



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 03 1985

Docket No: 50-289

MEMORANDUM FOR: Mary E. Wagner, Esq.
Office of the Executive Legal Director

FROM: Frank J. Congel, Chief
Radiological Assessment Branch, DSI

SUBJECT: AFFIDAVIT REGARDING AMENDMENT TO AAMODT MOTION DATED
JANUARY 15, 1985 (TAC #57459)

Per your request, attached is an affidavit regarding the subject motion for the restart of Three Mile Island Unit-1. The affidavit addresses alleged health impacts due to the accident at Three Mile Island Unit-2, and was prepared by Ed Branagan, Jerry Swift and Mike Wangler.

A handwritten signature in cursive script that reads "Frank J. Congel".

Frank J. Congel, Chief
Radiological Assessment Branch
Division of Systems Integration

Enclosure:
As stated

cc: R. Bernero
D. Muller
O. Thompson
W. Travers
B. Snyder
L. Finkelstein

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BEFORE THE COMMISSION

Docket No. 50-289
(Restart)

~~8-587561~~

4. The purpose of this affidavit is to address certain of the allegations raised in the "Amendment to Aamodt Motion of January 15, 1985 Additional Health Matters Which Must Be Considered Prior to the Commission's Decision on Restart of Unit 1," dated April 13, 1985 (hereinafter Aamodt Amendment).

5. Specifically, this affidavit addresses the Aamodts' allegations of (1) an increased incidence in neonatal hypothyroidism in 1979 in Lancaster County over that experienced in 1981 through 1983; (2) alleged withholding by the Staff of a study regarding the pathway of radioiodine to milk following the accident at TMI-2; and, (3) recent reports of significant health problems and environmental injury beyond the 10-mile emergency planning zone (EPZ) attributable to the TMI-2 accident. Aamodt Amendment at 6-11.

6. The Aamodts state that seven cases of neonatal hypothyroidism occurred in Lancaster County, Pennsylvania as a result of the TMI-2 accident. They present data which they assert was compiled by the Pennsylvania Department of Health showing that seven cases of neonatal hypothyroidism were reported in Lancaster County in 1979. This data, according to the Aamodts, represent "a tenfold increase in incidence over that expected" and a higher rate than that which was experienced in subsequent years. Id. at 6.

7. The Staff has not performed an epidemiological study of the available data. However, these data have been analyzed by G. K. Tokuhata, Ph.D., Director, Division of Epidemiological Research, Bureau of Epidemiology and Disease Prevention, Pennsylvania Department of Health and Edward Digon, M.P.H., Chief, Special Studies Section, Division

of Epidemiological Research, Bureau of Epidemiology and Disease Prevention, Pennsylvania Department of Health in a report entitled "Fetal and Infant Mortality and Congenital Hypothyroidism Around TMI." This report provides, in part, that:

During the March 28, 1979-March 27, 1980 period only one case of congenital hypothyroidism was identified within the 10-mile communities, where approximately 4,000 infants were born. This incidence rate is well within a normal range of expectation.

An apparent clustering of seven cases reported in Lancaster County (mostly beyond a 10-mile radius) during 1979 was subjected to a special in-depth analysis Having completed detailed diagnostic analysis and epidemiological assessment of the cases reported in Lancaster County during 1979, we concluded that cases of congenital hypothyroidism were not related to the TMI nuclear accident

* * *

Apart from the incidence analysis presented above, there is also an important consideration with respect to radiation in relation to congenital hypothyroidism.

First, from March 28 through December 31, 1979, no single case of congenital hypothyroidism was reported in Dauphin, Cumberland, Perry, Northumberland, Juniata, Snyder, Mifflin, and Union Counties, the areas downwind (N, NW, NNW) from the Three Mile Island during the first 48 hours of the accident, when probably the largest amount of radioactive releases took place.

Secondly, . . . the maximum likely fetal thyroid dose (approximately 75 mrad) and the maximum possible thyroid dose of 190 to 200 mrad in the vicinity of the damaged nuclear plant are still far too small to have caused congenital hypothyroidism.

G. K. Tokuhata, Ph.D. and Edward Digon, M.P.H., "Fetal and Infant Mortality and Congenital Hypothyroidism Around TMI" at 2-3 (presented at the International Symposium on Health Impacts of Different Sources of Energy, Nashville, Tennessee, June 1981). On the basis of the above-quoted excerpts, the Staff concludes that the Aamodts allegation of increased incidence of neonatal hypothyroidism in 1979 in Lancaster County due to the TMI-2 accident is without merit.

