk of childhood cancer, following irradiation during fetal life, are reported. They are based upon extended case-control investigations of childhood cancer deaths in England, Wales and Scotland between 1953 and 1979 comprising 14,759 geographically-matched and birth-date-matched case/control pairs.

The estimates were calculated using Conditional Logistic Regression (Mietttinen-Breslow) techniques. This method of risk-estimation limits the distortions caused by confounding factors or by biased selection of controls. Through analysing a range of reported exposures other than radiation, levels of general reporting and recording biases between cases and controls were also assessed. There was no evidence among cases or controls of any systematic reduction in the frequency of pregnancy x-rays between 1950 and 1979. During this period of time, about 7 percent of all childhood cancers,, and 8 percent of those with onset between the ages of 4 and 7 years, were caused by x-ray examinations. The dose-response relationship was one death per 990 obstetric x-ray examinations; or 2,000 deaths per 104 man-Gy.

See also:

E A Gilman, G W Kneale, E G Knox and A M Stewart. Pregnancy X-Rays and Childhood Cancers: Effects of Exposure Age and Radiation Dose. J. Radiol. Prot. 1988, Vol. 8, No. 1, 3-8.

Alice Stewart, Josefine Webb, David Hewitt. A Survey of Childhood Malignancies. British Medical Journal, June 28, 1958, Vol. i, pp 1495-1508.

MacMahon, Brian. Prenatal X-Ray Exposure and Childhood Cancer. Journal of the National Cancer Institute, 28:1173-1191, 1962.

The higher frequency of prenatal x-ray in the cancer cases than in the sample was statistically significant. After correction for birth order and other complicating variables, it was estimated that cancer mortality (including leukemia mortality) was about 40% higher in the x-rayed than in the un-x-rayed members of the study population. This relationship held for each of the three major diagnostic categories -- leukemia, neoplasms of the central nervous system, and other neoplasms.

III. OTHER LOW DOSE FINDINGS

CANCER RISKS NEAR THE PILGRIM NUCLEAR POWER PLANT.

Morris M, Knorr R. The Southeastern Massachusetts Health Study 1978-1986 - Report of the Massachusetts Department of Public Health, October 1990. (Not yet published in peer review journals.

This case-control study found an association between radiation released from the plant and leukemia incidence among cases diagnosed before 1984. A dose-response relationship was observed in that the relative risk of leukemia increased (four-fold) as potential for exposure to plant emissions also increased.

Clapp K, Cobb S, Chan C, Walker, B. "Leukemia Near Massachusetts Nuclear Power Plant". Letter, Lancet, Dec. 5, 1987.

Investigators observed an increased incidence of leukemia, particularly myelogenous leukemia, in a five-town area in Massachusetts during 1982-1984. In one of these towns, a commercial nuclear power plant is located and released significant radio-isotopes in 1974-75. The most striking excess was for myelogenous leukemia in males.

CANCER RISKS FROM URANIUM MINING.

Archer, Victor E. and Wagoner, Joseph K. Lung Cancer Among Uranium Miners in the United States. Healthy Physics, Pergamon Press 1973. Vol. 25 (Oct.), pp. 351-371.

Excess respiratory cancer has been demonstrated among all groups of uranium miners who have had more than 120 Working Level Months of radon daughter exposure. Lung cancer incidence rose with increasing exposure. Factors which might distort the exposure-response relationship were reviewed. Exposure to other agents such as cigarettes probably contributed to the excess, but these factors should not be considered in setting permissible levels. Respiratory cancers are continuing to appear at a high rate among the Study Group even though radon daughter levels have been markedly reduced and most of the Study Group have stopped mining.

See also:

Wagoner, Joseph K; Archer, Victor E; Carroll, Benjamin E; Holaday, Duncan A; Lawrence, Pope A. Cancer Mortality Patterns Among U.S. Uranium Miners and Miller, 1950 through 1962. Journal of the National Cancer Institute, Vol. 32, No. 4, April 1964.

Important Features Among Studies - Public Health Implications

These studies demonstrate that patterns of increased cancer risks with findings that range from suggestive to significant, have been apparent since 1977. Many of these studies show that with longer follow-up (particularly to 26 years) and when long exposure lags (15+ years) are calculated, more correlations between radiation exposure and cancer are detected. Cancers most frequently observed are lymphopoietic neoplasms (all leukemia, non-Hodgkins, myeloma, reticulum cell sarcoma), prostate and female cancers.

