ENVIRONMENTAL STATEMENT

WASTE
MANAGEMENT OPERATIONS

Hanford Reservation
Richland, Washington

VOLUME 3
PREDRAFT COMMENTS AND SUGGESTIONS
GLOSSARY LIST OF ELEMENTS

SEPTEMBER 1974

UNITED STATES ATOMIC ENERGY COMMISSION

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ENVIRONMENTAL STATEMENT
WASTE MANAGEMENT OPERATIONS
HANFORD RESERVATION
RICHLAND, WASHINGTON

VOLUME 3
(NUMBER 3 OF 3)

PREDRAFT COMMENTS AND SUGGESTIONS
GLOSSARY
LIST OF ELEMENTS

SEPTEMBER 1974
U.S. ATOMIC ENERGY COMMISSION

MASTER

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Barry Steele
Authorizing Official

Date: 5-23-07

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PREDRAFT COMMENTS AND SUGGESTIONS

PREDRAFT COMMENTS AND SUGGESTIONS

The Federal Register of August 14, 1973 (38 Fed. Reg 156) Waste Management Operations at Certain Plants, contained the following notice:

"....All interested persons desiring to submit suggestions for consideration in connection with the preparation of the draft environmental impact statements should send them in duplicate to Dr. James L. Liverman, Assistant General Manager for Biomedical and Environmental Research and Safety Programs, U.S. Atomic Energy Commission, Washington, D.C. 20545, on or before October 15, 1973."

Letters pertaining to the preparation of the Hanford Statement were received from the individuals and organizations listed below.

<u>Exhibit</u>	<u>Date</u>	<u>Organization and/or Individual</u>	<u>Page</u>
1	8-25-73	Mrs. Pat Hayes	C-5
2	8-28-73	Piedmont Organic Movement (Mrs. Charles W. Parrott)	C-19
3	8-28-73	Belser, Belser, Baker & Barwick (Mr. Townsend M. Belser)	C-23
4	9-9-73	Ms. Joan Bell	C-27
5	9-16-73	Ms. Mildred Noah	C-35
6	9-17-73	Natural Resources Defense Council (WASH) (Mr. Thomas B. Cochran)	C-39
7	9-25-73	Dr. Carlos G. Bell	C-43
8	10-1-73	South Carolina Environmental Action, Inc., (Mr. E. Stuart Gregg)	C-48
9	10-1-73	Concerned Californians (Mr. G. M. Millar)	C-54
10	10-1-73	Eugene Future Power Committee, Inc. (Mr. Fred Keppel) (Mr. R. G. Wolfe) (Ms. Jane Novick)	C-59
11	10-8-73	Environmentalists, Inc. (Ms. Ruth Thomas)	C-70
12	10-9-73	Mr. H. W. Ibser	C-77
13	10-9-73	Committee for the Conservation of Energy (Mr. Michael Litt)	C-81

<u>Exhibit</u>	<u>Date</u>	<u>Organization and/or Individual</u>	<u>Page</u>
14	10-10-73	Scientist's Committee for Public Information (Dr. Evelyn Mauss) (Dr. Stanley Deutsch)	C-87
15	10-10-73	Dr. Eloise W. Kailin	C-92
16	10-11-73	The Wilderness Society (Mr. Stewart M. Brandborg)	C-96
17	10-12-73	Midlands Natural Growers Association (Ms. Frances L. Baker)	C-100
18	10-12-73	Natural Resources Defense Council (Palo Alto) (Dr. Terry R. Lash) (Mr. John E. Bryson)	C-107
	10-31-73	Natural Resources Defense Council (Palo Alto) (Dr. Terry R. Lash) (Mr. John E. Bryson)	C-107
	1-25-74	National Resources Defense Council (Mr. John E. Bryson) (Dr. Terry R. Lash)	C-107
19	10-12-73	Zero Population Growth (Dr. L. Douglas DeNike)	C-149
20	10-12-73	North Anna Environmental Coalition (Mrs. Arthur W. Dietrich)	C-153
21	10-15-73	North Anna Environmental Coalition (Mrs. P. M. Allen)	C-158
22	12-4-73	Environmental Protection Agency (Dr. W. D. Rowe)	C-163
	3-28-74	Environmental Protection Agency (Dr. W. D. Rowe)	C-163

These letters presented a wide variety of matters concerned with the Hanford Waste Management Operations Program. Careful review of each letter resulted in identification of specific suggestions or comments to be covered. All letters were answered by direct AEC response prior to the preparation of the statement. Copies of these responses are only included if they address issues raised in the commentors letter. Acknowledgement letters are not reproduced. Every reasonable effort was made to fairly paraphrase or restate the specific suggestion or comment in the tabular form given on following pages. For each specific comment or suggestion, a reference is given to the section or sections of the draft statement which treats the subject matter of the suggestion or comment. Where redundancy occurs between the various letters, references are given for only the first appearance of the suggestion.

The fact that the subject matter of a suggestion or comment was treated in one or more sections of this draft statement does not necessarily imply that the particular subject was treated in the specific manner requested or that the assumptions made in the suggestions or comments are necessarily correct. If a specific subject was not treated in this draft statement, a brief explanation is given. The foreword delineates the scope of this draft statement.

After consideration of reasonable approaches to handling these predraft suggestions and comments, the method utilized was chosen to organize approximately 200 separate comments and suggestions contained in the 26 letters received. In several instances, suggestions were given for the format of this draft statement. The guide lines of the Council on Environmental Quality (40 CFR Part 1500) and AEC Regulations (10 CFR Part 11) were followed in preparing this statement.

EXHIBIT NO. 1

1. Letter from Mrs. Patt Hayes, 11-27-73	p. C-6
2. USAEC Interim Response	p. C-10
3. USAEC Response	p. C-17
4. Comment Guide	p. C-18

August 25, 1973

Dr. James L. Liverman

Assistant General Manager for Biomedical
and Environmental Research and
Safety Programs

U.S. Atomic Energy Commission
Washington, D.C. 20545

RE: Environmental Impact Statement on the Radioactive Waste
Management Programs at the Hanford Reservation, National
Reactor Testing Station, Savannah River Plant.

Dr. Liverman,

Hopefully the forthcoming AEC study on environmental impact will answer the many disturbing questions disquieting a large segment of the population. I earnestly urge that the study cover as broad a range as possible; for once the nation becomes totally committed to power by nuclear energy no area of our lives will remain untouched.

With total cultural patterns balancing on the decisions made now, the public should be fully informed and permitted a role in the policy determining bodies.

Questions of personal interest:

1. Why does the Maximum Permissible Dose Equivalent of the United States differ so radically from the MPDE of other nations?
2. When genetic mutations begin appearing among the new born, does the government or the AEC plan to assist with medical treatment, institutionalization or psychological repair?

3. Are efforts being made to preserve a genetic pool? What characteristics are considered "desirable"? Who makes these value judgements?

4. What percentage of the population^o is considered a tolerable level of expedience in the "cost-benefit" ratings?

5. Have there been higher incidence of ill health or of birth defects around existing power installations? Down wind or down stream of them? Has increased water temperatures affected aquatic life? Have comprehensive studies been made of the plant and animal life in these areas? Does the time lapse permit conclusive evidence?

6. Will the scientists who disagree with AEC findings be permitted to publish their work in the United States?

7. As exposure to industrial waste increases what restrictions will be placed upon the medical-dental professions? How will these restrictions be enforced?

8. Are methods of maintaining individual records of radiation accumulation being explored?

9. Do the international bodies of scientists consider our policies environmentally hazardous? Why are they not stock piling their own wastes?

10. In case of "catastrophic" accidents, what possible course of action can there be except to seal off the infected area?

11. What affect do prolonged fear and anger have upon the behavioral patterns of man?

12. How many "leaks", such as the Hanford incident, can be expected in the future? Are they within "manageable" proportions? How long will new storage offer containment? How often will new storage need to be found until safe half-life levels are reached? Is this method practical for hundreds of years?

13. Have alternate power sources been fully explored? Has research been adequately funded?

14. If the energy crisis is so pronounced why is the proliferation of electrical gadgets encouraged?

15. Will power limitations affect the free enterprise system if consumption controls are instituted? Are consumption controls more desirable or practical than unrestricted growth? Are they feasible?

16. Will unlimited energy supply create an insatiable inflationary economy?

Dr. Liverman, The Janus aspects of the nuclear power plants have been a source of personal concern for many years. I appreciate the opportunity to voice a few of the more pressing questions.

As long as these questions remain unanswered I must continue to doubt the value judgements of those in positions who alter history.

Most sincerely,

Mrs. Patt Hayes

Mrs. Patt Hayes
2833 S. E. 71st Street
Portland, Oregon
97206

Enclosure: 1 copy
cc, Dr. Terry Lash

NOV 27 1973

Mrs. Patt Hayes
2833 S. E. 71st Street
Portland, Oregon 97206

Dear Mrs. Hayes:

Your letter of August 25th was apparently prompted by the Atomic Energy Commission's announcement that environmental impact statements were being prepared on waste management operations in Washington, Idaho and South Carolina. I would like to assure you that we plan to prepare thorough and comprehensive statements directed toward analysis of the environmental impact of these operations. These statements cover operations associated with Atomic Energy Commission activities which are primarily associated with production of special materials used in the nuclear weapons program and processing of fuel used in the nuclear navy. These activities have been carried out for over 20 years at these sites and are expected to continue for many years. We hope that the statements will be informative and answer many of the questions raised by the public regarding the impact of our current and continuing operations.

The AEC is well aware of the potential for change that a national commitment to nuclear power will bring. The AEC is directly involved in not only research and development on the safety aspects of the nuclear industry and regulating the nuclear industry but has the responsibility for the ultimate disposal of long lived radioactive wastes. We are preparing an environmental statement covering the program for management of the radioactive wastes that will be generated in the commercial nuclear power industry. I trust that the latter statement combined with the three waste management operations statements will provide the breadth of coverage that you desire.

The AEC has prepared or has underway several intensive studies that relate to the national commitment to nuclear power. One study "The Year 2000 Study" projects the potential radiological implications of nuclear facilities in the area of the Upper Mississippi River Basin in the year 2000, and concludes that

"Contribution to the radiation potentially received by the population from these discharges represent only a small fraction of the radiation received from natural background radiation... Therefore, it can be concluded that the potential radiation received by the population from the operation of potential nuclear facilities in the year 2000 would present no hazard to their health and safety." I am enclosing a copy of that study for your information.

Since question number twelve seems to be the only one directly applicable to the environmental statements, I will attempt to answer it directly. We cannot predict the number of "leaks" in our waste tanks that can be expected in the future. However, past and estimated future experience will be taken into consideration in the preparation of the environmental statements that are being prepared on our waste management operations. Reasonable efforts will be made to minimize them at all sites and keep them within "manageable proportions." Replacement tanks are continuing to be constructed to replace the older ones that are most likely to leak. Several hundreds of years will be required to reach safe levels from most of the radioactivity to be stored. However, some of the radioactive materials such as plutonium will require storage for several hundreds of thousands of years and research is underway to develop storage facilities outside the biosphere for this period of time. The storage tanks offer a practical method as long as we have adequate surveillance over them and replace them at the proper intervals. I am enclosing a copy of WASH-1202 (73) July 1973, "Plan for the Management of AEC-Generated Radioactive Wastes" which may give you a clearer picture of our policy regarding management of our wastes.

We have pondered over the remaining questions of personal interest raised in your letter. They are on significant issues but are not necessarily easy for us to answer since as you yourself agree, total cultural patterns are involved in some of the subjects of your questions and the policy determinations do not necessarily reside with the AEC. Therefore, I have asked members of my staff to address these questions and their responses are attached. I hope that their efforts are helpful to you.

Staff Response on
Questions in Letter to Dr. Liverman from Mrs. Hayes
August 25, 1973

Some preliminary assumptions were made in formulating a few of the questions which may be subject to question. For example, in question #2 it was assumed that genetic mutations will begin appearing among the new born. Implied is the thought that these genetic mutations will be related to Atomic Energy Commission or other nuclear activities. While genetic mutations do occur and will undoubtedly continue to occur in the future there is no identifiable relationship between these mutations and nuclear activities.

Responses to the questions are listed in numerical order and the question repeated for clarity. Some of the responses involve best educated guesses and reflect the personal opinions of the staff.

1. Why does the Maximum Permissible Dose Equivalent of the United States differ so radically from the MPDE of other nations?

The U. S. does not have a position different from other nations on MPDE. To the best of our knowledge, the U. S. has followed the recommendations of the International Commission on Radiological Protection (ICRP) as do all other nations. In addition these recommendations have been reviewed by the National Council on Radiation Protection and Measurements and the Environmental Protection Agency. The Radiation Protection guides recommended were designed to limit the exposures of the entire body and of certain critical organs of radiation workers and the general population resulting from the use of ionizing radiation in normal peacetime operations. Using the "as low as practicable" concept, wherein recognition is given to the desirability to reduce radiation exposures to as low as practicable levels, the AEC has further required reduced permissible levels of radioactivity in effluents through its rulemaking procedures. Therefore, resultant exposures to the public living in the immediate vicinity of operating reactors have been small percentages of Federal radiation protection guides.

3. Are efforts being made to preserve a genetic pool? What characteristics are considered "desirable"? Who makes these value judgements?

Efforts are being made to preserve genetic pools in experimental organisms. There are several research groups trying to maintain not only varieties of species but also specifically selected stocks and mutants. One of the geneticists now at the AEC on a temporary assignment, is engaged in such a project with mice. We know of no efforts being made to preserve a genetic pool for humans. However,

it is interesting to note some reactions to the latter possibility. H. J. Muller (a noted geneticist) announced about 10 years ago that sperm from our most talented people should be preserved, stored, and used from time to time so that we could build up special qualities in the "race" that we desire. Actually the idea is in opposition to the idea of preserving a "genetic pool." The pool concept would preserve all kinds of genetic variability presently existing in the population. The Muller idea is just the opposite, that is preservation of specific genetic qualities and traits. What we are doing by not selecting (or propagating just as we are now) is actually preserving the so-called genetic pool about as well as it could be done.

J. V. Neel, another geneticist, thinks that man's control of his own evolution should be relegated to the future when we know more about what we are doing when we tamper with the intricate dynamics of population genetics and structure.

4. What percentage of the populous is considered a tolerable level of expedience in the "cost-benefit" ratings?

In performing "cost-benefit" analyses the population considerations are only one factor that is used. Generally, the population considered is that which is directly involved in the risk and/or benefit from the facility that is under consideration. In the case of nuclear power plants this can vary considerably. For a specific treatment of cost-benefit reference is made to Section XI-B in the Trojan Environmental Statement, a copy of which is enclosed. This statement was issued in August 1972 for a plant at Ranier, Oregon, about 40 miles from Portland.

5. Have there been higher incidence of ill health or of birth defects around existing power installations? Down wind or down stream of them? Has increased water temperatures affected aquatic life? Have comprehensive studies been made of the plant and animal life in these areas? Does the time lapse permit conclusive evidence?

Based on experience at existing power stations there has been no evidence after up to 15 years of operation to indicate a higher incidence of either ill health or of birth defects. An environmental impact statement is prepared by the AEC before the issuance of a license for a nuclear power reactor. These statements are the results of extensive, in-depth studies of the anticipated environmental impacts of the proposed nuclear power plant and include the effects of increased water temperature on aquatic life as well as comprehensive studies of of plant and animal life in the area. For a typical treatment of a plant site you may wish to refer to the enclosed Trojan statement.

6. Will the scientists who disagree with AEC findings be permitted to publish their work in the United States?

We know of no specific restrictions on publication by scientists who disagree with "AEC findings". All scientists have the long standing prerogative of publishing their research findings in scientific journals which offer a peer or referee evaluation before acceptance and publication and then a readership which may agree or disagree with the findings to make their views known. There may have been some confusion regarding this scientific avenue for the generation of information since many critical opinions on nuclear activities have been aired in newspaper interviews and television shows. Some of the critics of the AEC have been urged to publish their specific scientific findings so that a better perspective might be obtained.

7. As exposure to industrial waste increases what restrictions will be placed upon the medical-dental professions? How will these restrictions be enforced? AND
8. Are methods of maintaining individual records of radiation accumulation being explored?

Consideration was given to maintaining individual records of radiation accumulation by the National Academy of Science several years ago. However, such a system proved impractical since as a general rule, monitoring records are kept only by employers in occupations where there is known radiation exposure. The creation of a system for maintaining records for the general population would be very difficult. In the medical-dental professions the main record kept is an indication in the patient file that there has been an x-ray or exposure to radiation as in the case of diagnostic and therapeutic procedures involving exposure to radiation. In the case of the therapeutic exposures the exposure is calculated and noted in the file. In the foreseeable future we see no need for restrictions on the medical-dental profession based on increases in exposure to radiation from the nuclear industry. The average exposures to the general public from the nuclear industry are miniscule and are not expected to be significant by the year 2000. This is confirmed by the results in the enclosed "Year 2000" report. With regard to the medical-dental profession the average exposures to the population are very large compared to the exposures to industrial wastes and are a significant percentage of natural background. However, these exposures have generally been considered essential to the individual's health since the doctor or dentist makes a judgement that the damage associated with the radiation is a justified risk because of the benefits derived from the medical diagnostic or therapeutic procedure.

The time may come, however, when a national reporting system of personal exposure records for the medical or dental profession would be in order. It would probably require specific legislation by Congress to implement such a system.

9. Do the international bodies of scientists consider our policies environmentally hazardous? Why are they not stock piling their own wastes?

We do not feel that international bodies of scientists consider our waste management policies environmentally hazardous. Other countries treat their wastes much the same as we do in the U. S. The reference may be to the return of irradiated fuel to the U. S. Small quantities of research reactor fuel is required to be returned by the agreement under which the fuel was received. For the nuclear power industry other countries will own their nuclear fuel and will be responsible for their own radioactive wastes. The AEC does work with the International Atomic Energy Agency in establishing waste management policies in international waste management areas.

10. In case of "catastrophic" accidents, what possible course of action can there be except to seal off the infected area?