8. Furthermore, the Staff does not agree with the Aamodts that the Licensing Board's and the Pennsylvania Department of Health's explanation of the high incidence of hypothyroidism in 1979 in Lancaster County has been refuted by the lower incidence of hypothyroidism in 1981, 1982 and 1983. Dr. Tokuhata concluded that the cases of hypothyroidism in 1979 were caused by such factors as incomplete maturation of the thyroid glands (dysgenesis) and lack of enzymes to synthesize thyroxine (dyshormonogenesis) unrelated to radiation exposures. Dr. Tokuhata also concluded that two of the seven cases of hypothyroidism occurring in 1979 could not be related to the accident. One of the seven cases occurred prior to the accident and the other, involving severe multiple central nervous system anomalies, occurred within 3 months following the accident, a time period too short to have been influenced by the TMI-2 accident. Id. Thus, none of these cases are attributable to radiation exposure resulting from the accident at TMI-2. Consequently, the Staff maintains that changes in epidemiological data regarding the incidence of hypothyroidism unrelated to radiation exposure require no further investigation for their implications concerning emergency planning.

9. The Aamodts further state that the "higher than expected" incidence of neonatal hypothyroidism in 1980 in Lancaster County can be attributed to the venting of TMI-2 containment gases in 1980. Id. With regard to the venting of Krypton-85 from the TMI-2 reactor building, doses to a maximum-exposed individual at the site boundary were estimated to be about 10 millirems to the skin and about 0.1 millirem to the total body. NRC, "Answers to Questions About Removing Krypton from the Three Mile Island, Unit 2 Reactor Building," NUREG-0673, May 1980, at 4. Doses

to individuals beyond the site boundary would be less. Doses at these levels have not been shown to cause a detectable increase in neonatal hypothyroidism as alleged by the Aamodts.

10. The Aamodts allege that the most recent study of the TMI-2 inventory has accounted for between 17 and 28 percent of the radioiodine released during the TMI-2 accident. Aamodt Amendment at 8. A review of the study cited by the Aamodts in support of their allegation reveals that of the initial inventory of radioiodines in the core, 17 to 28 percent was released from containment to various systems and surfaces in the reactor building. C. Pelletier, "Preliminary Results of the TMI-2 Radioactive Iodine Mass Balance Study." The rest of the radioiodine remained within containment. See id. at 17. The Pelletier study does not discuss the amount of radioiodines released to the environment during the accident. However, it has been estimated that approximately 15 curies or .00002 percent of the initial inventory of radioiodines were released to the environment during the TMI-2 accident. M. Rogovin and G. T. Frampton, Jr., "Three Mile Island, A Report to the Commissioners and to the Public," January 1980, Vol. II, Part 2 at 344, (hereinafter Rogovin Report).

11. The Aamodts refer in their pleading to a report, entitled "A Review of Dose Assessments at Three Mile Island and Recommendations for Future Research" for the proposition that "[e]xtrapolations of iodine release from milk sampling has been shown to be too low by a factor of 50 because of an error of assumption that cows were on pasture." Aamodt at 8. The Staff's examination of the Beyea report's interpretation of the Pickard, Lowe and Garrick data for radioiodine releases reveals that "10%

grazing assumption overpredicts radioiodine concentrations in milk at 3 sites by a factor of 10 to 50." J. Beyea, "A Review of Dose Assessments at Three Mile Island and Recommendations for Future Research" at C-55, Table C-5. Although it is not known whether milk samples were taken at the exact locations of the cases of hypothyroidism, milk samples were taken at several distances in a generally easterly direction from the Three Mile Island Nuclear Station to Lancaster, Pennsylvania. Rogovin Report at 377-381. These and other milk samples provide sufficient data to characterize the uptake of radioiodine by milk cows in the vicinity of TMI-2. In no instances were iodine concentrations in milk sufficiently high to cause a detectable increase in the incidence of hypothyroidism.

12. The Aamodts assert that the Staff withheld a study which the Staff commissioned to determine the pathway of radioiodine to milk. Aamodt Amendment at 9. The Aamodts argue that this study, "Pathways to Iodine-131 to Milk Following the Three Mile Incident," if considered in the restart proceeding would have led the Licensing Board to different conclusions concerning hypothyroidism data. Id. This allegation is without foundation. This study was completed in June 1983. Although not in the NRC's Public Document Room, this study has been available from the Staff upon request since June 1983. See Attachment 1. While the study concluded that "for the three farms selected for study the most probable pathway was air inhalation by milk cows at least during the first ten days following the accident," the particular pathway by which the radioiodines were transferred to the milk has no impact on the measured concentrations of radioiodines in the milk.

13. In addition to claiming that the increased incidence of hypothyroidism in 1979 in Lancaster County is attributable to the TMI-2 accident, the Aamodts assert that "[s]erious health effects as far as 30 miles from TMI appear to be accident-related and challenge the NRC's emergency planning for the 10 mile radius of TMI." Aamodt Amendment at 1. In support of this assertion, the Aamodts provide a list of occurrences, the majority of which are instances of significant health problems. See id. at 10.

14. Based on studies conducted by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the Committee on the Biological Effects of Ionizing Radiations (BEIR) of the National Research Council, National Academy of Sciences concerning the relationship between various forms of ill health and irradiation, the Staff currently is using a risk estimator of 135 potential deaths from cancer per million person-rems.

