Natural Resources Defense Council, Inc.

917 15TH STREET, N.W.
WASHINGTON, D.C. 20005
202 737-5000

Western Office
664 HAMILTON AVENUE
PALO ALTO, CALIF. 94301
415 327-1080

New York Office
15 WEST 44TH STREET
NEW YORK, N.Y. 10036
212 869-0150

Representative Mike McCormack's

Nuclear Issues

A Critique

By

Dr. Thomas B. Cochran
Natural Resources Defense Council

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True Facts Systematists

DRAFT

In recent months Representative Mike McCormack (D-Wash.), a member of the Joint Committee on Atomic Energy (JCAE) has made several statements attacking nuclear critics, labeling their arguments as being "based entirely on fear and ignorance,"*/ and their statements as "being fantastically exaggerated [claims] by uninformed individuals,"**/ and "categorically untrue."***/ As demonstrated below -- assuming he has not been misquoted -- Rep. McCormack has erred in his technical arguments to support these unfounded claims.

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*/ National Journal Reports, March 22, 1975, p.420.

**/ National Journal Reports, April 5, 1975, p.512.

***/ Representative McCormack, Congressional Record, May 8, 1975, p.H3852.

1. "The environmentalist's arguments are based entirely on fear and ignorance," said Rep. Mike McCormack (D-Wash.), the only scientist Member of Congress and a leading congressional proponent of nuclear power . . .

   "The alleged health hazards of plutonium are fantastically exaggerated. The plutonium that occurs naturally in the granite inside Grand Central Station is about 100 times more than the dose you'll get at the power plant gate."

   National Journal Reports
   March 22, 1975, p.420

Response:

This is a totally meaningless and therefore irrelevant comparison. The principal radiation exposure hazard associated with plutonium is due to the emission of alpha radiation. Because alpha radiation cannot penetrate the skin, it is hazardous only when the alpha activity is inhaled, ingested, or contaminates open wounds. The plutonium in granite -- unlike radon gas in uranium deposits -- is locked in the rock matrix. Hence, even if there were substantial quantities of plutonium in the granite, which is not the case, the radiation doses to the people in Grand Central Station from plutonium exposure would be minute.

Furthermore, the principal plutonium exposure hazard to the public associated with the use of plutonium as a nuclear fuel is not due to exposure to routine gaseous releases of plutonium from reactors (i.e., the dose at the reactor "fence post" or gate) rather it is associated with routine releases from plutonium fuel processing and fabrication facilities, and depending on ones prospective on unplanned or accidental releases from these same facilities and from breeder reactors.

The average concentration of uranium in granite is 3 to 4 parts per mission (ppm).[1/] Conway granite from New Hampshire contains 12 ppm uranium.[2/] The ratio of the concentrations of plutonium-239 to uranium in ores varies from 4 X 10^{-13} to 1.5 X 10^{-11}.[3/] Assuming Grand Central Station is made of Conway Granite, one metric ton of this material would contain between 0.3 to 10 picocuries of plutonium-239.[4/] The average New Yorker has about 2.5 picocuries of plutonium in his body due to ingestion of plutonium from the fallout from atmospheric nuclear weapons testing.[5/] By comparison, it is conservatively estimated that the low and intermediate level plutonium (-238, -239 and -240) activity in the liquid effluent from the Clinch River Breeder Reactor (CRBR) is 1.5 X 10^{-8} curies/year.[6/] The low level activity is conservatively estimated to be diluted with 850 gallons of water. The probability of someone ingesting one ton of granite or drinking thirty-five gallons of CRBR liquid effluent (before it is discharged into the Clinch River), are recognized to be remote, although I would be inclined to believe the latter is of a higher probability. So much for meaningless comparisons.