Emergency plans have been developed by utilities that operate nuclear power plants to cover accident situations. If the accident were of "catastrophic" proportions involving releases of radioactivity, restrictions would be placed on entry to radioactively contaminated areas in order to prevent unnecessary radiation exposure. Radiological Emergency Assistance Teams are available in various regions of the country to offer assistance in such an event to assure maximum protection of the public from radiation exposure.

11. What affect do prolonged fear and anger have upon the behavioural patterns of man?

The concern expressed about the effects of prolonged fear and anger is outside the purview of the AEC staff. Perhaps one could seek information on these sociological and psychological areas from the National Institute of Mental Health of the Department of Health, Education and Welfare.

13. Have alternate power sources been fully explored? Has research been adequately funded?

Regarding the level of funding for research on alternate energy sources, the President announced several initiatives in his Statement on Energy of June 29, 1973 including a \$10 billion energy R&D effort over a 5-year period beginning in Fiscal Year 1975. To give impetus to this

drive he directed that an additional \$100 million in Fiscal Year 1974 be devoted to the acceleration of certain existing projects and the initiation of new projects in a number of critical research and development areas. Enclosed is a copy of that Statement and the portion that is relevant to the question has been noted.

14. If the energy crisis is so pronounced why is the proliferation of electrical gadgets encouraged?;
15. Will power limitations affect the free enterprise system if consumption controls are instituted? Are consumption controls more desirable or practical than unrestricted growth? Are they feasible?; and
16. Will unlimited energy supply create an insatiable inflationary economy?

Only general comments can be offered on the energy related questions since they are not related just to nuclear power. In our democratic society, demand is created in the market place. The proliferation of electrical gadgets is generally in response to consumer demands or desires since they are the ones who purchase and use them. The ramifications of unlimited energy versus power consumption controls involve complex societal changes and one would hope that an energy conservation program could be effected without too many mandatory controls and therefore, ease the "energy crisis" without too great a societal impact.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mrs. Patt Hayes
2833 S.E. 71st Street
Portland, Oregon 97206

Dear Mrs. Hayes:

This letter supplements my letter of November 27, 1973 acknowledging your August 25, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Many of your comments not relating to AEC's waste management operations were addressed in my earlier letter. Those comments relevant to the statement are listed in the enclosed guide and sections of the statement treating the comments are identified. We believe this will provide a convenient guide to assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Mrs. Pat Hayes, 8-25-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
How many "leaks" such as the Hanford incident, can be expected in the future?	III.2.2; III.2.5
Are they within "manageable" proportions?	III.1; III.2
How long will new storage offer containment?	III.2.2
How often will new storage need to be found until safe half-life levels are reached?	II.1.1.2.2; Table V-10; V.2.5
Is this method practical for hundreds of years?	V.2.5

EXHIBIT NO. 2

1. Letter from Piedmont Organic Movement (Mr. Charles W. Parrott), 8-28-73	p. C-20
2. USAEC Response	p. C-21
3. Comment Guide	p. C-22

Piedmont Organic Movement

714 S. Line Street
Greer, S. C. 29651
August 28, 1973

Dr. James L. Liverman, Assistant General Manager for Biomedical
and Environmental Research and Safety Programs
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Liverman:

The Piedmont Organic Movement is an organization of over 200 members in South Carolina, North Carolina, Georgia and Tennessee. We are vitally concerned over the waste management practices and operation of the AEC, especially at the Savannah River Plant at Aiken, South Carolina.

Our concern stems over the spills and leakages of over 1,000 gallons of radioactive waste over the past ten years at the Savannah River Plant. Since the majority of our members are engaged in the production of food, both vegetables and livestock, we are especially concerned over the concentration of radioactive isotopes in the food chain.

We feel that it is imperative that comprehensive studies of the concentration of radioactive material in the food chain be included in the environmental impact statements of the Hanford, Savannah River and AEC facilities. In addition, a study of cancer, leukemia, birth defects, infant mortality and heart disease patterns for a period of time beginning when each of these facilities went into operation until the present be done for the immediate area within a 50 mile radius of each facility. This should include actual residents in these areas, and not be based upon estimates of populations.

Of equal importance is the actual accidents that have happened at these facilities. Using the actual operating experiences as a guideline, a projection of how much waste leakage we can expect in the future, considering the expansion or cut-backs in the radioactive inventories should be done. We feel it is also important to include the lengths of time these pollutants will contaminate the environment.

We also feel that the AEC should include the probable effects of a total release of all radioactive materials at each of these facilities. No matter how small the chance of such a release occurring is, the fact remains that as long as these materials are in stowage the total release of these by some act is possible, and quite credible.

We would also like to see an evaluation, based on degenerative disease death increases in the areas of these facilities, as to how many humans have died as a result of the operation of these facilities.

We thank you for your attention to our suggestions and concerns in these matters.

Respectfully,

Charles W. Barnett
President, Piedmont
Organic Movement

CWP/hnp

cc: Congressman James R. Mann
Senator Ernest F. Hollings

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. Charles W. Parrott, President
Piedmont Organic Movement
714 S. Line Street
Greer, South Carolina 29651

Dear Mr. Parrott:

This letter supplements my letter of September 26, 1973 acknowledging your August 28, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments have been listed in the enclosed guide and sections of the statement treating the comments are identified. We believe this will provide a convenient guide to assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Piedmont Organic Movement (Mrs. Charles W. Parrott) 8-28-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Comprehensive studies of the concentration of radioactive material in the food chain be included.	II.1.2; II.3.13; Ref. 37 to III.1; App. III-A; Table III-A-26
A study of cancer, leukemia, birth defects, infant mortality and heart disease patterns for a period of time beginning when each of these facilities went into operation until the present be done for the immediate area within a 50 mile radius of each facility. This should include actual residents in these areas, and not be based upon estimates of populations.	III.1.1.2.2.2; III.1.1.2.6
Using the actual operating experiences as a guideline, a projection of how much waste leakage we can expect in the future, considering the expansion of cut-backs in the radioactive inventories should be done.	III.2.2; III.2.5; App. II.1-B, C, D, E
It is also important to include the lengths of time these pollutants will contaminate the environment.	III.1
Include the probable effects of a total release of all radioactive materials at each of these facilities.	III.1
An evaluation, based on degenerative disease death increases in the areas of these facilities, as to how many humans have died as a result of the operation of these facilities.	III.1.1.2.6; IV

EXHIBIT NO. 3

1. Letter from Belser, Belser, Baker and Barwick
(Mr. Townsend M. Belser, Jr.)	p. C-24
2. USAEC Response	p. C-25
3. Comment Guide	p. C-26

IRVINE FURMAN BELSER (1889-1969)
IRVINE F. BELSER, JR.
CLINCH HEYWARD BELSER
CHARLES E. BAKER
TOWNSEND M. BELSER, JR.
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JEAN H. TOAL
LEWIS M. LEVY

August 28, 1973

Dr. James L. Liverman
Assistant General Manager
Biomedical and Environmental Research
and Safety Programs
U. S. Atomic Energy Commission
Washington, D. C. 20545

Re: Waste Management Operations at Savannah
River Plant of AEC in South Carolina.

Dear Dr. Liverman:

In response to the Notice published by the AEC in the Federal Register on August 14, 1973, (38 F.R. 21955) concerning the above-referenced matter, I wish to submit the following comments:

1. The environmental impact statement for the AEC's own waste management operations should be prepared in the same detail and with the same amount of technical effort as required by the staff of Public Utilities seeking construction or operating licenses for nuclear facilities.
2. The AEC should be required to support the matters presented in its impact statement with technical evidence in a public forum to allow all controversial issues in this area to be fully aired before the public and to allow the submission of any additional evidence that concerned members of the public may wish to present. Since the waste management operations concerned can affect the economy and environment of the entire state, a public hearing on such matters should be held in the State Capitol with adequate publication of notice in statewide news media.

It is hoped that the foregoing suggestions will be given serious consideration by your agency and, in any event, a written reply thereto would be sincerely appreciated.

With kind regards,

Sincerely yours,

Townsend M. Belser, Jr.

TMBJr/bjb

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. Townsend M. Belser, Jr.
Belser, Belser, Baker & Barwick
P.O. Box 11690
Columbia, South Carolina 29211

Dear Mr. Belser:

Your letter to me of August 28, 1973 offered comments concerning the preparation of an environmental statement on waste management operations at the Savannah River Plant in Aiken, South Carolina. Although this statement is not yet ready for publication, the AEC is issuing a draft environmental statement on waste management operations at the Hanford Reservation near Richland, Washington. A copy of this statement is enclosed.

With regard to your comment concerning public hearings you may be interested to know that the AEC tentatively plans to conduct a public hearing on the Richland statement in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register. We considered holding the hearing in the state capital as you suggested, however, we feel that holding the hearing at a location close to the site covered by the statement would provide the greatest opportunity for the public living around the site to attend and participate in the hearings. Therefore, we feel the public interest is best served by conducting hearings close to the AEC site.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosure:
Draft Environmental Statement, Waste Management Operations,
Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Belser, Belser, Baker & Barwick (Mr. Townsend M. Belser), 8-28-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Technical detail, effort, evidence	(see Dr. Liverman's reply)

EXHIBIT NO. 4

1. Letter from Ms. Joan Bell, 9-9-73	p. C-28
2. USAEC Interim Response, 11-30-73	p. C-29
3. USAEC Response	p. C-33
4. Comment Guide	p. C-34

Highway 136 West
Rock Port, Mo. 64482
September 9, 1973

Dr. James L. Liverman
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Sir:

I understand the AEC is to prepare an impact statement on nuclear waste management operations. I feel this is undoubtedly the most urgent ecological problem of our time, and would like to recommend the following items for consideration.

We have not been able to keep the relatively small amount of nuclear waste which we presently have out of the environment. If we proceed with the present schedule of building atomic power plants, including fast-breeder plants, a fully developed nuclear power economy will produce some 200,000 pounds, or one hundred tons, of plutonium-239 annually. One pound of plutonium-239 represents the potential for some nine billion human lung cancer doses. Plutonium-239 has a half-life of 24,400 years. Even 99.999 percent containment would not be good enough to avert disaster. How can the AEC know they can achieve 100% containment?

There have been instances where shipments of radioactive materials have simply disappeared in transit and have not been located. If we have not been able to keep relatively small amounts of these materials out of unauthorized hands, how can we possibly hope to avert sabotage when we have acquired many times the amount of radioactive materials that we have today?

What would happen if a severe earthquake should occur at the Hanford Reservation today?

I understand there were more cases of cancer in Japan during the past year as a result of the World War II bombings than in any other year since the bombings occurred 28 years ago. This indicates the results of low-level radiation are more far-reaching than it was formerly believed. Is there any proof that individuals living near nuclear power plants, reprocessing plants, waste disposal facilities, or uranium mines will not eventually develop cancer, leukemia, or genetic defects as a result of continued low-level radiation?

Can the AEC prove that low-level radiation from nuclear power plants has not been responsible for increased infant mortality around these plants?

Will there be shipments of waste from the proposed fast-breeder plants? If so, what will be the method and what would happen if the vehicle (train or truck) carrying the waste were involved in an accident so severe that the container were demolished, perhaps in a highly populated area?

How can the United States condone the shipment of radioactive wastes into the States from other nations when we have not found a safe way to dispose of our own wastes?

Sincerely yours,

Joan Bell
Ms. Joan Bell

NOV 30 1973

Ms. Joan Bell
Highway 136 West
Rock Port, Missouri 64482

Dear Ms. Bell:

Thank you for your letter of September 9, 1973, in which you offered suggestions for consideration in the preparation of the environmental impact statement for waste management operations. Your letter has been brought to the attention of those responsible for preparation of the impact statements who will give your suggestions careful consideration. Your letter addresses problems not directly associated with waste management operations and I will try to address them in this letter as well as those related to waste management.

First of all I would like to clarify the object of the statements being prepared. They will cover the operations at existing AEC facilities that handle radioactive waste associated largely with the AEC's own programs including both military and peaceful uses of atomic energy. The quantities of waste stored and being managed are quite large — tens of millions of gallons. The nuclear power industry will also generate large quantities of similar wastes in the decades ahead. These wastes will be generated in commercial facilities and sent to the AEC in a storable solid form after about ten years. Management of commercial wastes will not be covered in these statements but will be covered in another environmental statement that we are currently preparing.

Your first concern is that plutonium-239 be sufficiently contained so that it does not represent a health hazard to individuals in the environment. You compared the annual rate of production of plutonium with an amount you stated was necessary to cause human lung cancer and noted that the potential for a large number of lung cancers exists. This method of comparison is frequently used to understand the potential toxicity of a material. However, this does not represent an indication of the expected hazard. The amount of exposure that may occur depends on many factors in addition to the quantity of a material available. These factors include: the amount which might be released into the environment; the fraction of the material present in the environment which can return to man; its chemical and physical form and its ultimate geochemical fate.

Our society safely handles many materials which on a similar comparative basis are used in amounts similar to the plutonium quantity mentioned in your letter. For example, the annual production of lead in the United States is about a million tons, or the equivalent of 10 billion toxic doses if administered internally to 10 billion children. Studies were undertaken by the Atomic Energy Commission's predecessor, the Manhattan Engineering District of the Corps of Engineers, which determined the toxicity of plutonium almost 30 years ago, and studies were published in the open literature as early as 1949. Therefore, plutonium has been handled with due regard for its toxicity from the very beginning of the atomic energy programs.

While we don't believe that 100% containment is attainable, we do believe that we can get quite close to it. The AEC experience to date with containment of plutonium and other radioactive waste has been favorable, and our experience in handling large quantities of waste will be summarized in the impact statements on nuclear waste management operations. These statements will also discuss the effects of earthquakes upon waste management facilities. We have reason to believe that with the isolation provided and type of condition involved, even severe earthquakes would not lead to significant radiation exposures to man in the vicinity of the Hanford reservation.

We have known for many years that large exposures to radiation can cause leukemia and cancer, both in animals and man. Studies of the Japanese survivors of Hiroshima and Nagasaki are continuing under the aegis of the Atomic Bomb Casualty Commission. The relatively recent detection of cancer in the Japanese survivors which resulted from large instantaneous exposures accordingly is not an unexpected development. There is a relatively long latent period between exposure and the overt development of a cancer and a shorter latent period for leukemia. In these populations the leukemias were accordingly detected earlier.

Prestigious scientific bodies such as the International Commission on Radiological Protection, which recommend radiation limits, assume that at lower exposures risk is proportionately reduced. Accordingly, the observations in Japan do not lead us to conclude that "the results of low-level radiation are more far reaching than it was formerly believed."

The AEC proposed rulemaking action which promulgates numerical guides for meeting "as low as practicable" levels for radioactive material in effluents from light-water cooled nuclear power reactors would limit the potential exposure to individuals living near the reactor. The radiation exposure to the public attendant to the operation of these plants in all

cases is less than accepted international standards and also a small fraction of the existing natural radiation background. Accordingly, the probability that individuals living near these plants would experience a significant increase in the incidence of cancer, leukemia or genetic effects as a result of the operation of the plants is considerably less than from other causes. In addition, there is no evidence to associate low level radiation from nuclear power plants with incidence of mortality around these plants.

There will be shipments of radioactive waste from fast breeder nuclear power plants as there are from existing nuclear power plants. These will be in the form of spent fuel elements and irradiated fertile material containing the plutonium that has been formed in the breeding process. Casks for shipping are designed and tested so that in the case of an accident the integrity of the container is sufficient to limit the consequences of the accident. Experience of the past fifteen years with the shipment of irradiated fuel from light water reactors is evidence that such shipments can be made safely. You may be interested in a summary and evaluation of our experience in this area contained in a report entitled "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants" which is enclosed.

Your conclusion that "we have not found a safe way to dispose of our own wastes" may be a bit extreme. We have been handling radioactive waste in rather large quantities for about thirty years and to my knowledge no member of the public has received radiation exposures from these operations in excess of internationally accepted guidelines. This record is notwithstanding the fact that techniques for handling these wastes were not based on prior experience when originally developed. However, with the experience we have gained, we are confident that the waste can be stored in a safe manner and ultimately disposed of adequately. I am enclosing a copy of "Plan for the Management of AEC Generated Radioactive Wastes" (WASH-1202(73)) for your information. As mentioned previously, we are currently preparing an environmental impact statement on our program for the management of commercially generated high level radioactive wastes. In this statement, we will examine the alternatives for interim surface storage and ultimate disposal of the waste. The relatively small quantities of wastes received from other countries under our bilateral agreements for cooperation can be stored within our existing plants.

Ms. Joan Ball

- 4 -

I appreciate receiving your letter and the opportunity to discuss your concerns regarding the nuclear industry. I will send you copies of the three draft environmental statements on AEC site operations and the statement on managing commercial wastes when they are issued and will welcome any comments you may have at that time.

Sincerely,

Original signed by
James L. Liverman

James L. Liverman,
Assistant General Manager for
Biomedical and Environmental
Research and Safety Programs

Enclosures:
As stated

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Ms. Joan Bell
Highway 136 West
Rock Port, Missouri 64482

Dear Ms. Bell:

This letter supplements my letter of November 30, 1973 acknowledging your September 9, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Many of the issues raised in your letter did not specifically relate to the Waste Management Operations Environmental Statements and were responded to in my previous letter. Those comments relevant to the statement were considered in its preparation and the sections of the statement dealing with these comments are identified in the enclosed comment guide. We believe this guide will assist you in reviewing the draft statement.

Your concerns regarding the management of radioactive waste from power reactors have been addressed in another environmental statement, WASH-1539, a copy of which has been sent to you.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Ms. Joan Bell, 9-9-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
What would happen if a severe earthquake should occur?	III.2.11; Table III.2-27
Alternatives for interim surface storage and ultimate disposal of the waste.	V.2.5

EXHIBIT NO. 5

1. Letter from Ms. Mildred Noah, 9-16-73	p. C-36
2. USAEC Response	p. C-37
3. Comment Guide	p. C-38

September 16, 1973

Dr. James L. Liverman,
Assistant General Manager for Biomedical
and Environmental Research and Safety Programs,
U.S. Atomic Energy Commission
Washington, D. C. 20545

Dear Sir:

I understand that the AEC is preparing an environmental impact statement on waste management operations at its Hanford Reservation in Eastern Washington, its Savannah River Plant, and its National Reactor Testing Station in Idaho.