15. The studies on which this estimator is based report that acute or short-term effects of irradiation have not been observed at doses like those estimated to the general public from the accident at TMI-2. Reviews of the scientific literature have not found any scientific basis from which to expect acute effects at such low doses. UNSCEAR 1982, "Ionizing Radiation: Sources and Biological Effects" (1980); BEIR III, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980" (1980). Latent long-term effects have been determined by statistical studies of the subsequent health experiences of irradiated populations. Id. In general, these are populations irradiated to doses of 5 rem or greater. The risk estimators such as the Staff uses for latent effects are based

on extrapolation to low doses of information obtained only from exposures at high doses. The Staff is confident that the risks from exposure at small doses are so slight that latent health effects, if any, cannot be distinguished from the vastly more numerous health problems normally experienced by the population. Latent health effects in adults generally occur ten years or more after the irradiation.

16. The risks of other forms of health effects from low doses of ionizing radiation likewise have been judged to be small. Use of such estimators for an individual exposure of 10 mrem reflects approximately a 1 in 700,000 chance for that individual to develop a fatal cancer from such an exposure.

17. Evidence in the form of dosimeter readings and environmental samples was gathered following the accident at TMI-2, analyzed by experts in Federal agencies concerned with the regulation of radioactive materials and published in reports such as "Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station," NUREG-0558, May 1979. NUREG-0558, published shortly after the TMI-2 accident, reports the analysis of radiation doses to individuals and the population in the vicinity of the Three Mile Island nuclear station.

18. As shown in Figures A-1 and A-2 of NUREG-0558, radiation doses decrease rapidly with distance from TMI. Figure A-2, included as part of Exhibit 1 of the Aamodt Amendment, indicates that the 10 mR exposure isopleth lies entirely within the 10-mile radius of TMI. Thus, all exposures outside the 10-mile radius are indicated to be less than 10 mR.

19. The authors of NUREG-0558 concluded that the maximum dose that was received by an individual located offsite in a populated area was

less than 100 mrem. The average dose to an individual within 10 miles of the site was estimated to be approximately 8 mrem, and the average dose received by individuals within 50 miles of TMI was estimated to be approximately 2 mrem. Similar estimates were made in the "Report of the President's Commission on the Accident at Three Mile Island," October 1979, at 34-35 and the Rogovin report.

20. Based on these estimated doses there would be no acute effects such as those alleged by the Aamodts (e.g., occurrences shortly after the accident of nausea and severe vomiting, loss of hair, blisters and sore throats), Aamodt Amendment at 10, in this population due to radiation exposures.

21. The Aamodts allege further that residual radiation from the TMI-2 accident has stimulated abnormal growth in vegetation. Id. at 10, 14. Based on investigation of vegetation around the TMI plant following the accident, there has been no evidence found to associate radiation exposure with effects on vegetation. See, e.g., NRC, EPA, "Investigations of Reported Plant and Animal Health Effects in the Three Mile Island Area," NUREG-0738, EPA 600/4-80-049, October 1980, at 30.

22. Using conservative estimates of risk, the Staff estimates that exposure to radioactivity released from the accident could result in less than one cancer death over the remaining lifetimes of the population within 50 miles of the Three Mile Island nuclear station. This potential cancer death would be indistinguishable from cancer due to other causes, and would be completely masked by the normal incidence (which normally accounts for approximately 20 percent of all deaths) of about 440,000 cancer deaths expected to occur in the population of approximately 2.2 million.

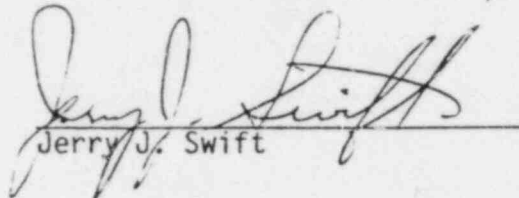
23. For many of the cancers which the Aamodts allege to be health effects, the period of time to the appearance of the cancer is inconsistent with the longer latency periods observed in studies of irradiated populations.


24. The annual dose due to exposure to natural background radiation in the Harrisburg, Pennsylvania area is estimated to be approximately 116 mrem. NUREG-0554 at 55. The doses due to the accident at TMI at 10 miles or greater from TMI, which are less than 10 mrem, are smaller than the variation in annual doses from background radiation which individuals experience in normal living by choices such as that between residing in a wood frame house or in a brick house. Such doses are even 100 times less than the lowest of the Protective Action Guide doses recommended by the U.S. Environmental Protection Agency in the "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents," EPA-520/1-75-001, September 1975.

25. Therefore, the Staff concludes that (1) the radiation dose to any person at distances of 10 miles or more from the Three Mile Island Nuclear power station were to a high likelihood less than 10 mrem which are within the differences in annual background radiation doses to individuals due to variations in lifestyles; (2) it is highly unlikely that any of the health problems listed by the Aamodts are a direct result

of irradiation of the individual or individuals by radionuclide releases attributable to the accident at TMI-2.


Edward F. Branagan, Jr.


Jerry J. Swift


Michael E. Wangler

Subscribed and sworn to before me this 3rd day of May, 1985

Notary Public

My commission expires: 7/1/85