Congressman McCormack and the Joint Committee on Atomic Energy (JCAE) could make a more meaningful contribution if they would examine the occupational and public exposures associated with the present fledgling plutonium industry. Robert Gillette, in the first of a three part series in Science, describes the present state of the industry:

> "Increasingly, and with a frequency that seems disproportionately high, incidents of plutonium inhalation are being recorded from a small group of privately owned and operated facilities engaged not in weapons work but in reclaiming plutonium from reactor fuel and recycling it in new reactor fuel . . .
>
> "The record reveals a dismal repetition of leaks in glove boxes; of inoperative radiation monitors; of employees who failed to follow instructions; of managers accused by the AEC of ineptness and failing to provide safety supervision or training to employees; of numerous violations of federal regulations and license requirements; of plutonium spills tracked through corridors, and, in half a dozen cases, beyond plant boundaries to automobiles, homes, at least one restaurant, and in one instance to a country sheriff's office in New York." 7/

Given the very toxic nature of plutonium, perhaps the JCAE could explain why the industry has such a dismal record rather than being a showcase exemplifying the care with which plutonium can purportedly be handled.

2. Referring to the roughly 5 tons of plutonium in the environment from fallout from atmospheric nuclear weapons testing, Rep. McCormack is quoted as saying:

> "There is no evidence to show that this plutonium has caused any harm to any person. The best statistical evidence would indicate that of the thousands of people who have died from lung cancer in the last year, not one death has been caused by this five tons of plutonium, and it has been in the atmosphere for more than an adequate time to kill us all if the exaggerated statements of the hazards of plutonium made by anti-nuclear activists were even remotely close to the truth."
>
> <u>National Journal Reports</u>
> April 5, 1975, p.512

Response:

The American Cancer Society estimates that in the United States in 1975 the incidence of cancer (all sites) will be 170 cases per 100,000 people. They anticipate 81,000 cases of lung cancer alone. If one arbitrairly assumed 800 cases of lung cancers per year were due to plutonium exposure from fallout, this would represent only one percent of the total. Clearly these could not be statistically identified with plutonium fallout exposure. It is meaningless and misleading to imply that because the effect cannot be measured it is not a real effect.

The radiation doses due to plutonium fallout exposure have been calculated, based on uniform distributions within the organs. The cumulative doses through 1973 to an individual exposed throughout the entire fallout period since 1954 have been estimated to be 15 mrem to lung, 8 mrem to bone and 4 mrem to liver.[8/] The cumulative doses through the year 2000 to the same exposed individual are estimated to be 34 mrem to bone, 17 mrem to liver, and 16 mrem to lung.[9/] The dose commitment through the year 2000 to the current U.S. population from fallout of plutonium is estimated to be 3 million man-rem to lung, 1.4 million to bone and 0.8 million to the liver.[10/] The carcinogenic risk due to these exposures can be derived using the National Academy of Sciences BEIR Report[11/] estimates of risk. The number of cancers due to uniform organ exposure is estimated to be on the order of:[12/]

16 - 110 cancers per 10^6 man-rem to lung;

2 - 17 cancers per 10^6 man-rem to bone;

1 - 7 cancers per 10^6 man-rem to liver.

Hence, the expected number of cancers in the current U.S. population from plutonium fallout exposure through the year 2000 is:

48 - 330	lung cancers
3 - 24	bone cancers
1 - 6	liver cancers
56 - 360	cancers total

or about 1 to 8 cancers per year.

The population in the northern hemisphere, where most of the fallout has occurred, is about 3 billion people or about 15 times the U.S. population. Worldwide plutonium exposure from fallout causes on the order of 840 to 5,400 cancers to the present generation or about 15 to 120 cancers per year. It should be noted that there is great uncertainty concerning the BEIR Report dose estimates. For example, Dr. Karl Morgan, Chairman of the Internal Exposure Committee of the International Commission on Radiological Protection (ICRP), believes the bone dose estimates for plutonium exposure that are presently in use may understate the bone cancer risk by a factor of 400.[13/] Although making this correction would increase the above estimates by more than two orders of magnitude, the increased cancer incidence would still be undetectible statistically.

Furthermore, plutonium is very persistent. Plutonium-239 has a half-life of 24,000 years. People around the world will be getting cancer (and genetic diseases) from this plutonium fallout for years to come. If people are still around they will be exposed to this plutonium after the next ice age, although certainly at a much reduced rate, in fact for several geological epocs. Considering the time period over which the plutonium insult is felt, the production of cancers from this source could easily number in the hundreds of thousands, or orders of magnitude higher if the higher risk estimates are correct.