I hope you will cover the following questions in the report:

1. How long can a barrel which is full of radioactive wastes be expected to last?
2. Are the used barrels radioactive? How are they disposed of?
3. How many full barrels will have accumulated by 1983?
4. What would be the consequences of a failure of the cooling system at the reprocessing plant in South Carolina? How would this possible failure compare to the failure of a cooling system of a power plant?

Thank you for your consideration of my questions.

Sincerely,

Mildred Noah

Mildred Noah
Rock Port, Mo.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Ms. Mildred Noah
Rock Port, Missouri 64482

Dear Ms. Noah:

This letter supplements my letter of October 4, 1973 acknowledging your September 16, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

We have considered the questions you raised in your letter in the preparation of the environmental statement. The enclosed comment guide identifies those sections of the statement which relate to your questions. We hope that this guide will assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Ms. Mildred Noah, 9-16-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
How long can a barrel which is full of radioactive wastes be expected to last?	II.1.1.2.2
Are the used barrels radioactive? How are they disposed of?	II.1.1.2.2
How many full barrels will have accumulated by 1983?	II.1.1.4

EXHIBIT NO. 6

1. Letter from Natural Resources Defense Council, Inc.
(Mr. Thomas B. Cochran), 9-17-73	p. C-40
2. USAEC Response	p. C-41
3. Comment Guide	p. C-42

Natural Resources Defense Council, Inc.

1710 N STREET, N.W.
WASHINGTON, D.C. 20036
202 783-5710

Palo Alto Office
AMILTON AVENUE
ALTO, CALIF. 94301
415 327-1080

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

September 17, 1973

Dr. James L. Liverman
Assistant General Manager for Biomedical
and Environmental Research and Safety
Programs
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Liverman:

I am writing in regard to the announcement in the Federal Register (August 14, 1973, p. 21955) that the AEC will prepare an environmental impact statement on waste management operations at Hanford, Savannah and NRTS. I would like to see in this statement a full and candid discussion of the following: 1) the environmental impact due to the high-level radioactive wastes should there be a loss of management of these facilities for a significant period due, for example, to a loss of government or social order in this country; 2) a detailed comparison of the high-level wastes from the military program and the civilian nuclear power industry as a function time (e.g. every 5 years through 2020); and 3) the toxicity and uncertainty in the toxicity of plutonium aerosols, including the issues raised by Donald P. Geesaman in UCRL-50387, Feb. 9, 1968 and ADDENDUM, October 9, 1968, and in "Plutonium and Public Health" (Senate Hearings before the Subcommittee on Public Works, Aug. 5, 1970, pp. 1524-1537).

Please send me a copy of the draft environmental impact statement when it becomes available. Thank you kindly.

Sincerely,

Thomas B. Cochran

TBC/pa

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. Thomas B. Cochran
Natural Resources Defense Council, Inc.
1710 N. Street, N.W.
Washington, D.C. 20036

Dear Mr. Cochran:

This letter supplements my letter of September 26, 1973 acknowledging your September 17, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. You may be interested in knowing that we have also received comments concerning the statements from the Palo Alto office of NRDC. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

We have attempted in the draft statement to be responsive to all relevant suggestions for coverage of topics. The textual location of the treatment of those suggestions received from the Washington, D.C. office of NRDC can be identified from the enclosed comment guide. Please note that we have endeavored to specifically treat all substantive comments in appropriate sections of the text.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Natural Resources Defense Council, Inc. (Mr. Thomas B. Cochran), 9-17-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The environmental impact due to the high-level radioactive wastes should there be a loss of management of these facilities for a significant period.	V.1 (see paragraph 2 of page V-1)
A detailed comparison of the high-level wastes from the military program and the civilian nuclear power industry as a function of time.	(Beyond the scope of this Statement.)
The toxicity and uncertainty in the toxicity of plutonium aerosols, including the issues raised by Donald P. Geesaman in UCRL-50387.	III.1.1.2.2.1; III.1.1.2.2.2; III.1.1.2.6

EXHIBIT NO. 7

1. Letter from Carlos G. Bell, 9-25-73 p. C-44
(Note: The Curriculum Vitae of Dr. Bell was not
included in this exhibit)
2. USAEC Response p. C-46
3. Comment Guide p. C-47

2000 Queens Rd., W.
Charlotte, N. C. 28207
September 25, 1973

Dr. James L. Liverman
Assistant General Manager for
Biomedical and Environmental Research
and Safety Programs
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Liverman:

This letter concerns suggestions in connection with the preparation of draft environmental impact statements on waste storage of nuclear materials in the United States.

As you may note from my enclosed resume, I have been concerned with the impact on environment made by radio active fission products since 1951. Much of my knowledge of the storage of high level waste materials has been gained through discussions with experts and through visits over the years at the Los Alamos Scientific Laboratory, the Hanford Laboratory, and the Arco, Idaho site.

It is obvious from the disturbing accidental losses of high level liquid wastes at the Hanford site that more than administrative failure is to blame. It must be obvious by now that triple containment with continuous monitoring for discharge from the primary containment must be seriously considered.

It appears to me following my three years away from the AEC operations that immediate full, candid discussion of all site safety features which do not involve national security is mandatory. Both the press and the public are becoming more and more capable of finding out cases of mistakes that result in significant releases. By not being entirely open and candid, the AEC suffers unduly from a lack of credibility. This mismanagement does insult and great harm to the thousands of hard workers among the AEC and its contractors. The whole problem must be rectified in this respect.

I have no doubt but that the ultimate discharge may require the storage of solid high level wastes in salt mines or salt domes deep under ground. If such methods are used, I suggest that all of their advantages and disadvantages be openly and candidly discussed. A waste disposal program should not be abused in the way that the reactor safety program has been hurt. The AEC's withholding new maximum accident facts for eight years beyond the time of the new Brook Haven study in 1965 is only one example in this regard. Most of us within the AEC family knew of that study and now that the public has learned of the suppression, I would presume all would agree that the AEC's public relations techniques need some revision.

One of the many questions concerning radioactive wastes that has not been adequately dealt with is that of earthquakes. Even though human mistakes, insanity, warfare and sabotage are more serious matters than all natural disasters, all such problems should be publicly documented. The Hanford operation was some fifteen years old before Holmes and Narver, an engineering consulting firm, made a preliminary study of the earthquake safety of the reactor structures. They, of course, found many shortcomings. Little, if anything, has been done on the waste tanks as far as I know. As the site is in the Circum-Pacific Earthquake zone, there is no reason to believe that an earthquake of great intensity could not occur at that site. The (unlikely) probability of fault slippage in the tank area should be documented.

Finally, I would suggest that the AEC consider possible ultimate disposal of carefully solidified radioactive materials into carefully located, very deep wells, possibly enlarged at the bottom with nuclear excavation. If such wells were put into subduction zones in the earth's crust, the wastes might plunge deeper into the earth at the rate of one or two centimeters per year. This suggestion is admittedly open to much question, but we all know that the long-range radioactive waste disposal problem is as yet unsolved.

Sincerely,

Carlos G. Bell

CGB:fps
Enc.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Dr. Carlos G. Bell
2000 Queens Road, W.
Charlotte, North Carolina 28207

Dear Dr. Bell:

This letter supplements my letter of October 10, 1973 acknowledging your September 25, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments regarding waste management operations were given careful consideration in the preparation of the statement. The enclosed comment guide identifies those sections of the statement which relate to your comments. We hope that this guide will assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Dr. Carlos G. Bell, 9-25-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Triple containment with continuous monitoring for discharge from the primary containment must be seriously considered.	II.1.1.2.2.2; V.2
Candid discussion of all site safety features which do not involve national security is mandatory.	II.1; III.2
Ultimate discharge may require the storage of solid high-level wastes in salt mines or salt domes deep under ground. If such methods are used, I suggest that all of their advantages and disadvantages be openly and candidly discussed.	V
The (unlikely) probability of fault slippage in the tank area should be documented.	III.2.11; Appendix II.3-C
Consider possible ultimate disposal of carefully solidified radioactive materials.	V.2.5

EXHIBIT NO. 8

1. Letter from South Carolina Environmental Action, Inc.
(E. Stuart Gregg, III), 9-28-73	p. C-49
2. USAEC Interim Response, 10-11-73	p. C-51
3. USAEC Response	p. C-52
4. Comment Guide	p. C-53

September 28, 1973

Dr. James L. Liverman
Assistant General Manager
Biomedical and Environmental Research
Safety Programs
U. S. Atomic Energy Commission
Washington, D. C. 20545

Sir:

This letter is directed to the Atomic Energy Commission's request that interested parties and organizations provide their inputs to the matter of preparation of draft environmental impact statements concerning nuclear waste management operations.

South Carolina Environmental Action, Inc. is a group of 150 individuals who are concerned about precipitate, shortsighted commitments to plans and policies that often result in adverse impacts upon the environment. The organization has taken a special interest in the matter of the still unsolved problems of transporting and storing nuclear wastes.

In response to AEC's request for inputs from concerned citizens and organizations, S.C.E.A.I. feels that the content of the environmental statements needs to be broad enough to encompass all public concerns about radioactive wastes. Most importantly, the environmental impact statements must demonstrate that no radioactive wastes will be emitted into the environment until the half life cycle has reduced such wastes to safe levels. It is also critical that nuclear waste management facilities be capable of guaranteeing that the following occurrences do not take place:

1. That no transportation accidents will occur during deliveries that will be made to the facilities or that if one does occur that no irradiated material be released.
2. That the plant will not be sabotaged during its operation and that temporarily stored materials will not be sabotaged.
3. That no malfunction of the emergency core cooling system be possible that might create the potential for a catastrophic explosion.

Further matters that the AEC should consider are:

1. That automatic shut-down systems be required to obviate the possibility that an accidental array of nuclear fuels could produce an event capable of breaching containment vessels.

2. That a thorough analysis of radionuclide concentrating mechanisms in the environment.
3. That the question of where radioactive materials are ultimately to be stored be rigorously examined for a satisfactory answer.

Finally, the membership of S.C.E.A.I. would like to alert the AEC that they are most interested in seeing that the alternative sources of power other than the fission process be scrupulously examined. Solar energy and the fission reaction process are only two such possibilities.

Cordially,

E. Stuart Gregg, III

ESG/jw

OCT 11 1973

Mr. E. Stuart Gregg, III
South Carolina Environmental
Action, Inc.
P. O. Box 1008
Hilton Head Island, South Carolina 29928

Dear Mr. Gregg:

This is in response to your letter of September 28, 1973 concerning preparation of draft environmental impact statements on nuclear waste management operations at sites in Washington, Idaho and South Carolina. Your concerns expressed and suggestions made will be given careful consideration in the preparation of the statements.

With regard to your interest in seeing that alternative sources of power be examined, I would like to refer you to President Nixon's June 28, 1973 statement on energy needs. The President noted three steps that were being taken to enlarge the Federal energy research and development efforts. This included an immediate review by the Chairman of the Atomic Energy Commission of Federal and private energy research and development activities to recommend an integrated energy research and development program for the nation. This was to be done under the general direction of the Energy Policy Office which was created by an Executive Order at that time. The program must encourage development and demonstration of new technologies that will permit better use of energy resources.

Thank you for your interest in the waste management activities of the Atomic Energy Commission. We will send you copies of the draft environmental statements when they are issued and would appreciate comments from South Carolina Environmental Action, Inc. at that time.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. E. Stuart Gregg, III
South Carolina Environmental Action, Inc.
P.O. Box 1008
Hilton Head Island, South Carolina 29928

Dear Mr. Gregg:

This letter supplements my letter of October 11, 1973 acknowledging your September 28, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments and suggestions were given careful consideration in the preparation of the statement. The enclosed comment guide indicates those sections of the statement which relate to your comments. We hope that this guide will assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

A handwritten signature in cursive script, reading "James L. Liverman".

James L. Liverman
Assistant General Manager

for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

South Carolina Environmental Action, Inc. (Mr. E. Stuart Gregg), 10-1-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Demonstrate that no radioactive wastes will be emitted into the environment until the half-life cycle has reduced such wastes to safe levels.	II.3.13; III.1.1
Waste management facilities be capable of guaranteeing that no transportation accidents will occur during deliveries that will be made to the facilities or that if one does occur that no irradiated material be released.	III.2.7; III.2.8.1
That the plant will not be sabotaged during its operation and that temporarily stored materials will not be sabotaged.	(Sabotage is not covered, however, the consequences should not differ from the accidents presented in III.2.)
That a thorough analysis of radionuclide concentrating mechanisms in the environment be considered.	II.1.2; II.3; III.1.1; Appendix III-A
That the question of where radioactive materials are ultimately to be stored be rigorously examined for a satisfactory answer.	V.2.5

EXHIBIT NO. 9

1. Letter from Concerned Californians (G. M. Millar) 10-1-73 p. C-55
2. USAEC Response p. C-57
3. Comment Guide p. C-58

C O N C E R N E D C A L I F O R N I A N S

2912 Baywater Avenue - San Pedro - California 90731

1 October 1973

Dr. James L. Liverman

Assistant General Manager for Biomedical & Environmental
Research and Safety Programs

United States Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Liverman:

As a citizen group comprising mainly engineering personnel, we submit the following suggestions in connection with the forthcoming draft environmental impact statement on waste management operations:

- (1) Inasmuch as adverse impact on the environment already has been established by the three plants under consideration, we feel that future management programs should concentrate on basic improvements in every phase of their operation.

Most important, we believe, should be establishment of a climate of continual mobility, acceptance of progressive change - and above all maximum vigilance in monitoring down to the most minute detail.

We feel that continuous research and development should be conducted looking toward improvement of all component materials - from storage tanks and processing equipment all the way down to pipes, valves, connections, etc. And that to achieve such improvements the Atomic Energy Commission should encourage a continuous input of contributions from knowledgeable sources outside of its own ranks - industrial engineering personnel, the nation's universities etc.

We believe that the most vigilant attention should be given to monitoring systems embracing every detail of each plant's operations. Wherever possible (even at high expense) monitoring should be achieved with the aid of computers - but in addition by highly skilled personnel. It should be a ceaseless, round-the-clock operation. And, above all, **IT SHOULD BE DONE BY, AND BE THE FULL RESPONSIBILITY OF, THE ATOMIC ENERGY COMMISSION - NOT OF ANY CONTRACTOR OR SUB-CONTRACTOR.**

We feel it important, too, for the safety of environment and populace, that there be tight control over the size of stockpile at each facility, and no surplus above a pre-determined amount accepted at any time. This apparently will become a crucial problem if the fast breeder reactor becomes operative, and for that reason the issue should enter into the upcoming impact statement.

Further in the interests of protecting environment and populace, we suggest

That all movement of waste radioactive materials into and out from the plants under discussion, be made during the night hours,

(over please)

To Dr. Liverman
From Concerned Californians

-2-

10-1-73

when more atmospheric stillness and less inversion usually prevail, and when normal traffic is at minimum: and

That all equipment of every nature used within or around the plants, and in the transportation of the waste and everything involved in its handling in transit, be painted either bright red or bright orange (as was done with critical materials during the second world war) - and that the customary symbol and the word "radioactive" be clearly inscribed thereon.

We earnestly hope that the upcoming environmental impact statement will achieve the dual purpose of full compliance with the very desirable objectives of the National Environmental Policy Act and at the same time enabling the Atomic Energy Commission to maintain its enviable record in the field of operational safety.

Sincerely

CONCERNED CALIFORNIANS

By ~~_____~~

G. M. Millar
Corresponding Secretary

M n

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. G. M. Millar
Corresponding Secretary
Concerned Californians
2912 Baywater Avenue
San Pedro, California 90731

Dear Mr. Millar:

This letter supplements my letter of October 10, 1973 acknowledging your October 1, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments and suggestions were given careful consideration in the preparation of the environmental statement. The enclosed comment guide identifies those sections of the statement which relate to your comments. We hope that this guide will assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Concerned Californians (Mr. G. M. Millar), 10-1-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Improvements in every phase of their operation.	II.1.1.2.4; V.2.1; Table V-5; V.4.1; V.3.1
Maximum vigilance in monitoring down to the most minute detail.	II.1; II.3; III.2.2.1
Tight control over the size of stockpile at each facility, and no surplus above a predetermined amount accepted at any time.	II.1.1.4; III.1

EXHIBIT NO. 10

1. Letter from Eugene Future Power Committee Inc.	p. C-60
(Messrs. Keppel and Wolfe and Ms. Novick), 10-1-73	
2. USAEC Response	p. C-66
3. Comment Guide	p. C-67

EUGENE FUTURE POWER COMMITTEE INC.

P.O. Box 5274 • Eugene, Oregon 97405
October 1, 1973

Dr. James L. Liverman
Assistant General Manager for Biomedical
and Environmental Research and Safety
Programs
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Liverman:

The Eugene Future Power Committee is writing this letter in response to the notice in the Federal Register (Doc. 73-16999) inviting public suggestions for the environmental impact statements on waste management operations. Our suggestions are attached.

The Eugene Future Power Committee was formed in 1969 when individuals in the Eugene, Oregon area were unable to get answers from responsible public bodies to their growing concerns about a proposed nuclear plant in their area. The nuclear plant was to have been principally sponsored by the Eugene Water and Electric Board, a municipal utility, and had been funded at \$225 million by a vote in 1968 in which 80% of the voters approved the bonding measure. Two years later, in May 1970, as a result of an initiative petition drive spearheaded by the Eugene Future Power Committee, that overwhelming mandate was overturned and a four-year halt in design and construction of Eugene's own plant was approved by the voters. The public's resentment of unresponsiveness to and ridicule of their concerns over the safety, reliability, economic viability, and necessity of nuclear plants played an important part in their determination to force a waiting and studying period before committing their community to construction of a nuclear plant.