Other significant features for cancer detection included controlling both for the general healthy worker effect and for a selection bias within the worker population. Several studies indicrte that workers in the more dangerous jobs are more selected (higher education, income, more physically fit). When internal comparisons were made controlling for this bias, there was increased risk detection.

Several major studies conclude that linear extrapolation from higher to lower doses may seriously underestimate radiation risks. These studies present a major public health concern, as elevated and significant cancer risks are found among workers exposed to very low levels of external radiation. In the Wing study, 140 millirems was the average exposure, others range from .2-3 rems. At these very low levels, we see elevated risks among a very healthy population. The general population, in the vicinity of these plants, receiving a fraction of these doses, could be at comparable risk for increased cancers.

(See appendix for specific study citations, their findings and an explanation of terms. Section III is an excerpt from the CCRI Newsletter - October 1991).

Ledger

Scientists find new radiation injury

N.Y. Times News Service
12-20-92

A form of radiation injury, one that causes longterm genetic damage to living cells, has been discovered independently by two groups of researchers. The effect, if confirmed, may eventually lead to more stringent standards for protecting nuclear power workers and others from radiation.

One research group, in a report being published in today's issue of the journal Nature, said that when they exposed mouse cells to the type of radiation known as alpha particles, abnormalities of the chromosomes appeared in some descendant cells several generations of cell division later. Alpha particles are emitted by radioactive plutonium and by radon gas.

This long-delayed effect is novel, and different from the immediate genetic damage caused by experimental X-rays and gamma rays, said Dr. Eric G. Wright, leader of the team from the British Medical Research Council Radiobiology Unit in Didcot, Oxfordshire.

Separately and in related work, Dr. John D. Little and colleagues at the Harvard University School of Public Health in Boston said they had found a similar "delayed mutation effect" when using X-rays to irradiate hamster cells.

Little said in a telephone interview that it appears both research groups found the same or similar phenomena while approaching the problem from different directions and with different types of radiation. "We did our experiments with X-rays and we saw evidence of a delayed genetic phenomenon that is different from normal radiation-induced mutation," Little said.

Usually, radiation alters the genetic makeup of a cell, causing its immediate descendants to take on new characteristics. In the new findings, some of the cells that survive radioactive assault appear normal through several divisions, Little said.

"We think the whole thing is set off by an induced metabolic process that continues to produce damage, unnoticed as the cell reproduces, until it suddenly becomes apparent for some reason," he noted.

Wright said in a telephone interview that the work by his group, including Munira A. Kadhim, a post-doctoral fellow, showed that some cells that survive an assault by low-level alpha radiation can pass on some unknown changes through many generations. This could have implications for the eventual rise of leukemias and other cancers long after exposure to radiation, he said.

Estimates of leukemia risk are now based on a person's possible exposure to high-energy, penetrating radiation, such as beta, gamma and X-ray radiation, and allow for little contribution from the weakly penetrating alpha rays, the British researchers noted.

Researchers from both groups said that if the work is confirmed, estimates of the health risks of radiation may have to be revised upward.

Alpha rays can be very damaging to cells they reach because they unload all their energy in a small area. The delayed effects seen in the mouse cells used in the experiments indicates the radiation damage can be greater than it appears initially, Wright said.

The British researchers used stem cells from mouse bone marrow for the experiment. This type of cell not only produces blood cells, but also next generations of stem cells through which an undetected abnormality caused by radiation could pass. Stem cells from inbred mice prone to developing leukemia were more susceptible to later alpha radiation damage than cells from mice without the blood cancer susceptibility, Wright noted.

"This indicates there is a genetic component to the phenomenon," Wright said. "This could mean that individual humans who also have a predisposition to certain cancers also would be more susceptible to alpha radiation than others."

Daily Games

Wednesday Mass.
Daily Number: 5943
Payoffs on $1 bet:
Exact order — All 4: $5,158
First or last 3: $722
Any 2: $62
Any 1: $6
The payoff in any order:
All 4: $215
First 3: $120
Last 3: $120
Megabucks: 2-3-5-13-20-42
Tri-State 3: 991
Tri-State 4: 1413 R.I.: 3409

Megabucks jackpot to reach $12 million

BRAINTREE (AP) — There were no jackpot winners in last night's Megabucks drawing, state lottery officials said.

Saturday's estimated jackpot is $12 million, they said.

Return to
Jane A. Fleming

APPEND D

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Activist Paper #1:
U.S. Radiation Protection Standards for the General Public

An IEER publication

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prepared by Scott Saleska
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