Finally, Rep. McCormack's comment fails to note important differences between fallout plutonium and plutonium in the nuclear fuel-cycle in terms of the chemical and physical form of the materials released, and the manner of distribution. The population density averaged over the northern hemisphere is much lower than the density surrounding nuclear facilities. Due to the distributional effect alone a gram of plutonium released from the nuclear fuel cycle would have 10 times the insult as a gram of fallout plutonium. In addition, the plutonium from weapons tests is incorporated in or deposited on particles that contain other material and its specific activity (i.e., the radactivity in curies per gram of material) is much lower than the highly radioactive particles of insoluble plutonium dioxide fuel that are projected to be released from the nuclear fuel cycle. The toxicity of "hot particles" from the nuclear fuel cycle is the subject of considerable controversy.[14/] Suffice it to say that some scientists (including myself) believe that under certain conditions one of these hot particles of plutonium can be several orders of magnitude more carcinogenic than if the same plutonium activity were dispersed more uniformly as would be the case with fallout plutonium. This controversy, to a large extent, is the source of what Rep. McCormack refers to as "exaggerated statements of the hazards of plutonium." Apparently, Rep. McCormack does not realize that fallout plutonium, because of its chemical and physical nature, is not pertinent to the assessment of the "hot particle" risk.

3. "Mr. Nader stated according to the news wire and a member of the Committee who were (sic) present, that -- "The Reactor could experience an accident known as the 'core disruptive accident.' In every-day language this technical euphemism means that the breeder can blow up." Mr. Speaker this is categorically untrue and Mr. Nader knows it is categorically untrue. He knew it when he said it. Unfortunately, however, members are being deluged with this kind of nonsense as they attempt to deal with important energy issues facing us."

Mike McCormack
<u>Congressional Record</u>
May 8, 1975, p.H3852

Response:

The explosive potential of the LMFBR is an unresolved issue. Some fast reactor safety experts do not believe LMFBRs can explode, while others believe they can. To demonstrate that Rep. McCormack has erred in his statement, it is sufficient simply to quote from some recent Nuclear Regulatory Commission (NRC) reports, which address safety aspects of the Fast Flux Test Facility (FFTF). The FFTF is similar to a breeder only it does not have a blanket of uranium surrounding the core and therefore can not breed more fuel than it burns. The FFTF is 400 Mw (thermal) in size, which is about 2-1/2 times smaller than the CRBR which in turn is about 3 to 4 times smaller than a commercial-size LMFBR.

The NRC staff, in its Safety Analysis Report (SER) Supplement No.1, (December 13, 1974, p.5) states:

> "Based on our review of the information relating to core disruptive accidents, it is the staff's opinion that the accident energetics are not likely to exceed the capability of the containment system for FFTF provided the results of the recommended R&D confirm RRD's current evaluation." (Emphasis added).

And, in March 1975 (SER Supplement No.2, p.2-1), the NRC stated:

> " . . . events leading to and following core disruption are subject to considerable uncertainty; substantial changes in the depiction of these events have been proposed since the issuance of our SER in October 1972 . . .

and

> "While we are of the opinion that a core disruptive accident will be of low probability, currently unquantified, we are not in agreement [with the RRD contractor] that the state of technology and experience on LMFBR systems is sufficient to establish that there is 'no realistic potential' or that such accidents are precluded." (Supplement No.2, p.1-1).

The NRC does not say a CDA in the FFTF can be contained, rather in its words

> "The NRC staff has concluded that substantial capability to accomodate the effects of a core disruptive accident and maintain the integrity of the primary coolant boundary exists."

An ACRS meeting was held on April 4, 1975 with the NRC in attendance to discuss whether a core-catcher will be incorporated in the FFTF. The remarks below are those of Mr. Richard Denise of the NRC staff. He is discussing disagreements between the NRC staff and the ERDA staff with respect to estimating the explosive potential of a core disruptive accident and the subsequent radiation exposure to the public.