Perhaps the area of greatest concern at that time was the legacy of radioactive waste, its storage and disposal. Since that time the failure of the Lyons, Kansas salt mine storage plant (which we were then assured was operable) and the recent disclosure of massive leaks of radioactive waste at Hanford, close to home, have confirmed our fear that radioactive waste storage or disposal remains an unsolved and crucial problem. Every nuclear plant that operates will, as you know, contribute to the backlog of radioactive wastes for which no permanent storage methods seem to have been devised. This represents a threat to the human environment unprecedented in history. If the breeder program is continued, the handling, processing, transportation, and storage of ton quantities of plutonium pose problems with essentially irreversible consequences, not only for us in the United States, but for the entire world. And, although some of the problems could have catastrophic consequences, they seem unanswerable..

More members of the public all over the country, individually and in groups, are becoming aware of such potentially disastrous and unsolved problems, just as the people of Eugene were in 1969-70. Enough information is now available to the public, if they have learned enough to look for it, to demand honest answers to their questions. (See the attached articles on radioactive waste leaks at Hanford and at the Idaho Testing Station for reported AEC responses typical of those we consider inadequate.)

October 1, 1973

no satisfactory solutions have been found to some of the problems raised, the public should be so informed. The public should be advised fully of risks and benefits of nuclear fission power, and their participation in the decision-making process should not only be permitted, but sought. You should accept the possibility that the public might choose a vigorous program of energy conservation and research and development of alternatives to nuclear fission. The Atomic Energy Commission should rise courageously out of the momentum of economic and bureaucratic pressures to face and answer honestly, with independent judgments added to their own, the mounting and urgent questions on nuclear fission that the public is asking--in fact that the AEC itself should be asking out loud. Radioactive waste management is a good place to start.

The Eugene Future Power Committee appreciates the opportunity to contribute to the preparation of the environmental impact statements on this subject. Some of our questions and suggestions will refer more explicitly to the Hanford site, but they will have implications for the other sites also. Some questions and comments will be technical in nature, some will be on management practices. These questions and suggestions are directed toward any and all sites where nuclear wastes are handled now and wherever they may be handled in the future. Our statement follows.

The Eugene Future Power Committee will maintain its interest in radioactive waste management as one of the crucial factors in the viability or desirability of using nuclear fission for the production of electricity. We appreciate the call for public input to the environmental impact statements and request the opportunity to participate, along with other interested members of the public, in the decision-making process. The last item, No. 11, in our statement suggests that the reports include at least two independent interpretations of the data, that the reports be made available to the public and ^{con}gress in a practical and timely way, and that public hearings on them be scheduled at convenient locations.

We request that we be sent the preliminary draft and draft statements of the three radioactive waste management environmental impact statements as soon as they are available. We would also appreciate being notified of future opportunities to participate in the formulation of nuclear fission power policy.

Sincerely yours,

Fred Keppel

Fred Keppel
President

R. G. Wolfe

R. G. Wolfe
Board Member

Jane Novick

Jane Novick
Board Member

EUGENE FUTURE POWER COMMITTEE INC.

P.O. Box 5274 • Eugene, Oregon 97405

October 1, 1973

RESPONSE OF THE EUGENE FUTURE POWER COMMITTEE* TO THE FEDERAL REGISTER NOTICE (Doc. 73-16999) INVITING PUBLIC SUGGESTIONS FOR ENVIRONMENTAL IMPACT STATEMENTS ON RADIOACTIVE WASTE MANAGEMENT OPERATIONS.

(*Identified in accompanying letter.)

Note: Although some of the questions and suggestions will refer more explicitly to the Hanford site, they will have implications for the other sites also. These questions and suggestions are directed toward any and all sites where nuclear wastes are handled now and wherever they may be handled in the future.

1. First, will the environmental impact statements include item by item consideration of the criticisms in the allegedly long-suppressed report by the Division of Earth Sciences of the National Academy of Sciences National Research Council Committee on Geological Aspects of Radioactive Waste Disposal, May 1966? In particular, will the expressed concerns of this Committee on disposal of radioactivity in the vadose zone be considered in detail from two points of reference:

(1) The factual basis for the assumption that radioisotopes from the vadose zone will not penetrate to the water table and, indirectly, to the surface.

(2) The factual basis for the belief that radioisotopes in the vadose zone will not migrate toward the surface under these arid climatic conditions.

2. Will the report include an analysis of the absorptive characteristics, including adsorptive capacity, of the soil (all different strata) above and below the vadose zone as well as analysis of the ionic composition of the ground water in each relevant zone? For instance, what are the factual basis and historical experience relating to the capacity of the soil to selectively retain and concentrate radioactive materials? Will the report ask and answer questions as to whether criticality could occur in open-bottom trenches for the disposal of fissionable material, such as those at Hanford, in case of flooding, acidification, or the inadvertant addition of more fissionable waste? Will the report deal with the matter of surface contamination above the vadose zone by migration induced through ion-exchange and surface evaporation? Will the report consider the possibility of windblown radioactive dust produced following surface migration?

3. Will a detailed climatic description be included which estimates the frequency and extent of flash flooding, a phenomenon not foreign to arid climates? Will the possibility of once-a-century flooding and surface erosion into contaminated strata be considered, and will contingency plans for dealing with these phenomena be presented? We point out that an average of 240 once-a-century floods would be expected during the first half-life of plutonium.

4. Will the reports include a complete seismicity and strain release map of each area? This matter is of crucial concern at the Hanford site.

Do you agree that the environmental impact statements should be written in two parts, with the purpose of separating interpretations by the writers and contractors from the data on which these interpretations are based? Do you agree that independent (blind) interpretation by other qualified experts, unaffiliated with the contractor or the AEC, in the appropriate fields, should be included in the report and that the interpretations should be as critically examined as the field data?

6. Will the matter of volatile waste product treatment be reexamined in the light of recent contributions by Gofman and Tamplin, which indicate that greater caution should be required in exposure? Will biological radioisotope concentration be considered? Will the increased radiation exposure of people near fuel and fission product processing plants be critically examined (see "Radiological Health Reports, 1969, p. 408, for a Hanford report) to consider:

(1) The trend in the amount of exposure with continued operation including possible increases in the processing volume, and the relationship of this trend to possible reductions in the allowable radiation exposures.

(2) Justification for allowing these levels of radiation exposure when much of it is technically retainable.

7. Will the environmental impact statements include contingency plans for dealing with various conceivable major and minor problems that could arise and an account of how these plans will be implemented? Will they also include an account of methods for insuring adequate and responsible monitoring in the future and the manner in which the problems of the last 25 years will be prevented? Will it include plutonium inventory accounting plans?

8. Will management practices be analyzed and included in the environmental impact statements? Operator errors and faulty management responses can have serious impacts on the environment and should therefore be considered as seriously as the technological problems.

As an example, at the United Nuclear Corp. fuels recovery plant in Wood River Junction, R.I. in July 1964, an operator death occurred a criticality accident that seemed almost inevitable because of lack of training, sloppy safety procedures, improper labeling, and lapses in chain of command. Although there was no environmental damage per se in this case, a death occurred. In this case the supervisors' response to the initial criticality accident caused a second nuclear excursion. Almost ten years later similar sloppy procedures, supervisor apathy, and other lapses in management seem to be at least in part responsible for leakage of radioactive waste into the environment at Hanford (see attached articles). The recurrence of incidents of this kind, related to training of personnel, the recording systems, and the responsiveness of the organization, shows that management practices can and do have environmental impacts. We therefore urge that thorough management analysis be included in all the environmental impact statements.

October 1, 1973 -3-

9. Will the statements report in full the status of the waste solidification and permanent storage project, particularly updating the state of the art from the 1969 review (Hardwick and Grover, "Progress in Nuclear Energy Series," XII Vol. 2, Health Physics, Pergamon Press)? Will the statements present a time schedule for the reduction of the present undesirably large volume of stored liquid wastes to a level compatible with an ongoing program for preparation of solid wastes for permanent storage? Will the environmental impact statements separate out and identify the contribution of weapons wastes to the waste management problems in order to clarify the environmental costs and consequences of the use of nuclear fission for the production of electric power?
10. Will the inclusion of cost estimates be made mandatory for each aspect covered in the environmental impact statements?
11. Will the results of the entire reports, including at least two independent interpretations of data, be made available in a practical and timely way to the public and Congress to study? How? When? Will public hearings on the environmental impact statements be scheduled at convenient times and locations?

Fred Keppel

Fred Keppel, President

R. G. Wolfe

R. G. Wolfe, Board Member

Jane Novick

Jane Novick, Board Member

(See also letter of transmittal and attached articles.)

● AEC denies Columbia nuclear contamination report

RICHLAND, Wash. (UPI) — The Atomic Energy Commission insists that nuclear wastes reaching the groundwater to the Columbia River and the river itself "have never exceeded the maximum permissible concentrations for drinking."

The statement Monday was an indirect response to the latest Los Angeles Times story which accused the AEC of "deliberately contaminating the groundwater beneath the Hanford Reservation" near this central Washington desert community.

Two weeks ago, the Times charged the AEC with three

decades of mismanagement which "now threatens extensive areas of the U.S. with nuclear contamination."

THE HANFORD reservation was the chief example given by the Times, which noted more than 500,000 gallons of deadly radioactive liquid leaked from huge storage tanks above the groundwater to the Columbia.

The AEC denied that accusation and an assertion by the paper that "luck", not AEC management, had prevented groundwater contamination.

At that time, Alex Fremling, deputy assistant manager at the 570-square-mile atomic

reservation, said: "None of the Hanford leaks reached the groundwater. We don't believe any of it will reach the ground supply."

Thomas Nemzak, manager at Hanford, said July 13 that it would take "over a thousand years for the liquid wastes to reach the Columbia River And, by the time it got there, it would be so diluted it would be difficult to detect its presence."

BUT A TIMES story Sunday said papers submitted to international symposiums in 1967 and 1970 said some long-lived radio-nuclides were not trapped in the soil and have

showed up in the groundwater.

One report stated that "eight long-lived radio-nuclides" have been detected in the groundwater underlying the disposal sites."

Named were strontium 90, cesium 127, cobalt 60, iodine 125, carbon 14, ruthenium 196, tritium, and technetium 99.

The AEC statement released Monday did not deal with the apparent contradiction between its stance last week and now, but instead dealt with the measurements of contamination.

"Most of the radio-nuclides are absorbed in the soil while

above the groundwater level," it said.

"SOME OF THEM, mainly tritium and ruthenium, have reached the groundwater, but do not present a public hazard."

The AEC said the estimated 1972 dose from all sources of exposure, such as drinking water, food and so forth, to the average Richland resident coming from the Hanford reservation, is less than one milligram of contaminants.

The AEC said this represents 0.6 per cent of the established limit for the general population.

N-Plants Tainting Water

Ground water beneath the Hanford nuclear reservation in Washington and the National Reactor Testing Station near Idaho Falls, Idaho, has been deliberately contaminated by the Atomic Energy Commission, the Los Angeles Times reports.

In Seattle, the U. S. Environmental Protection Agency confirmed that it reported three years ago that both poisonous chemicals and radioactive material was being dumped into the Snake Plain aquifer from the Idaho reactor testing site.

This ground water contamination could eventually reach the Snake River, the EPA spokesman said, probably in the 1,000 springs area.

At the time of the report, the EPA made several recommendations about the problem, but there has been no compliance and no follow-up, and apparently a dispute about jurisdictions has resulted.

Dr. Ed Cowan, in charge of radiation for the Pacific Northwest region of EPA, said "the agency's relationship with AEC is evidently in question." The AEC contends it has sole jurisdiction "on site" at its installations, and the only concern of the EPA is radioactive contamination that reaches off-site water supplies.

Dr. Cowan also said the EPA has been "wanting to look at Hanford," but has not been allowed to do so. The AEC is making a study of its own procedures at Hanford and has informed the other agency that it will be given a report on the results of the study, he said.

AEC Answers Charge Of Water Pollution

RICHLAND, Wash. (UPI) — The Atomic Energy Commission Monday said nuclear wastes reaching the groundwater to the Columbia River and the river itself "have never exceeded the maximum permissible concentrations for drinking."

The statement was an indirect response to a Los Angeles Times story which accused the AEC of "deliberately contaminating the groundwater beneath the Hanford reservation" near this Central Washington desert community.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. Fred Keppel, President
Mr. R. G. Wolfe, Board Member
Ms. Jane Novick, Board Member
Eugene Future Power Committee, Inc.
P. O. Box 5274
Eugene, Oregon 97405

Dear Messrs. Keppel and Wolfe and Ms. Novick:

This letter supplements my letter of October 11, 1973 acknowledging your October 1, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments and suggestions were given careful consideration in the preparation of the environmental statement. The enclosed comment guide identifies those sections of the statement which relate to your comments. We hope that this guide will assist you in reviewing the statement.

With regard to your comments concerning the review of the statement, we are sending the statement to a number of Federal, state and private organizations, such as yours, for review and comment. These organizations, as well as any other interested parties, are welcome to express their views on the statement, including their independent interpretation of the data contained in the statement, in a public hearing tentatively scheduled to be conducted in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register. The results of these hearings as well as all comments received on the draft statement will be made available to both the public and Congress.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations,
Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Eugene Future Power Committee, Inc.
(Messrs. Keppel and Wolfe and Ms. Novick), 10-1-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Disposal of radioactivity in the <u>vadose zone</u> be considered in detail from two points of reference:	II.3.8.2; Appendix II.3-D; Appendix III-C.2
(1) The factual basis for the assumption that radioisotopes from the vadose zone will not penetrate to the water table and, indirectly, to the surface.	
(2) The factual basis for the belief that radioisotopes in the vadose zone will not migrate toward the surface under these arid climatic conditions.	
An analysis of the <u>absorptive characteristics</u> , including <u>adsorptive capacity</u> , of the soil (all different strata) above and below the vadose zone as well as analysis of the ionic composition of the groundwater in each relevant zone.	II.1.1.4.3; II.3.6; II.3.8.2; Appendix II.3-B; Appendix III-C.2; Appendix II.3-D
What are the factual basis and historical experience relating to the capacity of the soil to selectively retain and concentrate radioactive materials?	II.1.1.4.3; II.3.6; II.3.8; Appendix III-C.2; Appendix II.3-D.2.2.2
Whether <u>criticality</u> could occur in open-bottom trenches for the disposal of fissionable material, such as those at Hanford, in the case of flooding, acidification, or the inadvertent addition of more fissionable waste.	III.2.10
<u>Surface contamination</u> above the vadose zone by migration induced through ion-exchange and surface evaporation.	II.1.1.4.3; Appendix II.3-D.2.2.2

COMMENT GUIDE (continued)

Eugene Future Power Committee, Inc.

(Messrs. Keppel and Wolfe and Ms. Novick), 10-1-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The possibility of <u>windblown radioactive dust</u> produced following surface migration.	II.1.1.4.3; Appendix II.3-D.2.2.2; III.2.9
Detailed climatic description be included which estimates the frequency and extent of <u>flash flooding</u> .	II.3.9; III.2.11.3
<u>Once-a-century flooding</u> and <u>surface erosion</u> into contaminated strata be considered, and contingency plans for dealing with these phenomena.	III.2.11.3
A complete <u>seismicity and strain release map</u> of each area.	II.3.7; Appendix II.3-C
Will the matter of <u>volatile waste</u> product treatment be reexamined?	II.1.1.2.4; III.1.1.2.6; V.4
Will <u>biological radioisotope concentration</u> be considered?	II.1.2; II.3.10; II.3.11; II.3.13; III.1.1.2.1; Appendix III-A
To consider:	III.1; V.2; V.3
(1) The trend in the amount of exposure with continued operation including possible increases in the processing volume, and the relationship of this trend to possible reductions in the allowable radiation exposures.	
(2) Justification for allowing these levels of radiation exposure when much of it is technically retainable.	
Contingency plans for dealing with various conceivable major and minor problems that could arise and an account of how these plans will be implemented.	II.1.1.2; II.1.2; III.2.2.1

COMMENT GUIDE (continued)

Eugene Future Power Committee, Inc.
(Messrs. Keppel and Wolfe and Ms. Novick), 10-1-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Methods for insuring adequate and responsible monitoring in the future.	II.1.1.2; II.1.2; III.2.2; V.1
The manner in which the problems of the last 25 years will be prevented.	II.1.1.2; III.2.2; V
Will it include plutonium inventory accounting plans?	(Waste management practices are included throughout the Statement. Special nuclear materials safeguards practices are beyond the scope of this Statement.)
Will management practices be analyzed?	(The analysis of management practices is a continuous ongoing responsibility of the AEC and is, therefore, beyond the scope of this Statement.)
Status of the waste solidification and permanent storage project.	V
Will the statements present a time schedule for the reduction of the present undesirably large volume of stored liquid wastes to a level compatible with an ongoing program for preparation of solid wastes for permanent storage?	Foreword; II.1.1.2.2; V.2; V.3
Will the environmental impact statements separate out and identify the contribution of weapons wastes to the waste management problems in order to clarify the environmental costs and consequences of the use of nuclear fission for the production of electric power?	(Beyond the scope of this Statement.)
Will the inclusion of cost estimates be made mandatory for each aspect covered in the environmental impact statements?	V; IX

EXHIBIT NO. 11

1. Letter from Environmentalists, Inc. (Ms. Ruth Thomas)
10-8-73	p. C-71
2. USAEC Interim Response, 10-26-73	p. C-74
3. USAEC Response	p. C-75
4. Comment Guide	p. C-76

ENVIRONMENTALISTS, INC.

1339 Sinkler Rd.
Columbia, S.C.
29206

October 8, 1973

Dr. James L. Liverman,
Assistant General Manager
Biomedical & Environmental Research
& Safety Programs
U. S. Atomic Energy Commission
Washington, D. C. 20545

Re: Environmental Impact Statements on Radioactive
Waste Management Operations at three AEC Facilities

Dear Mr. Liverman:

We submit the enclosed recommendations in response to the notice published by the U. S. Atomic Energy Commission in the Federal Register on August 14, 1973 (38 F. R. 21955) concerning the preparation of environmental impact statements on the radioactive waste management programs at the Hanford Reservation, the Savannah River Plant and the National Reactor Testing Station.

