FEB 0 3 1981

The Honorable John C. Danforth
United States Senate
Washington, D. C. 20510

Dear Senator Danforth:

In your memorandum of December 16, 1980, you requested that the Nuclear Regulatory Commission (NRC) comment on a letter written by one of your constituents, Mrs. Marilyn Hieronymus. Mrs. Hieronymus's letter expresses concern about a news item indicating that the Callaway Nuclear Plant would discharge low-level radioactive water into the Missouri River. In her letter, Mrs. Hieronymus implies that the proposed liquid releases from the Callaway Nuclear Plant are dangerous because "dumping even very small amounts of radioactive material into our river system will affect every citizen of this state in some way no matter how small."

I believe that it might be helpful to first explain to Mrs. Hieronymus a few things about radiation in general, before providing more specific information about the radioactive materials to be released from the Callaway Nuclear Plant.

Low levels of natural radiation are all around us. Natural radiation, which existed on earth before man, comes from the earth itself and outer space. Natural radiation is in the air we breathe and the food we eat and drink. For example, the amount of radiation (measured in millirem/yr and abbreviated as mrem/yr) received by humans from potassium-40, a natural radioactive material in the blood, is about 20 mrem/yr. Although we have been exposed to natural radiation for thousands of years, we do not have any evidence that the natural radiation has significantly affected our health.

Since the beginning of the twentieth century, people have been exposed to man-made sources of low-level radiation in addition to natural sources. These sources include x-ray machines used in medicine, nuclear power facility releases, television sets, some wristwatches, and airline travel. For all of these sources, except x-rays from medicine, the amount of radiation received by the general public is much lower than from natural radiation (see Enclosure 1). Natural background radiation is typically about 100 mrem/yr in the U.S. although it varies from about 70 to about 300 mrem/yr depending on the location in the U.S. (see Enclosure 2). It is important to note that when exposure to radiation is quantified in units of rem (or millirem), then there are no differences associated with a given amount of radiation, be it natural or man-made.

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Since Mrs. Hieronymus is concerned about liquid radioactive releases from the Callaway Nuclear Plant, it may be helpful to discuss the potential doses that may result from these releases. The NRC requires nuclear power plant licensees to design their plants such that liquid radioactive releases are as low as reasonably achievable, currently defined as 3 mrem/yr total body and 10 mrem/yr to any body organ, or about 1% of the limits. These potential doses can be compared with national and international public health standards for radiation exposure. Based on the recommendations of nationally and internationally recognized experts in the medical and biological sciences, limits of 500 mrem/yr to the total body and 1500 mrem/yr to most organs are placed on members of the general public. The dose limits are applicable to all age groups, including the most sensitive individuals in a population (infants and children).

Doses from liquid radioactive releases from the Callaway Nuclear Plant were estimated in the Final Environmental Statement for the Callaway Nuclear Plant (i.e., NUREG-/5/011) prior to the issuance of a construction permit. The estimated doses to the maximum hypothetical individual from proposed liquid radioactive releases from the Callaway Nuclear Plant were far below the total body limit of 500 mrem/yr and also below the as low as reasonably achievable design objectives (i.e., 3 mrem/yr, total body, and 10 mrem/yr to any body organ, see Enclosure 3). (The "maximum hypothetical individual" is defined as an individual, living outside the fenced-in area around a nuclear plant, who would receive the largest radiation dose. This individual is assumed to eat larger-than-average amounts of food and to use the region in the vicinity of the plant site more frequently than the average person. It is highly unlikely that such a person actually will exist.) The estimated doses from the proposed Callaway Nuclear Plant are also well below natural background radiation. Thus, even if a child were exposed to the maximum hypothetical dose, he or she would receive less than 1% of the maximum dose limit recommended by the national and international organizations. This exposure represents a virtually negligible risk for any individual. We have also calculated that the average annual dose to persons within 50 miles of the Callaway Nuclear Plant would be less than 1% of the annual dose to the maximum individual, and less than 0.1% of natural background radiation.

Lastly, Mrs. Hieronymus states that she and her husband want to ensure that their children have a clean and healthy environment. We share Mrs. Hieronymus's concern about the safety of her children as well as adult citizens and are continuing to assure that no one is exposed to unsafe levels of radiation from releases of radioactive material from the Callaway Nuclear Plant.

Thank you for the opportunity to provide this information in response to your request. Mrs. Hieronymus's letter is being returned as requested (Enclosure 4).