> "There is clear disagreement in the method of calculation. There is clear disagreement in the criteria for acceptability of these doses. We have looked at a number of the scenarios and let me dwell on one for a moment. Quite a while ago, about three years ago, there was a HCDA scenario that had 150 megawatt seconds of energy release related to it. That energy release, with time, came down to a few tenths of megawatt seconds and the latest analysis gets it up in the range of 150 to 350 megawatt seconds. In all of these energetic analyses, from the 150 upward, there are leakage paths which are potentially opened and which put activity, noble gases, halogens, and fuel material into the containment. As long as the containment integrity is maintained such that we are at about a tenth of one per cent leak rate, the doses off-site appear to be acceptable. But even in that event, there is on the order of 130,000 pounds of sodium splashed into the reactor cavity. Now we have a pool about four feed deep, or so, of hot sodium inside the reactor cavity, and there is a carbon steel liner with fire brick behind it called a hot liner. What the NRC staff has been concerned about in this situation even without melt-through, but with activity in the containment, is whether we are on the so-called edge of the cliff. If the liner fails, the sodium available in the pool will begin interacting with the concrete below it, under and behind the liner, and the degree to which you generate hydrogen depends on how big the failure in the liner is. It depends on whether the initial reaction leads to greater liner failure or not. In any event, if you proceed such that there is significant concrete and sodium interaction, there will be a significant amount of hydrogen generated, and we would calculate that they would be in a position of having to vent the containment in order to avoid explosive mixtures of hydrogen in the containment even without melt-through. What I said is that

> we got the activity up there, and we got something that is compromising or threatening to compromise the containment vessel integrity; and it is that scenario which is threatening the integrity of the containment so that we have asked them to look at it further. We are not satisfied with the numbers we get. We are not satisfied with the numbers that they get." 15/

There are also breeder reactor safety experts in the United Kingdom who believe a breeder explosion is a credible event. The bottom line of a recent article in Nature reads:

> "Fuel melting could also arise in fast reactors under fault conditions, and our calculations show that pressures of the order of 15 kbar could be produced from large scale events involving sodium and molten uranium dioxide." 16/

This is 60 times the large pressure generated in the explosive disassembly of the SPERT ID experimental reactor. 17/

FOOTNOTES:

1/ Bureau of Mines Information Circular/1971, IC 8501, "Availability of Uranium at Various Prices From Resources in the United States," United States Department of the Interior, p.12.

2/ Ibid.

3/ Katz, J.J., Chapter VI, The Chemistry of Actnide Elements, Methuen and Co., Ltd., London, 1975, pp.239-330.

4/ The specific activity of plutonium-239 is 0.062 curies per gram. A picocurie is 10^{-12} (one trillionth) of a curie.

5/ U.S. Atomic Energy Commission, "Plutonium and Other Transuranium Elements: Sources, Environmental Distribution and Biomedical Effects," WASH-1359, December, 1974, p.152.

6/ Project Management Corporation, "Preliminary Safety Analysis Report," Clinch River Breeder Reactor Plant, p.11.2-13.

7/ Gillette, Robert, Science 185 (September 20, 1974), pp.1030-1031.

8/ Op. Cit., WASH-1359, p.145.

9/ Ibid. These dose commitments are less than 10% of the total dose commitments due to all other fallout radionuclides.

10/ U.S. Atomic Energy Commission, "Proposed Final Environmental Impact Statement, PFEIS," LMFBR Program, December, 1974, Vol.II, G.-46. This assumes no intake subsequent to 1972, and would tend to understate the total commitment.

11/ NAS-NRC, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," (BEIR Report), NAS-NRC, Washington, D.C., November, 1972.

12/ U.S. Atomic Energy Commission, "Proposed Final Environmental Impact Statement, PFEIS," LMFBR Program, December, 1974, Vol.II, G.-61. The lower estimates refer to the BEIR Report absolute risk model with a 30 year plateau following a latent period during which risk remains elevated. The upper estimates refer to the BEIR Report relative risk model with lifetime plateau.