We have addressed ourselves to the question of what procedure s would be the most effective in bringing out a full disclosure of all the facts and evidence on the subject of radioactive waste management at Atomic Energy Commission facilities. Our reasons for the choice of recommendations include:

1. If a court procedure is used much more factual information is made public.
2. The atomic Energy Commission is not put in the impossible position of being asked to objectively evaluate and judge its own programs.
3. A step toward renewing the public's confidence in federal agencies would be accomplished.

Please send us the names and addresses of organizations, officials of industries, representatives of state and federal agencies and members of the public who have sent in comments and recommendations on this matter.

Sincerely yours,

Ruth Thomas
Ruth Thomas, President

cc/ Dixy Lee Ray
R. W. Fri, Acting Administrator, EPA
T. A. Nemzek, Manager AEC, Richland Operations Office
William D. Ruckelshaus, EPA
Russell E. Train, EPA
Other state & federal officials

RECOMMENDATIONS
for a court proceedings to be held on

Re: Environmental Impact Statements on
Radioactive Waste Management operations
at Atomic Energy Commission Facilities.

- I. That a court proceeding be held which included these and other subjects related to the radioactive waste management operations at the Hanford Reservation, National Reactor Testing Station, and the Savannah River Plant.
 - A. Tank Storage and the problems related to tank leaks
 - B. Past and present waste management practices
 - C. Ground Water studies
 - D. Effects of past and present waste management programs
 - E. Possible future outcomes of storage, disposal and radioactive waste management practices
 - F. Assessments of conditions resulting from waste management programs and assessments of impacts which will continue for generations
 - G. Comparative studies showing how different waste management programs compare in costs, impact, amount of damage, etc.
 - H. Full disclosure of economic facts and figures on all steps and operations in the nuclear industry:
 1. The production of nuclear fuel
 2. The use of nuclear fuel as an energy source
 3. The reprocessing of nuclear fuel
 4. The transportation of nuclear materials and its problems
 5. The management, storage, disposal and surveillance of nuclear wastes
- II. That lawyers for the Atomic Energy Commission and lawyers for individuals and organizations protesting the continued generation of commercial nuclear waste materials each present their case for the conclusions reached by each.
 - A. Opening statements
 - B. Presentation of and examination of witnesses
 - C. Cross examination of witnesses of the opposing side

D. Submit exhibits

E. Right of subpoena of persons and information

III. That a list of 12 perspective jurors' names be submitted by both sides, such persons meeting the following requirements:

A. Sixty years of age or older

B. Having no vested interest in the nuclear industry:

1. Not employed by a nuclear industry or related industry

2. Not employed by a state or federal agency

3. In the case of an economist- not associated with a financial company having interests in utilities, nuclear industries or nuclear related industries

C. Persons trained and experienced in the scientific investigation and evaluation of data and testimony

IV. That the selection of the 12 to serve be arrived at by mutual consent:

A. Each side would have the opportunity to reject 6 from the opposing side's list

B. Each would make decisions after questioning the perspective jurors

V. That the Atomic Energy Commission's educational monies be allocated to a fund for the court proceedings as outlined. Among the fees and expenses to be included would be: (Or from another federal source.)

A. For all lawyers

B. For all witnesses

C. For the jurors

D. For provisions to insure that members of the public receive prompt, accurate and complete news of the proceedings and the evidence and information presented:

1. Balanced news coverage going to newspapers throughout the country

2. The possibility of covering the proceedings on television

3. Prior planning and notices so that members of the public can contact both sides

These Recommendations submitted by- Environmentalists, Inc.
Ruth Thomas, President
1339 Sinkler Road
Columbia, S. C. 29206

OCT 26 1973

Ms. Ruth Thomas, President
Environmentalists, Inc.
1339 Sinkler Road
Columbia, South Carolina 29206

Dear Ms. Thomas:

Thank you for the letter of October 8, 1973, from Environmentalists, Inc. concerning preparation of environmental impact statements covering waste management operations at three AEC sites. Your recommendations are not addressed to the preparation of the statements but to the procedural aspects of attaining full disclosure of the subject matter by an alternate method - a court proceeding.

We feel that a full disclosure can be obtained in the statements being prepared. We are making available for public inspection the documents being used in the preparation of the statements as announced in the Federal Register, August 14, 1973. This same announcement invited suggestions which could be helpful to the AEC in making a full disclosure. I am responding to your request for the names and addresses of those sending in comments by enclosing copies of all the letters received to date. I feel this will be more helpful to your organization. We note that the outline for the suggested court proceeding offers helpful suggestions for topics to be used in preparation of the statements. These will be given consideration in the preparation of the statements. We will send you copies of the draft environmental statements when they are issued. You may judge at that time whether or not the AEC has made an adequate disclosure of the facts.

We appreciate your interest in the operations of the AEC.

Sincerely,

Original signed by
James L. Liverman
James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Ms. Ruth Thomas, President
Environmentalists, Inc.
1339 Sinkler Road
Columbia, South Carolina 29206

Dear Ms. Thomas:

This letter supplements my letter of October 26, 1973 acknowledging your October 8, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

As noted and discussed in my previous letter to you, your recommendations are not addressed to the preparation of the statement but to the procedural aspects of attaining full disclosure of the subject matter by a court proceeding. A number of topics you would like discussed at the court proceeding were identified, however, and we have prepared the enclosed guide for your use in identifying those sections of the statement relating to these topics. We hope this guide will assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Environmentalists, Inc. (Ms. Ruth Thomas), 10-8-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Tank storage and the problems related to tank leaks.	II.1.1.2.2; III.2.2; V.2.1
Past and present waste management practices.	I; II.1.1; Appendix II.1-B, C, E
Groundwater studies.	II.1.1.4.4; II.1.2; II.3.8.2; Appendix II.3-B, Appendix II.3-D; Appendix III-C
Effects of past and present Waste management programs.	II.1.2; II.3; III.1; Appendix II.1-B, C, D, E
Possible future outcomes of storage, disposal and radioactive waste management practices.	II.1.1.2; II.1.1.5; III.1; III.2; V; II.1.1.4
Assessments of conditions resulting from Waste management programs and assessments of impacts which will continue for generations.	II.3; III.1
Comparative studies showing how different Waste management programs compare in costs, impact, amount of damage, etc.	III.1; V; IX
Full disclosure of economic facts and figures on all steps and operations in the nuclear industry:	(Beyond the scope of this Statement; see Foreword.)

EXHIBIT NO. 12

1. Letter from H. W. Ibser, 10-9-73	p. C-78
2. USAEC Response	P. C-79
3. Comment Guide	p. C-80

October 9, 1973

Dr. James L. Liverman
Assistant General Manager
USAEC, Washington, D.C. 20545

I want to suggest the following for inclusion in the Environmental Impact Statements to be prepared by the Atomic Energy Commission regarding its radioactive waste disposal facilities at Hanford, Washington, and at two other sites.

The impact statements should include consideration of effects, including long term effects, of malicious dispersal of radioactive wastes (fission products and plutonium) which will have been accumulated at the subject sites by postulated future dates; or similar dispersal at postulated dates extended beyond the expected periods of accumulation by periods appropriate to the half-lives of the radioactive components of the waste; by criminal or military hostile forces.

Fairly recent historical episodes show that powerful military and political forces can come under the control of men quite capable of deliberate genocide; it is only realistic to assume the possibility that such people may come into control of the radioactive waste repositories and, perhaps under conditions of desperation, misuse them.

Among other effects to be considered should be included the synergetic influence (under conditions of deliberate dispersal) of radiation induced mutations on the evolution of harmful organisms - including but not limited to disease vectors - resistant to control measures.

Obviously, the possible radiation-induced mutational deterioration of desirable biota should be considered in detail.

Please send me for review a copy of the draft environmental statement when it is available.

Thank you.

H. W. Ibser
2670 Kadema Drive
Sacramento, Calif. 95825

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. H. W. Ibser
2670 Kadema Drive
Sacramento, California 95825

Dear Mr. Ibser:

This letter supplements my letter of October 25, 1973 acknowledging your October 9, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments have been given careful consideration in the preparation of the statement. The enclosed guide identifies those sections of the statement related to your comments. The effects of a limited military action would be similar to an act of sabotage. The consequence of such actions is addressed in section III.2.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Mr. H. W. Ibser, 10-9-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Consideration of effects of malicious dispersal of radioactive wastes by criminal or military hostile forces.	III.2
The synergetic influence (under conditions of deliberate dispersal) of radiation induced mutations on the evolution of harmful organisms-including but not limited to disease vectors-resistant to control measures.	III.1.1; III.1.2
Possible radiation-induced mutational deterioration of desirable biota.	III.1.2

EXHIBIT NO. 13

1. Letter from the Committee for the Conservation of Energy p. C-82
 (Mr. Michael Litt), 10-9-73
2. USAEC Response p. C-85
3. Comment Guide p. C-86

3865 N.E. Klickitat St.
Portland,
Oregon, 97212
October 9, 1973

Dr. James L. Liverman
Assistant General Manager for Biomedical
and Environmental Research and Safety
Programs
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Liverman:

On behalf of the Committee for the Conservation of Energy, I am writing this letter in response to the notice in the Federal Register (Doc. 73-16999) inviting public suggestions for the environmental impact statements on waste management operations.

The Committee for the Conservation of Energy was founded in 1971 in Portland, Oregon. Its goals are

- a.) to study the impact of energy production and use on the global environment and on the supply of natural resources.
- b.) to inform the public of the risks and costs associated with various forms of energy production and use.
- c.) to involve the public in decisions affecting the construction of additional power plants, marketing of power, utility ownership and accountability and advertising.
- d.) to develop greater concern among industry and regulatory bodies for the environmental, social, and economic impact of their actions regarding energy production.

Since the founding of the Committee for the Conservation of Energy, one of its greatest concerns has been the management and disposal of high-level radioactive wastes from nuclear power plants. Although the physical volume of these wastes is relatively small, their extremely hazardous and long-lived nature requires that they be sequestered from the environment for many thousands of years. The escape into the environment of even a small fraction of the wastes which are expected to be on hand in the year 2000 could contaminate large areas of the earth for many generations. Therefore, an adequate scheme for waste management must be proof against "acts of God" such as earthquakes, volcanic activity and floods which might occur in the next several thousand years. The system must also be secure against acts of Man such as sabotage or negligence. To quote Alvin Weinberg, "the price that we demand of society for this magical energy source is both a vigilance and a longevity of our social institutions that we are quite unaccustomed to." Whether the

October 9, 1973

risks to future generations from high-level wastes are worth the benefits of the large-scale development of fission power is not a technical question, but an ethical one. However, only when the risks and uncertainties are made explicit and given wide publicity can the public decide whether these risks are worth the benefits.

We are pleased to have an opportunity to furnish input to the preparation of the environmental impact statements on waste management operations. Our suggestions are given below. Some apply specifically to Hanford; others are relevant to all present and future disposal sites.

1) The environmental impact statements should give detailed consideration to each of the criticisms given in the report by the Division of Earth Sciences of the National Academy of Sciences Research Council on Geological Aspects of Radioactive Waste Disposal, May 1966. This committee expressed concern about the factual basis for the assumption that radioisotopes in the vadose zone would not migrate to the water table or, in an arid climate such as Hanford's, to the surface.

2) The statements should include an analysis of the climate of each area where wastes are stored. This should include an estimate of the frequency of flash floods and the possible effects of once-a-century and once-a-millennium flooding on those areas.

3) The statements should be written in such a way that it is possible to separate clearly the data which has been obtained and the interpretation of such data. The data and its interpretation should be critically reviewed by experts in the relevant fields who are demonstrably independent of the AEC and of any government agency or private corporation which has an interest in the development of nuclear power. These critical reviews should be made an integral part of the environmental impact statements.

4) The procedure, said to be in use at Hanford, of disposing plutonium in open bottomed trenches should be critically reviewed. Recent press reports suggest that these trenches contain much more plutonium than had been anticipated and that flooding of the trenches might set off a chain reaction leading to dispersal of plutonium over a wide area.

5) The statements should report on the AEC's program for solidification and permanent storage of high-level wastes. In view of the apparent abandonment of the plan to store such wastes in a salt mine in Lyons, Kansas, are sites other than the Lyons site being considered for this purpose? What steps are planned to insure that whatever sites are

October 9, 1973

chosen will be secure against acts of God and Man for the next several thousand years? What is the AEC's timetable for application of solidification technology to the liquid wastes presently stored at Hanford, Idaho Falls and Savannah River?

6) So that the public may be better able to compare the costs of nuclear power generation with those of other modes of power generation, estimates of the costs involved should be included for each step of the processes which are being used or are proposed to be used in the future to manage and dispose of nuclear wastes.

7) By 1990, it is projected that there will be about 20 million kilowatts of installed fission-powered generating capacity in the Pacific Northwest. These power plants will generate about 40 million curies of long-lived high-level wastes annually. What are the AEC's plans for the management of these wastes from Pacific Northwest reactors? If they are to be reprocessed and stored in the Pacific Northwest, will this be done at Hanford or at Idaho Falls? What would be the environmental impact if 1% of a single years production of such wastes were to leak into the Snake or Columbia rivers?

8) The complete texts of each of the environmental impact statements should be made public and readily accessible to all interested parties.

The Committee for the Conservation of Energy appreciates the AEC's request for public input into the environmental impact statements. We hope to continue to be involved in the decision making process. We therefore request that copies of the preliminary draft and draft statements of the three radioactive waste management environmental impact statements be sent to us as soon as they are available.

Sincerely,

Michael Litt
Member, Committee for the
Conservation of Energy

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. Michael Litt
Member, Committee for the Conservation of Energy
3865 N.E. Klickitat Street
Portland, Oregon 97212

Dear Mr. Litt:

This letter supplements my letter of October 23, 1973 acknowledging your October 9, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments were given careful consideration in the preparation of the statement. The enclosed comment guide identifies those sections of the statement that relate to your comments. We hope this guide will assist you in reviewing the statement.

With regard to your comment concerning power reactor waste, the scope of the statement covers only waste produced at AEC facilities and, therefore, power reactor waste are not addressed. As you know, the AEC has prepared an environmental statement covering power reactor waste, and a copy of this statement has been sent to you.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Committee for the Conservation of Energy (Mr. Michael Litt), 10-9-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Factual basis for the assumption that radioisotopes in the vadose zone would not migrate to the water table or, in an arid climate such as Hanford's, to the surface.	II.1.1.2; Appendix II.3-D.2.2.2
Analysis of the climate to include an estimate of the frequency of flash floods and the possible effects of once-a-century and once-a-millennium flooding.	II.3.9; III.2.11.3
Procedure of disposing plutonium in open bottom trenches should be critically reviewed.	II.1.1.2; III.2.10
Report on the AEC's program for solidification and permanent storage of high-level wastes.	II.1.1.2; V.2.1; V.2.5
Timetable for application of solidification technology to the liquid wastes presently stored.	II.1.1.2; V.2.1; V.2.5
Estimates of the costs involved should be included for each step of the processes to manage and dispose of nuclear wastes.	V; IX
What are the AEC's plans for the management of 40 million curies of long-lived high-level wastes annually from Pacific Northwest reactors and the environmental impact if 1% of a single year's production of such wastes were to leak into the Snake or Columbia Rivers.	(Beyond the scope of this Statement.)

EXHIBIT NO. 14

1. Letter from the Scientists Committee for Public Information, p. C-88
Inc. (Dr. Evelyn Mauss and Dr. Stanley Deutsch), 10-10-73
2. USAEC Response p. C-90
3. Comment Guide p. C-91

SCIENTISTS'
COMMITTEE FOR
PUBLIC INFORMATION, INC.

30 East 68th Street

New York, New York 10021

Telephone: (212) 737-7302

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October 10, 1973

Dr. James L. Liverman
United States Atomic Energy Commission
Washington, D.C. 20545

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Executive Director

Dear Dr. Liverman:

We are members of the Radiation Subcommittee of the NY Scientists' Committee for Public Information. SCPI is a 15 year old organization of scientists, physicians and engineers who provide objective analysis of technical issues in order to enable the public to make informed choices.

We have recently been confronted with expressions of deep concern on the part of diverse organizations and individuals with respect to nuclear power reactor safety in general and radioactive waste management in particular. We therefore submit the following suggestions concerning the environmental impact statements now in preparation by the AEC, as required under FR DOC. 73-16999.

Information on the proposed transfer and handling procedures for high level radioactive wastes should include a broad discussion of the proposed short and long range disposal plans, including the timetable of nuclear waste solidification programs to immobilize the wastes and eliminate the need for storage tanks.

Data should be made available on related questions, viz., the rate and extent of concentration of radionuclides by plants and lower animals in the food chains, the effects of chronic exposure of large populations to low levels of radiation, and the calculated probability, however small, of catastrophic accidents at nuclear facilities.

The standard for radioactive emissions for those AEC operations that are expressed in terms of "as low as possible" should be replaced by a more quantitative evaluation.

Finally, since the AEC is sponsoring continuing research on the effects of chronic exposures at low levels of radiation, both in man and lower organisms, complete and prompt publication of your data would be welcome. This would, in turn, permit complete and prompt discharge of their public information responsibilities by groups such as ours.

Thank you for your attention to these matters.

Sincerely,

Evelyn Mauss D.K.

Evelyn Mauss, ScD.
Associate Professor of Physiology
NYU College of Dentistry

^{P.H.D.}
Stanley Deutsch, M.D.
supervising endocrinologist,
Long Island Jewish Hospital

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Dr. Evelyn Mauss
Dr. Stanley Deutsch
Scientists Committee for Public Information, Inc.
30 East 68th Street
New York, New York 10021

Dear Dr. Mauss and Dr. Deutsch:

This letter supplements my letter of November 6, 1973 acknowledging your October 10, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments relative to this statement have been given careful consideration in the preparation of the statement. The enclosed comment guide identifies those sections of the statement that relate to your comments. We hope this guide will assist you in reviewing the statement.

