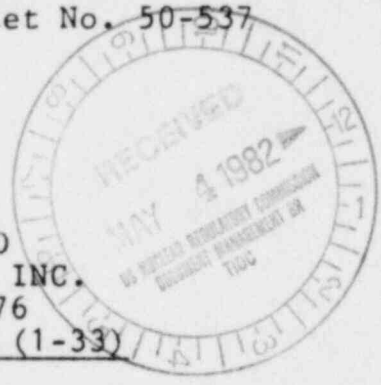
4/30/82

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of UNITED STATES DEPARTMENT OF ENERGY PROJECT MANAGEMENT CORPORATION TENNESSEE VALLEY AUTHORITY (Clinch River Breeder Reactor Plant	Docket No. 50-537



APPLICANTS' UPDATED RESPONSE TO
NATURAL RESOURCES DEFENSE COUNCIL, INC.
AND THE SIERRA CLUB JULY 28, 1976
REQUEST TO APPLICANTS FOR ADMISSIONS (1-33)

Pursuant to 10 C.F.R. § 2.742, and in accordance with the Board's Prehearing Conference Order of February 11, 1982, the Department of Energy, Project Management Corporation, and the Tennessee Valley Authority (the Applicants), hereby submit their updated Responses to Intervenors, Natural Resources Defense Council, Inc. and the Sierra Club, July 28, 1976 Request to Applicants for Admissions (1-33).[1/]

Admission.

1. Aerosols of mixed-oxide fuel are produced at various stages in the LMFBR fuel cycle.

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1/ Applicants previously responded to Admissions 1-33 on September 10, 1976 and supplemented certain of these responses (8 and 14) on January 21, 1977.

Response.

1. The Applicants admit this statement in that small quantities of aerosols of mixed-oxide fuel will be produced at some stages of the CRBRP fuel cycle. Most of these particles are removed from airstreams prior to discharge.

Admission.

2. The specific alpha activity of some of the mixed-oxide fuel particles produced as aerosols in the LMFBR fuel cycle exceeds the specific activity of $^{239}PuO_2$.

Response.

2. The Applicants admit this statement.

Admission.

3. Aerosols of mixed-oxide LMFBR fuel will be inhaled by workers in various stages of the CRBRP fuel cycle. The CRBRP fuel cycle facilities are designed to minimize the inhalation of mixed-oxide fuel particles by workers. However, as noted in response 1 above, no aerosols of mixed-oxide fuel are expected to be released to occupied areas of the CRBRP under normal operating conditions.

Response.

3. The Applicants admit this statement to the extent that aerosols of mixed-oxide fuel may be inhaled by

workers in various stages of the CRBRP fuel cycle. The CRBRP fuel cycle facilities are designed to minimize the inhalation of mixed-oxide fuel particles by workers.

Admission.

4. Aerosols of mixed-oxide LMFBR fuel will be released to the environment.

Response.

4. The Applicants admit this statement to the extent that small quantities of aerosols of mixed-oxide LMFBR fuel may be released to the environment at various stages of the CRBRP fuel cycle. The facilities are designed to minimize the release of mixed-oxide LMFBR fuel to the environment and no aerosols of mixed-oxide LMFBR fuel are expected to be released to the environment from the CRBRP under normal operating conditions.

Admission.

5. Some of the particles in the aerosols of mixed-oxide LMFBR fuel released to the environment will be inhaled by members of the general public.

Response.

5. The Applicants admit this statement to the extent that if it is assumed that aerosols of mixed-oxide LMFBR fuel are released to the environment from CRBRP fuel

cycle facilities, then some of these particles may be inhaled by members of the general public. As stated in response 4, no aerosols of mixed-oxide LMFBR fuel are expected to be released to the environment from CRBRP under normal operating conditions.

Admission.

6. When an aerosol of PuO_2, or mixed-oxide LMFBR fuel is inhaled by man, some of the aerosol particles less than about 5-10 microns in diameter are retained in the periphery of the lung.

Response.

6. The Applicants admit this statement to the extent that the task group for Lung Dynamics of ICRP Committee 2 has predicted that when aerosols of PuO_2 are inhaled by man, some particles less than 5-10 AMAD microns will be deposited in the periphery of the lung and may be retained for variable periods of time, depending upon the physical and chemical properties of the particle inhaled.

Admission.

7. When an aerosol of PuO_2, or mixed-oxide LMFBR fuel, is inhaled by man, the retention half-time for the initially deposited PuO_2, or mixed-oxide LMFBR fuel is of the order of 200 days, or longer.

Response.