Sincerely,

(Signed) T. A. Rehm

William J. Dircks, Executive Director
for Operations

Enclosures:
1. Excerpts frm BEIR III (pp. 84, 85, 87)
2. Table 4-3 frm NUREG-0558
3. Table 5.8 frm NUREG-75/011
4. Undated ltr. frm MHieronymus to
   Sen. J. C. Danforth

Annual Dose Rates from Important Significant Sources of Radiation Exposure in United States[a]

Source	Exposed Group		Body Portion Exposed	Average Dose Rate, mrems/yr	
	Description	No. Exposed		Exposed Group	Prorated over Total Population
Natural background:					
Cosmic radiation[b]	To[illegible]	220 X 10^6	Whole body	28	28
Terrestrial radiation[c]	[illegible]al population	220 X 10^6	Whole body	26	26
Internal Sources	Total population	220 X 10^6	Gonads	28	28
			Bone marrow	24	24
Medical x rays:					
Medical diagnosis	Adult patients	105 X 10^6/yr	Bone marrow	103	77
Dental diagnosis	Adult patients	105 X 10^6/yr	Bone marrow	3	1.4

Source	Exposed Group: Description	Exposed Group: No. Exposed	Exposed Group: Body Portion Exposed	Average Dose Rate, mrems/yr: Exposed Group	Average Dose Rate, mrems/yr: Prorated over Total Population
Radiopharmaceuticals:					
Medical diagnosis	Patients	10×10^6 to 12×10^6/yr	Bone marrow	300	13.6
Atmospheric weapons Tests	Total population	220×10^6	Whole body	4-5	4-5
Nuclear industry:					
Commerical nuclear power plants (effluent releases)	Population within 10 miles	$<10 \times 10^6$	Whole body	<<10	<<1

Source	Exposed Group: Description	Exposed Group: No. Exposed	Exposed Group: Body Portion Exposed	Average Dose Rate, mrem/yr: Exposed Group	Average Dose Rate, mrem/yr: Prorated over Total Population
Research activities (cont)[a]:					
Consumer products:					
Building materials	Population in brick and masonry buildings	110×10^6	Whole body	7	3-4
Television receivers	Viewing populations	100×10^6	Gonads	0.2-1.5	0.5
Miscellaneous:					
Airline travel (cosmic radiation)	Passengers	35×10^6	Whole body	3	0.5

[a] Excerpts from BEIR III (Table III-23).

[b] The annual dose assumes about 10% reduction to account for structural shielding.

[c] The annual dose assumes 20% reduction for shielding by housing and 20% reduction for shielding by body.

Table 4-3[a]

Estimates of Natural "Background" Radiation Levels in the United States

Location	Annual Dose Rate (mrem/year)			
	Cosmic Radiation[(a)]	Terrestrial Radiation[(a)]	Internal Radiation[(b)]	Total
Atlanta, Georgia	44.7	57.2	28	130
Denver, Colorado	74.9	89.7	28	193
HARRISBURG, PA.	42.0	45.6	28	116*
Las Vegas, Nev.	49.6	19.9	28	98
New York, NY	41.0	45.6	28	115
PENNSYLVANIA	42.6[(c)]	36.2[(c)]	28	107
Washington, DC	41.3	35.4	28	105
UNITED STATES[(d)]	40-160	0-120	28	70-310

(a) From [(4) Table A-1]

(b) Based upon total for soft tissue (gonads) doses from [(5) Tables 42 and 43, p. 104].

(c) From [(4) Table A-2]

(d) From [(4), Table 15, p. 34]

*The value used elsewhere in this report is 125 mrem/year which is based upon the Final Environmental Statement for the Three Mile Island Facility (AEC, 1972, Section VD 7, p. V-28). As neither value represents direct measurements and ambient radiation dose rates are expected to vary by at least 25% between locations within a 50-mile radius, these estimates are essentially identical.

[a] From NUREG-0558.

TABLE 5.8 Annual Individual Doses From Liquid Effluents[a]

Location	Pathway	Dose (mrem/yr) Total Body	GI Tract	Thyroid	Bone
Coolant	Fish Ingestion	2.8	0.15	3.1	2.0
Discharge	Swimming (100 hrs/yr)	0.0013			
Region	Fishing, Boating (100 hrs/yr)	0.0007			

[a] From "Final Environmental Statement Related to the Proposed Callaway Plants, Units 1 and 2," NUREG-75/011, March, 1975.

JOHN C. DANFORTH
MISSOURI

United States Senate

WASHINGTON, D.C. 20510

December 16, 1980

Congressional Liaison
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Congressional Liaison:

A constituent has written me concerning a matter which falls within the jurisdiction of your agency.

I refer this matter to your office for a preliminary examination. I would appreciate receiving your comments, in duplicate, together with the return of the correspondence.

Your attention to this matter is appreciated.

Sincerely,

John C. Danforth

Enclosure

12/22...To EDO For Direct Reply...Suspense: Jan. 9...Original to Docket, OCA to Ack...80-2177

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