Your concerns regarding management of radioactive waste from power reactors have been addressed in another statement, WASH-1539, a copy of which has been sent to you.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Scientist's Committee for Public Information
(Dr. Evelyn Mauss and Dr. Stanley Deutsch), 10-10-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
A broad discussion of the proposed short and long range disposal plans including the timetable of nuclear waste solidification programs to immobilize the wastes and eliminate the need for storage tanks.	II.1.1.2; V; IX
The rate and extend of concentration of radionuclides by plants and lower animals in the food chains.	II.3.10; II.3.11; II.3.13; III.1; Appendix II.3-F; Appendix II.3-G; Appendix III-A
The effects of chronic exposure of large populations to low levels of radiation.	III.1.1.2.6
The calculated probability, however small, of catastrophic accidents at nuclear facilities.	III.2

EXHIBIT NO. 15

1. Letter from Eloise W. Kailin, M.D., 10-10-73	p. C-93
2. USAEC Response	p. C-94
3. Comment Guide	p. C-95

ELOISE W. KAILIN, M. D.
RTE. 1 BOX 253
SEQUIM, WASHINGTON 98382
AREA CODE 206
TELEPHONE 683-6644
October 10, 1973

Dr. James L. Liverman
Ass't. Gen'l. Manager for Biomed. and Environmental Research/Safety Programs
U.S. AEC
Washington, D.C. 20545

Dear Sir:

Re: Draft environmental impact statement on radioactive waste management at Hanford, Savannah, and in Idaho

I would assume that provisions have been made in pre-waste management years for background measurements of radioactivity in soil, air, and water as well as in biota at the sites in question. I would like the impact statements to summarize this data and compare it with subsequent measurements, indicating quantitatively any increases which have been discovered. I would like to know the sampling frequency, geographic pattern around the sites, size of samples, and which radionuclides have been examined. If monitoring is only for radiation intensity, have alpha and beta emissions been monitored, or only gamma emissions? What measurements have been made in birds and insects of varieties frequenting these sites? Have these been monitored at a distance in conformity with their migratory patterns?

Inasmuch as Sternglass has data indicating increased infant mortality in the environs of processing plants, I would like to see provisions made for adequate statistics on humans. This should include miscarriages, stillbirths, neo-natal mortality, mortality age 1-12 mo. as well as leukemia and other cancer incidence. Statistics from the area of these plants and from a comparable "non-exposed" area should be gathered in a regular way. I understand that there has been a Regional Medical Program for cancer statistics which included the hospital at Pasco. *(Tri-state area
New
Hanford)* My information is that this program has dropped this hospital. I feel it is imperative that adequate human statistics be kept in the areas surrounding facilities which are capable of emitting radioactivity.

Yours truly,

Eloise W. Kailin, M.D.

CC. Terry Lash, N.R.D.C.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Dr. Eloise W. Kailin
Route 1, Box 253
Sequim, Washington 98382

Dear Dr. Kailin:

This letter supplements my letter of November 13, 1973 acknowledging your October 10, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments concerning health studies were addressed in my previous letter to you. The enclosed comment guide identifies those sections of the statement relating to these comments as they pertain to Richland waste management operations. We hope this guide will assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Dr. Eloise W. Kailin, 10-10-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Summarize background measurements of radioactivity in soil, air, and water as well as in biota at the sites and compare it with subsequent measurements, indicating quantitatively any increases which have been discovered.	II.3.12; II.3.13
Sampling frequency, geographic pattern around the sites, size of samples, and which radionuclides have been examined.	II.1.1.4.4; II.1.2; II.3
Have alpha and beta emissions been monitored, or only gamma emissions?	II.1.2; II.3; III.1; Appendix III-C
What measurements have been made in birds and insects of varieties frequenting these sites? Have these been monitored at a distance in conformity with their migratory patterns?	II.1.2; II.3.10; II.3.11; III.1.2.1

EXHIBIT NO. 16

1. Letter from The Wilderness Society (Stewart M. Brandberg), p. C-97
10-11-73
2. USAEC Response p. C-98
3. Comment Guide p. C-99

October 11, 1973

Dr. James L. Liverman
Assistant General Manager for Biomedical
& Environmental Research and Safety Programs
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Liverman:

This is in response to the notice in the August 14 Federal Register regarding environmental impact statements to be prepared on waste management operations at the Hanford Reservation in Washington, the Savannah River Plant in South Carolina and the National Reactor Testing Station in Idaho.

We would like to suggest the following questions for consideration in preparing the environmental impact statements:

1. At plants where radioactive waste is discharged into waterways, what is the effect on fisheries and streams?
2. What is the concentration of radionuclides in organisms coming in contact with radioactive wastes, and how is it measured?
3. What are the discharge methods of liquid or gaseous wastes at these plants?
4. What are the effects of currently accepted maximum permissible concentrations of radioactivity and of chronic exposure to very low levels of radiation?
5. What long-term studies have been done on the above, by whom and over what period of time?
6. What are the known or possible consequences of catastrophic accidents on radioactive waste storage facilities?
7. What are the thermal effects on marine organisms of coolant water discharged into waterways?
8. What provisions are there for shielding of radioactive wastes discharged into the atmosphere, and what evidence of such protection is there?
9. What are the means for ultimate disposal of existing wastes?

We trust that these questions will be of help in guiding the preparation of fully comprehensive studies to assess possible impacts of this project.

Sincerely,

Stewart M. Brandberg
Executive Director

C-97

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mr. Stewart M. Brandborg, Executive Director
The Wilderness Society
1901 Pennsylvania Avenue, N.W.
Washington, D.C. 20006

Dear Mr. Brandborg:

This letter supplements my letter of October 23, 1973 acknowledging your October 11, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments were given careful consideration in the preparation of the statement. The enclosed comment guide identifies those sections of the statement relating to your comments. We hope this guide will assist you in reviewing the statement.

As noted in section V.2.5 (p. V-21), "The final plan for ultimate disposal for the high-level radioactive waste will emerge only after technology is development." An environmental statement on the ultimate disposal plan will be issued at that time. Since 90% of the projected total waste volume from all operations over the lifetime of the Hanford Reservation is already in existence, continued operation without an ultimate disposal plan does not represent a significant or unacceptable commitment.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

The Wilderness Society (Mr. Stewart M. Brandborg), 10-11-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
At plants where radioactive waste is discharged into waterways, what is the effect on fisheries and streams?	II.1.2; II.3.10; III.1.2.2.1
What is the concentration of radio-nuclides in organisms coming in contact with radioactive wastes, and how is it measured?	II.1.2; II.3.10; II.3.11; II.3.13; III.1.2; Appendix III-A
What are the discharge methods of liquid or gaseous wastes at these plants?	II.1.1; II.3.13
What are the effects of currently accepted maximum permissible concentrations of radioactivity and of chronic exposure to very low levels of radiation?	III.1.1.2.5; III.1.1.2.6; Table III.1-14
What long-term studies have been done on the above, by whom and over what period of time?	III.1
What are the known or possible consequences of catastrophic accidents on radioactive waste storage facilities?	III.2
What are the thermal effects on marine organisms of coolant water discharged into waterways?	III.1.3.2.3
What provisions are there for shielding of radioactive wastes discharged into the atmosphere, and what evidence of such protection is there?	II.1.1; III.1.1.2.2; V.4.2

EXHIBIT NO. 17

1. Letter from Midlands Natural Growers Assn. (Ms. Frances L. Baker), 10-12-73 p. C-101
2. USAEC Response p. C-104
3. Comment Guide p. C-105

October 12, 1973

Dr. James L. Liverman,
Assistant General Manager
Biomedical and Environmental Research
and Safety Programs
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Liverman,

The enclosed recommendations are submitted in response to the August 14, 1973 notice in the Federal Register in relation to the preparation of environmental impact statements on nuclear waste management programs at the U. S. Atomic Energy Commission's facilities, the Hanford Reservation, the National Reactor Testing Station and the Savannah River Plant.

Please notify us of the AEC's plans for holding public hearings. We would appreciate receiving a response to this letter and to our recommendations.

Sincerely yours,

Frances L. Baker

Frances L. Baker
Midlands Natural Growers Assn.
3415 Devereaux Rd.
Columbia, S. C. 29205

cc: The Hon. Dixy Lee Ray,
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

Mr. William D. Ruckelshause, Administrator
Environmental Protection Agency
401 M. Street, S. W.
Washington, D. C. 20460

South Carolina and U. S. officials
of other agencies

RECOMMENDATIONS

Part I: Information to be considered for reaching conclusions on the preparing of environmental impact statements on nuclear waste management programs at the 3 U. S. Atomic Energy Commissions' facilities.

1. The findings of independent studies on past and present waste management practices in relation to the effects.
2. Studies of leaks, spills and such accidents be included.
3. Complete findings from a number of sources on various methods of waste disposal and storage of nuclear wastes.
4. That all questions related to what can be safely done to transfer the high-level wastes now in tanks to some other type of storage or disposal as the tanks wear out and present dangers to the ground water of an area.
5. Findings from teams of independent investigators on the problems of radioactive waste management and surveillance.
6. Studies of the costs involved in nuclear waste management, again from numerous independent sources.
7. Independent assessments of accident probabilities in the nuclear waste management area, particularly related to long-term effects.
8. Studies of Alice Stewart, Dr. Gofman, Studies on Japanese Survivors of the Atom bombing, W. L. Russell's findings on genetic mutations, etc. showing the effects of exposure to radiation.
9. Studies of Dr. C. Henry Kempe and Dr. Robert Ross of persons living in homes built on fill containing uranium tailings.
10. Full investigation of plutonium released to the environment at AEC facilities, such as at Rocky Flats also.
11. Complete investigations as to whether evaluations of releases of facilities are based on the impact of all the nuclear plants and operations in an area. Is enough study being done and considered of build-up?
12. Findings of the 1966 Committee for the National Academy of Science, the studies of independent organizations such as Delta Laboratories, etc. need to be included.

Midlands Natural Growers Assn.'s
RECOMMENDATIONS-Cont.

Part II: Changes to be considered in the methods used for making decisions about environmental impact statements and decisions on radioactive waste management practices, particularly in relation to the decision of whether or not commercial radioactive waste generation need to be halted.

1. A series of public hearings be held throughout the country.
2. That hearings be held in centrally located cities in the states close endin the state where AEC facilities are.
3. Suggested locations in relation to the Savannah River Plant include Augusta, Columbia, Charleston and Greenville in South Carolina, Atlanta and Athens in Georgia.
4. That prior to pre-hearings and hearings notice by mail and newspapers being given in order that all interested persons will have an opportunity to know and prepare for these hearings.
5. That individuals and representatives of organizations be parties to the pre-hearings and hearings, particularly those who have been actively involved in studies of nuclear plants and related matters.
6. That a panel of 7 or more members, from several fields of science and economics conduct the hearings, such persons having no vested interest in nuclear industry or its promotion.
7. That those representing the AEC and the position of favoring nuclear industry and those opposing or questioning the continued use of nuclear fission present their facts and evidence similar to a court proceeding, including cross-examination of witnesses and other rights which insure full disclosure of all pertinent information.
8. That among the organizations involved in being parties to the hearings the following groups be included:

National Intervenors
153 E. Street, S. E.
Washington, D. C. 20003

Natural Resources Defense Council, Inc.
564 Hamilton Avenue
Palo Alto, Cal. 94301

The Task Force-Against Nuclear Pollution
305 High Street
Moorestown, N. J. 02139

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Ms. Frances L. Baker
Midlands Natural Growers Association
3415 Devereaux Road
Columbia, South Carolina 29205

Dear Ms. Baker:

This letter supplements my letter of October 25, 1973 acknowledging your October 12, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your recommendations contained in Part I of your letter which pertained to the waste operations at Richland were given careful consideration in the preparation of the statement. The enclosed comment guide identifies those sections of the environmental statement which relate to these comments.

My previous letter to you addressed your concerns regarding hearing procedures. You may be interested to know that the AEC has announced tentative plans to hold public hearings on the Richland statement in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Midlands Natural Growers Association (Ms. Frances L. Baker), 10-12-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The findings of independent studies on past and present waste management practices in relation to the effects.	(Studies of independent organizations were used and referenced throughout this Statement.)
Studies of leaks, spills and such accidents be included.	II.1.1.4.5; II.1.2; III.2.2; Appendix II.1-B, C, E; III.2.5
Complete findings from a number of sources on various methods of waste disposal and storage of nuclear wastes.	V
That all questions related to what can be safely done to transfer the high-level wastes now in tanks to some other type of storage or disposal as the tanks wear out and present dangers to the groundwater of an area.	II.1.1.2.2; V
Findings from teams of independent investigators on the problems of radioactive waste management and surveillance.	(Studies of independent organizations were used and referenced throughout this Statement.)
Studies of the costs involved in nuclear waste management again from numerous independent sources.	V; IX
Independent assessments of accident probabilities in the nuclear waste management area, particularly related to long-term effects.	III.2

COMMENT GUIDE (continued)

Midlands Natural Growers Association (Ms. Frances L. Baker), 10-12-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Studies of Alice Stewart, Dr. Gofman, Studies on Japanese Survivors of the Atom Bombing, W. L. Russell's findings on genetic mutations, etc., showing the effects of exposure to radiation.	III.1.1.2.6; IV
Studies of Dr. C. Henry Kempe and Dr. Robert Ross of persons living in homes built on fill containing uranium tailings.	(Beyond the scope of this Statement.)
Full investigation of plutonium released to the environment at AEC facilities, such as at Rocky Flats also.	II.1.1.2; II.3.13; III.1
Complete investigations as to whether evaluations of releases on facilities are based on the impact of all the nuclear plants and operations in an area. Is enough study being done and considered of build-up?	II.1.1.2; II.1.2; III.1
Findings of the 1966 Committee for the National Academy of Science, the studies of independent organizations such as Delta Laboratories, etc., need to be included.	(Studies of independent organizations were used and referenced throughout this Statement.)

EXHIBIT NO. 18

1. Letter from Natural Resources Defense Council, Inc.
(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73	p. C-108
2. Letter from Natural Resources Defense Council, Inc.
(Dr. Terry R. Lash and Mr. John E. Bryson), 10-31-73	p. C-128
3. Letter from Natural Resources Defense Council, Inc.
(Mr. John E. Bryson and Dr. Terry R. Lash), 1-25-74	p. C-129
4. Letter from Natural Resources Defense Council, Inc.
(Mr. John E. Bryson and Dr. Terry R. Lash), 2-15-74	p. C-135a
5. USAEC Response	p. C-136
6. Comment Guide for 10-12-73 NRDC Comments	p. C-137
7. Comment Guide for 10-31-73 NRDC Comments	p. C-144
8. Comment Guide for 1-25-74 NRDC Comments	p. C-145
9. Comment Guide for 2-15-74 NRDC Comments	p. C-148a

Natural Resources Defense Council, Inc.

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October 12, 1973

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Dr. James L. Liverman
Assistant General Manager for
Biomedical and Environmental
Research and Safety Programs
U. S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Liverman:

The enclosed suggestions for your consideration are in response to the public notice (38 Federal Register 21955) inviting participation in the preparation of environmental impact statements on the overall radioactive waste management programs at three Atomic Energy Commission facilities. We welcome this opportunity to take part in an important decisionmaking process. Feel free to contact us for elaboration or clarification of our comments.

Please send us copies of the draft statements as soon as they are available.

Sincerely,

Terry R. Lash, Ph.D
Staff Scientist

John E. Bryson

TRL/JEB/krc

Enclosure

cc: Russell E. Train
John A. Busterud

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COMMENTS
REGARDING THE PREPARATION OF
ENVIRONMENTAL IMPACT STATEMENTS
ON THE OVERALL
RADIOACTIVE WASTE MANAGEMENT PROGRAMS
AT
HANFORD,
THE NATIONAL REACTOR TESTING STATION
AND
THE SAVANNAH RIVER PLANT

Submitted To:

The U. S. Atomic Energy Commission

Terry R. Lash, Ph.D
John E. Bryson

October 12, 1973

On August 1, 1973, the Natural Resources Defense Council (NRDC) and other environmental organizations filed suit in federal district court in Spokane, Washington, charging that the Atomic Energy Commission (AEC) had unlawfully failed to prepare and circulate for comment a detailed environmental impact statement (EIS) on the overall radioactive waste management program on the Hanford Reservation near Richland, Washington. On August 17, 1973, Judge Marshall A. Neill signed an order, which is based upon an agreement between the AEC and the plaintiffs, requiring the AEC to "prepare with diligence and with all reasonable speed a detailed environmental impact statement on the storage and disposal of radioactive wastes generated and accumulated at the AEC Hanford Reservation near Richland, Washington (Hanford), pursuant to the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321-4335"

These comments are in response to the AEC invitation (39 Federal Register 21955) "to submit suggestions for consideration in connection with the preparation of the draft environmental impact statements" on the radioactive waste management operations at Hanford, the Savannah River Plant (SRP) in South Carolina and the National Reactor Testing Station (NRTS) in Idaho. In these comments, we identify some of the matters which we believe should be discussed in the draft statements. Our suggestions are not intended to be a

comprehensive or inclusive compilation of topics to be covered in the three EIS's. The legal papers filed in NRDC, et al. v. Ray, et al. (Eastern District of Washington Civil Action No. 3924) likewise indicate a number of the important issues which should be covered in these EIS's.

I. INTRODUCTION

The problems associated with the interim and long-term storage or disposal of toxic long-lived radioactive wastes are unprecedented in human history. The public, unfortunately, has not been adequately informed about the hazards of radioactive wastes which will be generated through the operation of thousands of nuclear power plants for electrical energy. Although the proposed EIS's commented on here will not assess the environmental and health effects of radioactive wastes produced in commercial nuclear reactors, the programs at Hanford, NRTS, and SRP are the only models by which to judge the AEC's ability to handle safely over hundreds of years the vast quantities of radioactive wastes that will be generated in licensed nuclear power plants. Unless the public can be fully assured that the relatively smaller amounts of wastes generated by nuclear weapons production can be safely managed in perpetuity, there will be no basis for public confidence in the AEC's proposed programs for the containment of radioactive wastes produced in the private sector.