7. The Applicants admit this statement to the extent that a substantial fraction of the PuO_2 deposited in the pulmonary region of the lung may be retained with half-times of 200 days or longer. However, the half-times for retention of the PuO_2 deposited in upper respiratory tract are on the order of 1 day. The fraction of the PuO_2 deposited in the various regions of the lung depends upon the particle size. The fraction of the pulmonary PuO_2 deposit retained with half-times of 200 days, or longer, will vary with the precise physical and chemical state of the PuO_2. See L. Watts, 1975, "Clearance Rate of Insoluble Plutonium-239 Compounds from the Lung", Health Physics 29, pp. 53-59; and D. Ramsden, 1976, "Assessment of Plutonium in Lung for Both Chronic and Acute Exposure Conditions", in Diagnosis and Treatment of Incorporated Radionuclides, IAEA, Vienna, pp. 139-161.

Admission.

8. Some aerosol particles of PuO_2, or mixed-oxide LMFBR fuel, will be deposited in the alveolar tissue and become immobilized for long periods (i.e., in excess of 200 days).

Response.

8. The Applicants admit this statement to the extent that some particles of PuO_2, if inhaled, will be deposited in the alveolar tissue and will be cleared with a retention half-time that may be less than, or greater than, 200 days. These particles, however, may or may not be immobile.

Admission.

9. When a critical tissue mass is irradiated at a sufficiently high dose, the probability of tumor production is high.

Response.

9. The Applicants cannot truthfully admit or deny this statement since the meaning of "critical tissue mass" is not clear and NRDC has not specified whether this term refers to an organ or a specific cell structure.

Admission.

10. The corollary to the hot particle hypothesis as stated by A. R. Tamplin and T. B. Cochran in "NRDC Supplemental Submission to the EPA Public Hearing on Plutonium and Transuranium Elements," February 27, 1975, is:

> When a critical tissue mass in the lung is irradiated by an immobile particle of sufficient alpha activity the probability of a lesion developing approaches unity and the probability of this lesion developing into a tumor is high.

(See F.R. 41 No. 71, April 12, 1976, p. 15373)

Response.

10. The Applicants admit that the corollary is quoted correctly, but do not agree with its content. See NRC Denial of NRDC Petition for Rulemaking. 41 Fed. Reg. 15373 (April 12, 1976).

Admission.

11. Tamplin and Cochran's hot particle corollary as stated in No. 10 above does not contain a reference to, and is not based on, the existence of a particular susceptible type of tissue in the lung (Cf. Comments by NRDC on the NRC's Denial of Petition for Rule Making [Docket No. PRM-20-5]).

Response.

11. The Applicants deny this admission because, while the statement does not refer to a "particular susceptible" type of tissue in the lung per se, the words "critical tissue mass" in NRDC's corollary clearly infer the existence of a particularly susceptible type of tissue in the lung.

Admission.

12. Bronchiolo-alveolar carcinoma is the predominant lung tumor type observed in animals exposed to insoluble particulates of plutonium. (See Bair and Thomas, IAEA-SM-199/58.)

Response.

12. The Applicants admit this statement.

Admission.

13. If plutonium in the form of insoluble particulates irradiates the bronchiolo-alveolar region of the human lung, it would be reasonable to expect tumors of similar cellular origin, i.e., bronchiolo-alveolar carcinoma. (See Bair and Thomas, Ibid.)

Response.

13. The Applicants admit that if tumors develop it would be reasonable to expect that they would be of similar cellular origin.

Admission.

14. A plutonium particle deposited in the palmar tissue of a machinist produced a lesion. (See Lushbaugh and Langham, ref. 17, F.R. 41, op. cit.)

Response.

14. The Applicants admit this statement to the extent that plutonium deposited in the palmar tissue of a machinist produced a lesion. However, this lesion was caused not by one particle, but by a total mass of 0.08 ug of plutonium oxide consisting of many particles. See C. C. Lushbaugh and J. Langham, 1962, "A Dermal Lesion from

Implanted Plutonium", Archives of Dermatology 86, pp. 461-464; C. C. Lushbaugh, R. J. Cloutier, G. Humason, J. Langham, also S. Guzak, 1967, "Histopathologic Study of Intradermal Plutonium Metal Deposits: Their Conjectured Fate", Annals New York Academy of Sciences 145, pp. 791-797; and G. L. Voelz, 1975, "What We Have Learned About Plutonium From Human Data," Health Physics 29 (4).

Admission.

15. Plutonium microspheres immobilized in the periphery of rat and hamster lungs produced lesions in the lungs. (See Richmond, et. al., ref. 18, F.R. 41, op. cit.)

Response.