II. SCOPE AND PURPOSE OF DRAFT
ENVIRONMENTAL IMPACT STATEMENTS

The National Environmental Policy Act (NEPA) which became effective on January 1, 1970, was enacted by Congress to insure that federal agencies give full and detailed consideration to the environmental consequences of, and alternatives to, all "major Federal actions significantly affecting the quality of the human environment." The EIS is the principal mechanism for insuring such full and detailed consideration of environmental values. NEPA sets forth in detail the environmental factors which the EIS must discuss. Section 102(2)(C) states that EIS's must discuss in detail the following:

- (i) the environmental impact of the proposed action,
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
- (iii) alternatives to the proposed action, short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

NEPA seeks to promote environmental protection by requiring federal agencies to consider environmental effects in their decisionmaking, to provide disclosure to the public and other government decisionmakers of the impacts and alternatives to major federal actions, and to promote the

long-range planning objectives of NEPA. The Senate Report on NEPA states that the Act was designed to correct a situation in which

"[i]mportant decisions concerning the use and shape of man's future environment continue to be made in small but steady increments which perpetuate rather than avoid the recognized mistakes of previous decades." S. Rep. No. 91-296, 91st Cong., 1st Sess. 5-6 (1969).

The President's Council on Environmental Quality (CEQ) in its Guidelines (38 Federal Register 20550) on the preparation of EIS's has stated that

"[t]he draft statement must fulfill and satisfy to the fullest extent possible at the time the draft is prepared the requirements established for final statements by section 102(2)(C)." § 1500.7(a).

The comprehensive, detailed draft EIS's should, in this case, form a solid basis for the holding of hearings on plans for the management of radioactive wastes at Hanford, NRTS and SRP. The CEQ Guidelines state that

"any draft environmental statements to be issued should be available to the public at least fifteen (15) days prior to the time of such hearings," 1500.7(d).

The draft EIS's on the overall radioactive waste management operations at Hanford, NRTS and SRP must contain sufficient data and discussion for a timely reassessment of the policies and practices followed over the past three decades and also to provide the public with the information it needs to make its own evaluation of past operations as well as proposals for the future. All alternatives to current

and future procedures should be analyzed to the greatest possible extent, including the use of cost/benefit analyses, in order to allow the AEC, the Congress and the public to know fully the social burdens, environmental hazards and economic costs of the available levels of protection from the release of radioactive materials into the biosphere. Among the alternatives which need be seriously considered is the possibility that radioactive wastes, no matter how managed, pose an unacceptable risk to society of widespread contamination and disaster and, therefore, should not be generated at all.

At the end of the NEPA review, the AEC must make decisions that have profound implications for the health and safety of many generations in the future. In light of the seriousness of the issue, the AEC must take the necessary steps to insure that all relevant information and points of view, including responsible opposing views, are fully, fairly and openly presented.

III. CONTENTS OF DRAFT ENVIRONMENTAL IMPACT STATEMENTS

The following matters should be included and fully discussed in the draft environmental impact statements for the overall radioactive waste management programs at Hanford, SRP and NRTS. The initial, general suggestions are equally applicable to all three sites. Topics peculiar to individual facilities follow the general discussion. While these

suggestions are based upon NEPA's requirements, they are not intended to be comprehensive or inclusive.

A. General Topics

Many individuals who will want to read and comment upon the draft EIS's, while generally aware of the hazards of radioactivity, are not familiar with the terminology and jargon of the technicians and scientists involved in the management of radioactive wastes at Hanford, SRP and NRTS. Therefore, a substantial effort should be made to define all specialized terms and describe important radioactive waste management facilities such that the concerned non-expert can readily appreciate the pluses and minuses of the alternatives available to the AEC in its decision-making. Such words as mrem, curie, radionuclide, alpha-, beta- and gamma-rays, half-life, ionizing radiation and ion-exchange should be carefully defined, for instance. Full, complete "operational" definitions of terms such as high-, intermediate- and low-level radioactive wastes should also be listed.

The deleterious effects of ionizing radiation should be fully presented. In particular, the AEC should emphasize that there is no "safe" level of radiation, i.e., that all ionizing radiation increases, proportionately, the rate of genetic mutation and incidence of cancer. In this connection, the conclusions of the National Academy of Sciences -- National Research Council report Biological Effects of

Ionizing Radiation (November, 1972) should be presented.

The fact that susceptibility to harmful effects of radiation varies widely within human populations -- with the young, old and sick being most seriously affected -- should be thoroughly discussed.

The absence of safe-levels of radioactivity and the diversity of human responses to radiation should be described in relation to the AEC's standards for maximum permissible concentrations of radionuclides, including a detailed description of the process used to establish these standards. General statements about the conformity of the AEC standards with the standards of other groups are insufficient. Rather, a detailed assessment of their adequacy to protect fully the public health and welfare should be given. A cost/risk analysis of these standards also should be included.

The processes of bioconcentration and bioaccumulation should be comprehensively analyzed, especially in relation to the organisms and radionuclides in the biosphere near Hanford, SRP and NRTS. Special attention should be paid to animals that are at the top of food chains and/or that may be consumed by human beings. For instance, the implication of the "[e]xceptionally high concentrations of radioactivity (primarily P-32)" found in a duck near a radioactive waste disposal trench at Hanford should be discussed. (BNWL-1505, November 1970, p. 11). The radionuclides, e.g., strontium and plutonium, that may concentrate in human organs should receive special attention.

The AEC's detailed plans and all reasonable alternatives to those plans for the safe containment of radioactive wastes in perpetuity must be comprehensively presented. Each possibility should include a cost/risk analysis so that the public can ascertain the costs of each level of protection for future generations. In this section, vague terms such as "interim" should not be used without reference to a specific period of time described in years. Many concerned citizens will be especially interested in the alternative means of handling radioactive wastes, including the alternative of not generating any additional radioactive wastes. All alternatives, therefore, should be presented with sufficient detail, completeness and clarity so that the intelligent, non-expert reader will be able to assess the social, environmental and financial costs of these alternatives.

Additionally, the following items should be carefully considered and thoroughly discussed in each of the three EIS's:

- (i) A complete inventory, by radionuclide, of the total radioactive wastes at the sites under construction (This inventory should also include a description of all wastes ever released to the environment through stacks, pipes, wells, cribs, trenches, seepage pits or any other waste disposal facility that has allowed radioactivity to enter the soil, air or ground

and surface waters. The physical state and chemical composition of all currently stored radioactive wastes should be indicated.);

(ii) The physical environment of each site, including the locations of geological faults, perched water zones, groundwaters, surface streams and rivers, and soil types and their locations beneath the sites;

(iii) The historical weather patterns, including a complete analysis of the worst possible winds, rains, and flooding foreseeable during the long-term (centuries) storage of radioactive wastes at the sites;

(iv) The possibilities of severe earthquakes and their impacts (The discussions should include indirect effects, e.g., the bursting of an upstream dam, as well as direct impacts on buildings, underground tanks, etc.);

(v) A catalogue of important plant and animal species near each site, including special note of rare or endangered species;

(vi) The locations and extent of nearby human habitation and recreation, including relevant factors such as nearness to the site, direction from the site in relation to prevailing winds and whether or not they are downstream from the site and human uses of ground and surface waters, for e.g., drinking water, irrigation, swimming, boating, fishing;

(vii) The extent of environmental monitoring for radioactivity in organisms, soil, ground and surface waters, and air, including any measurements of radionuclides in nearby human populations (Contingency procedures for use in case high levels of radioactivity are detected in the environment should be specified.);

(viii) The annual production of radioactive wastes, by radionuclide, including the physical and chemical composition of the wastes and the means of storage or disposal;

(ix) All radioactive waste storage and disposal facilities, including those no longer in use but which still contain radioactive wastes, e.g., the plutonium-bearing Z-trenches at Hanford;

(x) The potential of sabotage by terrorist or other groups or individuals;

(xi) Procedures for the "decommissioning" of buildings and other facilities;

(xii) A detailed history of all accidental releases of radioactivity to the environment.

B. Specific Items to be Included in the Draft Environmental Impact Statement for Hanford

Two of the major problems at Hanford are the frequently leaking underground storage tanks containing high-level radioactive wastes and the open-bottom radioactive waste disposal facilities, e.g., cribs and trenches,

that allow radioactive liquids to enter the soil, groundwaters and, eventually, the Columbia River. A thorough analysis of the subsequent history of the various radionuclides accidentally or purposely released to the ground must be presented in order to allow the public to assess the possibility of either an imminent hazard or a long-term threat to future generations. Sufficient data and information should be given to allow for independent analysis of all AEC assertions of safety.

Such information includes, for instance, the specific exchange and sorptive capacities, by radionuclide, for each soil type beneath Hanford. In this analysis, all possible ways in which the radioactivity now residing in the soil could migrate to the water table should be fully presented. The areas of consideration should include changes in soil and groundwater conditions due to substantially increased irrigation, industrialization, the accidental release of chemicals into the soil, or a change in the chemical composition or volume of liquid effluents at Hanford. The precautions taken to prevent radioactivity in the soil from entering the groundwater via the dry wells used to monitor soil and water contamination should also be discussed. The possibility of "leaked" radioactivity entering perched water zones and the potential of waste liquids being "channeled" to the water table due to soil inhomogeneities should be considered. Included in this section should be a

consideration of the total amounts of radionuclides that have already entered the water table. The amounts and distribution of radionuclides in any groundwater sediments, and the migration of radionuclides, e.g., tritium and ruthenium, to the Columbia River should be stated, if known.

On the other hand, mechanisms for causing radionuclides to move upward to the soil surface should also be discussed. In a semi-arid area such as Hanford, moisture carrying radioactivity may return to the soil surface after precipitation. Or plants may withdraw radionuclides from the soil via their roots and transport the radioactivity to their above-surface foliage. This section should detail any indications that plutonium-239 has escaped to the surface. For instance, there should be an explanation of the source and mechanism of release of the plutonium in the following statement:

"Studies to determine this [Pu/Cs activity] ratio in and about the Hanford site indicate that small localized releases of Pu have taken place." 1/

There should be a separate section on the Z-trenches which have been used to receive wastes containing hundreds of kilograms of explosive and toxic plutonium-239. Trench Z-9 is of special concern because of the AEC's assertion that

1/ C. M. Unruh, "Hanford Radionuclides in the Environment" in Management of High Level Radioactive Wastes at the Hanford Site, edited by R. C. Forsman and W. C. Schmidt (September 1972).

"[d]ue to the quantity of plutonium contained in the soil of Z-9 it is possible to conceive of conditions which would result in a nuclear chain reaction." (WASH-1520).

The circumstances leading to this situation should be fully documented, including a description of changes, if any, in operational procedures that have been made to prevent the occurrence of a similar situation in another trench. Steps taken to reduce the likelihood of a chain reaction in Z-9 occurring now or in the future, including during the proposed "mining" operation, should be presented in detail. All measurements of the neutron multiplication constant (K-effective) should be given for Z-9 and all other Z-trenches containing substantial amounts of plutonium.

The recent leak of 115,000 gallons of high-level radioactive wastes from one of the old, single-walled carbon steel tanks at Hanford has underlined the necessity for a thorough re-evaluation of the means and procedures for storing high-level liquid wastes. The wisdom of the continued use of these tanks that have a history of 16 leaks over the past 17 years must be seriously questioned. At NRTS, double-walled stainless steel tanks for high-level wastes, for instance, have prevented the leakage of a radioactivity to the environment. The EIS for Hanford should consider in detail the alternative of building double-walled stainless steel tanks to receive newly generated intermediate- and high-level wastes. Additionally,

the administration of the Hanford radioactive waste management program by operating contractors should be comprehensively reviewed. A description of all new procedures instituted as a result of the AEC's investigation into the recent two-month-long leak should be described in detail.

The decision to dehydrate all high-level radioactive liquids to "salt-cake" needs to be re-evaluated and the current program compared to alternative means of solidifying the liquid wastes. Such alternatives should include the conversion of existing and future liquid wastes into calcine, "glass" or aluminosilicate, all of which are much less soluble in water and afford, correspondingly, substantially more safety in the long-term. The fruits of years of research and development at Hanford and elsewhere on these alternative solid forms should be summarized and the applicability of the results to the Hanford situation thoroughly discussed. This section should also consider in detail the AEC's plans for retrieving the salt cake after it is formed in the underground tanks. In particular, studies that indicate the life span of tanks holding salt cake should be reviewed.

One of the alternatives that should be explicitly considered in detail is the permanent closing of the Purex irradiated fuel reprocessing plant in order to eliminate the further generation of and need to store high-level radioactive wastes at Hanford.

C. Specific Items to be Included in the Draft
Environmental Impact Statement for NRTS

The procedure of pouring radioactive liquids directly into the regional groundwater supply beneath NRTS should receive detailed consideration. The total amounts of radionuclides so disposed and the extent of groundwater contamination should be included. All monitoring and test procedures should be fully discussed.

The total amounts of radioactivity and solids that are buried in the soil should be given, including a detailed schedule for their removal. The specific amounts of plutonium and other transuranic radionuclides that have breached their containers and are now sorbed to the soil should also be set out, and the susceptibility of the buried wastes to leaching from ground and flood waters should be described.

The transportation, storage, and disposal of radioactive wastes at NRTS that were generated at other AEC facilities, e.g., the Rocky Flats Plant, and the amount of wastes resulting from the reprocessing of irradiated fuel elements from nuclear power plants in foreign countries should be thoroughly discussed, including projections of the amounts of these wastes well into the next century.

D. Specific Items to be Included in the Draft
Environmental Impact Statement for SRP

The use of carbon-steel underground tanks and the dehydration of alkaline high-level radioactive wastes to

"salt cake" should be reviewed thoroughly and compared to the significantly safer procedure of using stainless steel tanks to store acidic wastes and solidification to less soluble solids, e.g., aluminosilicate. In preparing a cost/risk analysis of these two alternatives, the costs must be considered over a period of hundreds of years. Short-term (i.e., decades) economies should not be achieved by accepting long-term (i.e., centuries) risks. The series of steps for concentrating, solidifying and storing in stainless bins intermediate-level radioactive wastes at SRP should be fully described. The suitability of this procedure for use at SRP should be specifically discussed. The feasibility and costs of retrieving the salt cake from the tanks also should be thoroughly evaluated and costs estimated.

Other important matters which should be discussed or presented include: (1) the use of seepage basins to "decontaminate" low-level wastes, (2) the total amounts of radioactivity, by radionuclide, discharged to the ground, (3) detailed projections of the radioactive wastes to be disposed in the soil, and (4) the specific and total ion-exchange and sorptive capacities of the SRP soils.

Due to the proximity of the water table to the underground storage tanks for high-level wastes, there should be a comprehensive presentation of the potential adverse impacts on the environment and public health in the event of a major leak. There should be a complete

description of the hydrological conditions around SRP, including seasonal variations in the water table. The discussion should include a detailed description of all emergency procedures to be followed after a leak is detected. The individuals responsible for reporting the leak, taking corrective action and notifying public health and state officials should be identified.

Finally, the suitability of the SRP site for the permanent storage of radioactive wastes should be discussed in detail and at length. If the site is not an appropriate storage facility to contain radioactive wastes for thousands of years, the full costs of removing the radioactive wastes to a proper storage or disposal facility should be presented.

IV. CONCLUSION

The preparation of EIS's on the overall radioactive waste management programs at Hanford, NRTS and SRP is an integral step in the AEC's decisionmaking process. To facilitate public involvement in this decisionmaking, the EIS's should be made intelligible to the concerned non-expert. Furthermore, the EIS's must present reasonably detailed, balanced information, including responsible dissenting viewpoints, on risks posed by radioactive wastes. Publication of the EIS's should allow members of the public, the Executive and the Congress, as well as the AEC, to evaluate fully the existing programs and to judge

all reasonable alternatives, including the possibility of not producing additional wastes.

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October 31, 1973

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Dr. James L. Liverman
Assistant General Manager for Biomedical
and Environmental Research and Safety
Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Liverman:

We wish to supplement our suggestions of October 12 for the AEC's consideration during the preparation of the draft environmental impact statement (EIS) on the radioactive waste management program at Hanford. Two matters that should be covered in an adequate draft EIS have been brought to our attention by recent newspaper articles.

First, in an October 2 article in The Seattle Times, by Hill Williams, an unnamed AEC spokesman is quoted as stating that radioactive wastes have been removed from cribs by "a tumbleweed and some gophers." This raises an important question regarding the containment of radioactive wastes in the soil during their full toxic lives. The draft EIS should discuss whether and how the AEC can prevent the removal of radioactive wastes from the ground by plants and burrowing animals over the next 600 years in the case of strontium-90 and cesium-137 and during the next 250,000 years in the case of plutonium-239.

Secondly, an October 21 article in the Seattle-Post Intelligencer, by Tom Read, suggests that reports highly relevant to a full assessment of the environmental impact of radioactive waste disposal at Hanford are being withheld from the public because of "secret" classification. We strongly urge that all reports dealing with the radioactivity of effluent streams and the extent of radioactive contamination of the Columbia River and environs be placed in the AEC's public documents rooms. All secret reports which, after review cannot be reclassified should be listed by title, author, and date. A justification for retaining the secret classification should be provided. See Committee for Nuclear Responsibility v. Seaborg, 463 F.2d 783 (D.C. Cir.), 404 U.S. 917 (1971).

Sincerely,

Terry R. Lash
Terry R. Lash

John E. Bryson
John E. Bryson

C-128

TRL/JEB/gg

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January 25, 1974

Mr. Richard L. Hames
Chief Counsel
U.S. Atomic Energy Commission
Richland Operations Office
P. O. Box 550
Richland, Washington 99352

Re: Draft Outline, Hanford Environ-
mental Impact Statement, Effluent
and Waste Management Program

Dear Mr. Hames:

We appreciate the opportunity to comment on the Draft Outline of the environmental impact statement (EIS) on the Hanford effluent and radioactive waste management program. These comments supplement our previous observations on the proposed EIS which were transmitted to Dr. James L. Liverman of the AEC on October 12 and 31, 1973.

Rather than attempting to cover all significant issues, the following comments are limited to topics which are not clearly identified in the Draft Outline or which require emphasis because of their special importance.