15. The Applicants admit that plutonium microspheres immobilized in the periphery of rat and hamster lungs produced lesions in the lungs. However, these lesions were not a frequent response.

Admission.

16. The historical descriptions of these lesions are suggestive of an incipient carcinogenic response.

Response.

16. The Applicants deny that the histological descriptions of these lesions are suggestive of an incipient carcinogenic response. See the copy of the letter from C.

C. Lushbaugh to Lester Rogers, dated September 10, 1974, contained in WASH-1359 and enclosed as Attachment 1 hereto. See also Response 14.

Admission.

17. It is possible that PuO_2 particles and particles of mixed-oxide LMFBR fuel deposited in the periphery of human lungs could produce lesions similar to those produced in the hamster lungs by the Pu microspheres.

Response.

17. The Applicants cannot truthfully admit or deny this statement. Such lesions have not been observed in human lungs with small quantities of plutonium. If the human lung were to respond like the hamster lung, it is possible that deposition of large quantities of PuO_2 particles and particles of mixed-oxide fuel in the human lung, in the same manner as the hamster experiment, would produce lesions similar to those observed in the hamster experiment.

Admission.

18. There is a possibility that a lesion similar to those produced in hamster lungs by Pu microspheres, if produced by PuO_2 particle deposited in the periphery of human lungs, could develop into pulmonary carcinoma.

Response.

18. The Applicants cannot truthfully admit or deny the possibility that if such lesions were produced in the human being they would develop into pulmonary carcinomas. The lesion in question has not been observed directly to progress to pulmonary carcinoma in the hamster. Nor has such a progression been observed in man.

Admission.

19. It is possible that a lesion in the human lung, similar to those produced by microspheres in hamster lungs, could represent a risk of 1/2000 of developing into a cancer.

Response.

19. The Applicants deny this statement based upon the evidence cited by NRC in their denial of NRDC's petition for Rulemaking. 41 Fed. Reg. 15376 (Apr. 12, 1976), and also on the basis of more recent experiments in hamsters, summarized by the International Commission on Radiological Protection (Publication 31, Biological Effects of Inhaled Radionuclides, Pergamon Press, 1980).

Admission.

20. There is limited human experience which is relevant to the "hot particle" question. (See F.R. 41, No. 71, April 12, 1976, p. 15376.)

Response.

20. The Applicants admit that there is limited human experience relevant to the "hot particle" question.

Admission.

21. McInroy, et. al. ["Studies of Plutonium in Human Tracheobronchial Lumph Nodes," LA-UR-74-1454 (Preprint), LASL, updated] determined the plutonium particle size distribution in a lymph node of a plutonium worker (case 7-138).

Response.

21. The Applicants admit this statement. However, it should be noted that the method of measurement used could not differentiate between a single particle and an aggregate.

Admission.

22. McIrony and co-workers have since measured the particle size distribution in the lung of the same worker (case 7-138) and found the distribution fits a log-normal distribution with MMAD=0.16u and Og-1.4.

Response.

22. The Applicants admit this statement. However, it should be noted that the particle size was 0.16 MMD micron, not 0.16 MMAD micron. However, see Attachment 1.

Admission.

23. The particle size distribution in the lung of case 7-138 as measured by McInroy and co-workers is more relevant to the "hot particle" distribution in the lung than the lymph node data.

Response.

23. The Applicants admit that, since the lung is the organ of interest, the size distribution in the lung is more pertinent than the lymph node data.

Admission.

24. If the minimum activity to constitute a hot particle is 0.2pCi, and the tumor risk per hot particle is 1/2000, and the particle size distribution in the lung of case 7-138 is representative of the particle size distribution in the 24 Manhattan workers reported by Hempelmann, et. al. [LA-5148MS, LASL, Jan. 1973], then the observation of no lung tumors in the Manhattan workers would not be inconsistent with the hot particle hypothesis of Tamplin and Cochran.

Response.

24. The Applicants admit that the conclusions may follow from the assumption. However, the Applicants do not agree with the assumptions that have been made. See responses 10 and 19.

Admission.

25. The period of time since the 1965 Rocky Flats exposure of 25 persons is too short to draw any definitive conclusions from the Rocky Flats results from the standpoint of their providing support for, or refutation of, Tamplin-Cochran's hot particle hypothesis and assessment of risk.

Response.

25. The Applicants admit this statement to the extent that at the present time no definitive conclusions can be drawn solely from this data in providing support for, or refutation of, Tamplin and Cochran's hot particle hypothesis and assessment of risk.

Admission.

26. The plutonium exposure resulting from world-wide fallout from atmospheric testing of nuclear weapons cannot be used to draw any definitive conclusions from the standpoint of their providing support for, or refutation of, Tamplin-Cochran's hot particle hypothesis and assessment of risk.

Response.

26. The Applicants admit this statement for the reasons stated in response 25.

Admission.

27. If Tamplin-Cochran's hot particle hypothesis is correct, it would be possible to design a series of animal experiments consistent with the hypothesis such that the number of lung tumors observed per nanocurie of initial lung burden increases as the activity is spread more diffusely in the lung, i.e., as the number of particles is increased.

Response.

27. The Applicants admit that it would be possible to design such a series of experiments since there already is experimental evidence to confirm this correlation. However, this experimental evidence does not depend upon the existence or correctness of the hot particle hypothesis.

Admission.

28. One such series of experiments is described on page 14 of NRDC's Critique of WASH-1320 and summarized below:

Response.

28. The Applicants admit that the proposed experiment and hypothesized results are contained in NRDC's Critique of WASH-1320.

Admission.

29. If the Tamplin-Cochran hot particle hypothesis is correct, it would be possible to design a series of experiments, which when analyzed on a tumor per nanocurie basis, suggest the opposite that is, uniform exposure carries a smaller risk than non-uniform exposure.

Response.

29. The Applicants admit that it might be possible to design such an experiment, if the hot particle hypothesis were assumed to be correct and were, in fact, correct. However, as indicated in responses 10 and 19, the Applicants do not agree that the hot particle hypothesis is correct.

Admission.

30. One such series of experiments is described on page 15 of NRDC's Critique of WASH-1320 and summarized below:

Response.

30. The Applicants admit that the proposed experiment and hypothesized results are contained in NRDC's Critique of WASH-1320.

Admission.

31. Consequently, if the Tamplin-Cochran hot particle hypothesis is correct, one would not expect, a priori, to see a correlation between tumors per nanocurie and the number of particles (uniformity of dose).

Response.

31. The Applicants admit that this might be the case if the hot particle hypothesis were assumed to be correct, and were, in fact, correct. However, as indicated in responses 10 and 19, the Applicants do not agree that the hot particle hypothesis is correct.

Admission.

32. Some animal experiments, when analyzed on the basis of tumors per nanocurie or tumors per absorbed dose (tumors/rad), suggest that uniform exposure carries a higher risk than nonuniform exposure.

Response.

32. The Applicants admit this statement.

Admission.

33. Some animal experiments when analyzed on the basis of tumors per nanocurie or tumors per absorbed dose (tumors/rad) suggest that non-uniform exposure carries a higher risk than uniform exposure.

Response.

33. The Applicants admit this statement.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the matter of ,)

Department of Energy ,)

PROJECT MANAGEMENT CORPORATION and,)

TENNESSEE VALLEY AUTHORITY ,)

DOCKET NO. 50-537

AFFIDAVIT OF Robert L. Woolley, being duly sworn, deposes and says as follows:

1. That he is employed as Licensing Manager, Plant Development Division, Office of Nuclear Energy, U.S. Department of Energy, and that he is duly authorized to update the replies to Item 1-5 the Natural Resources Defense Council's July 28, 1976 request for Admission concerning Contention 7.
2. That the above-mentioned and attached answers are true and correct to the best of his knowledge and belief.

Robert L. Woolley
Signature

SUBSCRIBED and SWORN to before me this 30 day of April, 1982.

Patricia G. Climberg
Notary Public

My Commission expires _____, 19__.

PATRICIA G. CLIMBERG
NOTARY PUBLIC STATE OF MARYLAND
My Commission Expires July 1, 1982

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of

U.S. ENERGY RESEARCH AND DEVELOPMENT
ADMINISTRATION

PROJECT MANAGEMENT CORPORATION and

TENNESSEE VALLEY AUTHORITY

AFFIDAVIT OF JOHN W. HEALY

John W. Healy, being duly sworn, deposes and says as follows:

1. That he is employed as a staff member, Health Division, Los Alamos National Laboratory, and that he is duly authorized to answer 7/28/76 admissions, contention 7, numbers 6-33; contention 8A, numbers 1-20; and contention 8C, numbers 1-19.

2. The above mentioned and attached answers are true and correct to the best of his knowledge and belief.

John W. Healy

SUBSCRIBED and SWORN to before me
this 10th day of April, 1982.

Shirley A. McConnell
Notary Public

My commission expires: Aug. 20, 1983

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of UNITED STATES DEPARTMENT OF ENERGY PROJECT MANAGEMENT CORPORATION TENNESSEE VALLEY AUTHORITY (Clinch River Breeder Reactor Plant)	Docket No. 50-537

CERTIFICATE OF SERVICE

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DATED: April 30, 1982

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