1. An important topic omitted from the Draft Outline is analysis of the meaning, in terms of human health, of the AEC's radiation exposure and secondary (concentration) standards. See NRDC's Comments, dated October 12, 1973, at 6-7. The statement should make clear to the general reader the significance of:

- (a) The fact that the AEC's radiation standards and maximum permissible concentrations are upper limits that should not be used as "acceptable" or "safe" levels;
- (b) The cost-benefit approach of the standards;
- (c) The complete lack of a "safe" level of radiation exposure; and
- (d) The variation among persons in susceptibility to injury from radiation.

In this respect, the adequacy of the plutonium-239 air standard deserves special scrutiny in light of (a) the huge amount of this extremely toxic radionuclide that now resides in the soil on the Hanford Reservation, and (b) the substantial criticism of the current AEC standards by responsible experts. The draft EIS should present fairly, for instance, the criticisms of the existing plutonium standards by Long, Geesaman, and Morgan. 1/

Discussion of these exposure and concentration standards is essential if the general reader is to understand the implications of alternative waste management strategies which might be employed at Hanford. Simple assertions that exposures are within AEC standards, without further explanation, would be misleading and unsatisfactory.

2. The Hanford Reservation has a long history of accidents and leaks that have allowed substantial quantities of radioactive materials to escape from pipes and tanks. The rate and magnitude of such accidents have accelerated within the past year, necessitating the complete shut-down of Hanford's waste management activities for several months during the summer and fall. These accidental releases of toxic radionuclides are a matter of grave public concern, not only because of potential threats to the immediate Hanford environment, but also because they are evidence of the more general difficulty of foolproof radioactive waste storage.

The Draft Outline omits this important subject. An adequate draft environmental statement, however, should contain a complete enumeration of all significant accidental releases of radionuclides, the amounts and types of radionuclides that were released, the likely fates of the radionuclides over their toxic lives, and the probable causes of and reasons for these releases. 2/ The best available

1/ For instance, Geesaman has stated: "Present plutonium standards are certainly irrelevant and probably not conservative" (Donald P. Geesaman, "Plutonium and the Energy Decision," Bulletin of the Atomic Scientists, September 1971, p. 35). Long has also stated his belief that current standards are inadequate: "Until sufficient experimental data become available to allow an accurate assessment of the risks involved in plutonium inhalation, there is an urgent need to dispel the sense of security and certainty that the present limits for the maximum permissible lung burden and the maximum permissible air concentration bring." (A.B. Long, "Plutonium Inhalation: The Burden of Negligible Consequence," Nuclear News, June 1971, p. 73.)

2/ A full analysis of the recent spewing of 7,000 gallons of high-level waste out of a 12-inch pipe 11 feet above the ground surface is of special concern because this release occurred shortly after waste management operations were resumed following a supposedly thorough inspection of Hanford's waste management facilities and because plutonium and other radionuclides which were released to the surface may have spread far from the release point.

estimates of potential future releases should also be made, based upon the knowledge obtained in handling wastes at Hanford for the past 30 years. 3/

Following the largest leak of high-level liquid waste at Hanford, the AEC has described a series of almost unbelievable errors and neglect of duty that permitted the highest level of Hanford wastes to seep into the soil for about 50 days. The draft statement should succinctly describe this series of events and then go on to explain fully the steps that have been taken by the AEC and its contractors to ensure that such an error is not likely to occur again.

3. The cost-benefit analysis in the draft statement should include an estimate of the total costs of all reasonable, long-term alternatives for managing Hanford's radioactive wastes throughout their toxic lives. In so doing, the statement should distinguish, with an explanation of its conclusion, the "reasonable" alternatives from all the "possible", but economically or technically impractical, alternatives that have been put forward by the AEC and others.

While making economic forecasts far into the future may be difficult, it is, nevertheless, essential because Hanford's waste must be isolated from the environment for hundreds, or, in the case of some radionuclides, thousands of years.

4. The draft statement should also provide detailed projections and analyses regarding waste generation, storage, and disposal at Hanford from the present until at least the end of the century. The most likely scenario should be compared with the costs and benefits of other reasonable alternatives. The best timing estimates should be presented, indicating in each case the likely effects of subsequent amendments to those schedules. Since waste generation and storage at Hanford has been characterized by a series of delays and previously unexpected extensions, the possibility of further delays and extensions in future operations should be considered in the draft. Among the issues that should be addressed specifically

3/ The current Manager of the Richland Operations Office, Alex G. Fremling, has publicly stated ("More Hanford Leaks Termed Inevitable", Oregonian, November 13, 1973) that leaks can be expected in the future. In order to evaluate meaningfully the importance of installing expensive protection facilities, the draft statement should provide a specific numerical estimate of the number and extent of these future leaks. The former Manager at Richland, Thomas Nemzek, also has predicted more leaks. (See, "Radiation Spill at Hanford: The Anatomy of an Accident", Science 181, p. 730 (August 24, 1973).)

are the following: (a) the consequences of conceivable extensions in the operating life of the N reactor; (b) the potential of the Hanford Reservation as the site for a national radioactive waste repository; and (c) the possibility that the Purex plant or another irradiated fuel reprocessing plant at Hanford will be used to process fuel elements from commercial nuclear power plants that are located at Hanford or elsewhere in the Northwest.

In light of the grave hazards of the much criticized practice of soil disposal, special attention, including cost-benefit analyses and a detailed phase-out schedule, should be presented for achieving at Hanford the AEC's goal of "... eliminating the routine use of surface and near-surface techniques that depend on soil to remove radioactivity from liquid wastes." 4/

5. The assessment of the environmental impacts of Hanford's radioactive waste management and effluent program should include consideration of environmental effects far removed from the Hanford site, including an evaluation of the accumulation of radionuclides in organisms and sediments in the lower Columbia River and in the ocean around the river mouth. The fate of the actinides in the aquatic and marine environments "downstream" from Hanford should be thoroughly analyzed and presented to the public. Research into this concern in the course of preparation of the EIS is particularly important because present knowledge appears to be very meager.

"We know very little about the behavior of the other transuranics in the ocean, and far less of the behavior and fate of the elements in fresh water environments." 5/

4/ WASH-1202(73), p. 27. The validity of the following assertion should be specifically considered in the draft EIS: "systems" will be available during fiscal year 1976 for "eliminating the routine use of soil columns to remove radioactivity from liquid waste [at Hanford]." (WASH-1202(73), Table B-1).

5/ Victor E. Noshkin, "Ecological Aspects of Plutonium Dissemination in Aquatic Environments," *Health Physics* 22, p. 538 (June 1972). Noshkin makes two points that the draft EIS should specifically address: (a) "Neptunium-230. . . a significant component in the cooling waters of the Hanford reactors. . . [has been] detected as far as 260 miles downriver from the facilities at Hanford This quantity of ^{239}Np . . . produced by radioactive decay, some 0.1 Ci of ^{239}Pu which is now distributed downriver to, and presumably into the offshore waters of Washington and Oregon" (p. 540), and (b) "[s]uch food items as . . . canned salmon, etc., which are consumed whole. . . will represent important transfer vectors of plutonium into humans via the food chain."

To the maximum possible extent, the distribution and bioconcentration of radionuclides from the Hanford Reservation that are found in water environments should be considered over their toxic lifetimes.

6. The Draft Outline appears to omit the following important subjects:

- (a) The draft statement should analyze precisely what has happened to the liquid radioactive wastes poured into the ground at several points on the Hanford Reservation. The discussion should include a detailed soil profile for each ground disposal area. If some of the wastes poured into the ground cannot be accounted for, the best possible explanation of their disappearance and a description of any associated hazards should be provided. Finally, the analysis should examine alternative means of reducing such hazards.
- (b) The statement should discuss alternative means of dealing with ("decommissioning") obsolete buildings and facilities at Hanford.
- (c) Any non-AEC activities contemplated as possible in the long-run on the Hanford Reservation should be discussed.

7. Throughout the draft statement, the reasoning and data supporting important judgments, evaluations and conclusions should be presented and documented. We emphasize this because earlier reports on Hanford's environmental monitoring program have sometimes been inadequate in this respect. For instance, in the discussion concerning the "[e]xceptionally high concentrations of radioactivity (primarily ^{32}P) . . ." 6/ that were found during December 1969 in a duck on the Hanford Reservation, the following conclusion stands alone without supporting data:

" . . . it is our judgment that ducks collected on swamps, trenches, or ponds are not representative of those available to the general population and that dose

6/
Evaluation of Radiological Conditions In The Vicinity of Hanford For 1969 (BNWL-1505), p. 11 (November 1970). Evidently, consumption of only one-half pound of this highly contaminated duck would have resulted in a radiation exposure to a member of the public near the Hanford Reservation nine and a half times greater than the maximum permissible amount that is recommended by the International Commission on Radiological Protection and adopted as a standard by the AEC.

estimates derived therefrom are not pertinent for comparison with the established dose standards." 7/

No such unsupported conclusions should appear in the draft statement. 8/

8. NEPA requires the AEC to:

" - utilize a systematic interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment. . . ." (NEPA, § 102(2) (A))

To fulfill this requirement, the draft EIS should provide clear evidence 9/ that a systematic multidisciplinary procedure has been used in the evaluation of the environmental effects of Hanford's programs. The conceptual framework for the statement should be set out, fully explaining the approach adopted by the responsible AEC officials in assessing the total environmental impact of the Hanford radioactive waste management program. To assure professional accountability, the authors of each major section of the statement and their professional qualifications should be listed in the draft statement.

7/ Id., at 40. One wonders, for instance, whether any tagging experiments had been conducted to determine the number of birds that visited trenches and ponds on the Hanford Reservation and then were subsequently shot by hunters.

8/ In order to avoid undue length and technical complexity in the body of the EIS, CEQ has recommended that:

"[h]ighly technical and specialized analyses and data. . . should be attached as appendices or footnoted with adequate bibliographic references." Guidelines § 1500.8(a)(1).

9/ "[A federal agency] must not only observe the prescribed procedural requirements and actually take account of the factors specified, but it must also make a sufficiently detailed disclosure so that in the event of a later challenge to the agency's procedure, the courts will not be left to guess whether the requirements of NEPA. . . have been obeyed. . . To enable a court to ascertain whether there has been a genuine, not a perfunctory compliance with NEPA, the [federal agency] will be required to explicate fully its course of inquiry, its analysis and its reasoning (emphasis added). Ely v. Voelke, 451 F.2d 1130, 1138 (4th Cir. 1971)

Mr. Richard L. Hames
January 25, 1974
Page seven

If you would find further comment from us useful in the preparation of the Hanford radioactive waste EIS, we would be pleased to provide it.

Sincerely yours,

John E. Bryson

Terry R. Lash

JEB/TRL:gg

cc: Dean C. Smith
James L. Liverman
Russell W. Peterson
Russell E. Train

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February 15, 1974

Dr. James L. Liverman
Assistant General Manager for
Biomedical and Environmental Research
and Safety Programs
United States Atomic Energy Commission
Washington, D.C. 20545

Re: Hanford Environmental
Impact Statement, Effluent
and Waste Management Program.

Dear Dr. Liverman:

As you know, very large quantities of plutonium-239 have been poured into the soil as part of the Hanford waste management program.

In our initial comments on the preparation of the Hanford programmatic environmental impact statement, we stated that the potential health hazards posed by the plutonium now in the Hanford soil should be fully discussed. 1/ The possibility of the release of plutonium from the bottoms of disposal trenches to the soil surface by the action of plants and animals was emphasized in our second communication on the impact statement. 2/

This letter is to urge that an additional feature of plutonium distribution in the Hanford soil and the hazards and mitigation options relating to it be discussed in the upcoming EIS. Data developed during the investigation into the Z-9 plutonium disposal trench indicates

1/ Terry R. Lash and John E. Bryson, "Comments Regarding the Preparation of Environmental Impact Statements on the Overall Radioactive Waste Management Programs at Hanford, the National Reactor Testing Station and the Savannah River Plant," p. 12 (October 12, 1973).

2/ Letter to Dr. James L. Liverman from Terry R. Lash and John E. Bryson, dated October 31, 1973.

Dr. James L. Liverman
February 15, 1974
Page two

that a substantial amount 3/ of plutonium has migrated away from the bottom of Z-9. 4/ This is an unexpected finding in light of previous AEC assurances that plutonium is very tightly bound by the Hanford soil. As was stated by a scientist at the AEC's Savannah River Laboratory, this extensive migration of plutonium away from the bottom of the Z-9 trench ". . . is of environmental concern." 5/ The discussion in the EIS of this phenomenon and the hazards posed by it should include an analysis of (1) how far the plutonium may migrate during its 250,000-year toxic life and (2) mitigation measures that are available to stop the further spread of plutonium away from the open-bottom disposal facilities.

Do not hesitate to contact us for additional comments.

Sincerely yours,

Terry R. Lash

Terry R. Lash

John E. Bryson

John E. Bryson

TRL:JEB:gg

cc: Dean C. Smith, Esq.
Richard L. Hames, Esq.
The Honorable Russell W. Peterson
The Honorable Russell E. Train

3/ There are approximately 35 kilograms between the 1 foot and 8 foot levels below the bottom of the trench.

4/ Nuclear Reactivity Evaluations of 216-Z-9 Enclosed Trench, ARH-2915, page R-7 (December 1973).

5/ ARH-2915, page R-7.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Dr. Terry R. Lash
Mr. John E. Bryson
Natural Resources Defense Council, Inc.
664 Hamilton Avenue
Palo Alto, California 94301

Dear Dr. Lash and Mr. Bryson:

This letter supplements my letters of October 25 and November 26, 1973 and March 1, 1974 responding to your letters of October 12 and 31, 1973 and February 15, 1974 concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

In preparing the draft statement we have attempted to be responsive to all relevant suggestions for coverage of topics. The textual location of the treatment of those suggestions received from the Palo Alto office of NRDC can be identified from the enclosed comment guides. Please note that we have endeavored to specifically treat all substantive comments in appropriate sections of the text.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guides
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Natural Resources Defense Council, Inc.
(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Define all specialized terms.	Glossary of Terms
Describe important radioactive waste management facilities.	II.1.1.2; Appendix II.1-B, C, E
The deleterious effects of ionizing radiation should be fully presented-should emphasize that there is no "safe" level of radiation.	III.1.1.2.6
The conclusions of the National Academy of Sciences - National Research Council report <u>Biological Effects of Ionizing Radiation</u> (November 1972) should be presented.	III.1.1.2.6
Fact that susceptibility to harmful effects of radiation varies widely within human populations should be thoroughly discussed.	III.1.1.2.6
The absence of safe-levels of radioactivity and the diversity of human responses to radiation should be described in relation to the AEC's standards for maximum permissible concentrations of radionuclides, including a detailed description of the process used to establish these standards.	(Not included within the scope of this Statement; see Foreward and III.1.1.2.6.)
A cost-risk analysis of these standards also should be included.	(Not included within the scope of this Statement; see Foreward and III.1.1.2.6.)

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The processes of bioconcentration and bioaccumulation should be comprehensively analyzed.	II.1.2; II.3.10; II.3.11; II.3.13; Table III-A-13; Appendix II.3-F; Appendix II.3-G; Appendix III-A
The implication of the "[e]xceptionally high concentrations of radioactivity (primarily P-32)" found in a duck near a radioactive waste disposal trench at Hanford should be discussed. (BNWL-1505, November 1970, p. 11.)	III.1.2; Table III.1-16; Table III.1-20
The AEC's detailed plans and all reasonable alternatives to those plans for the safe containment of radioactive wastes in perpetuity must be comprehensively presented.	II.1.1.2; V
Each possibility should include a cost/risk analysis.	V; IX
A complete inventory, by radionuclide, of the total radioactive wastes at the sites under construction.	I.2; II.1.1.4; II.3.13; Appendix II.1-B, C, E
This inventory should also include a description of all wastes ever released to the environment.	II.1.1; III.1; Appendix II.1-B, C, D, E, F
The physical state and chemical composition of all currently stored radioactive wastes should be indicated.	II.1.1.4; Appendix II.1-B, C, E; Appendix III-D

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The physical environment of each site, including the locations of geological faults, perched water zones, groundwaters, surface streams and rivers, and soil types and their locations beneath the sites.	II.3; Appendix II.3-B, C, D
The historical weather patterns, including a complete analysis of the worst possible winds, rains, and flooding foreseeable during the long-term (centuries) storage of radioactive wastes at the sites.	II.3.9; III.2.11; Appendix II.3-E
The possibilities of severe earthquakes and their impacts (the discussions should include indirect effects, e.g., the bursting of an upstream dam, as well as direct impacts on buildings, underground tanks, etc.).	III.2.11; Appendix II.3-C
A catalogue of important plant and animal species near each site, including special note of rare or endangered species.	II.3.10; II.3.11; Appendix II.3-F; Appendix II.3-G
The locations and extent of nearby human habitation and recreation, including relevant factors such as nearness to the site, direction from the site in relation to prevailing winds and whether or not they are downstream from the site and human uses of ground and surface waters, e.g., drinking water, irrigation, swimming, boating, fishing.	II.1; II.3; Appendix II.1-A; Appendix II.3-A; Appendix II.3-D; Appendix II.3-E

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The extent of environmental monitoring for radioactivity in organisms, soil, ground and surface waters, and air, including any measurements of radionuclides in nearby human populations (contingency procedures for use in case high levels of radioactivity are detected in the environment should be specified).	II.1.2; II.3; III.1; Appendix III-A, C
The annual production of radioactive wastes, by radionuclide, including the physical and chemical composition of the wastes and the means of storage or disposal.	II.1.1.5; Appendix II.1-B, C, E
All radioactive waste storage and disposal facilities, including those no longer in use but which still contain radioactive wastes, e.g., the plutonium-bearing Z-trenches at Hanford.	II.1.1.2; Appendix II.1-B, C, E
The potential of sabotage by terrorists or other groups or individuals.	(Sabotage is not covered, however, the consequences should not differ from the accidents presented in section III.2.)
Procedures for the "decommissioning" of buildings and other facilities.	(Research and development for decommissioning is in progress. Procedures have not yet been developed.)
A detailed history of all accidental releases of radioactivity to the environment.	II.1.1.4.5; II.1.2; III.2; Appendix II.1-B, C, E

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
A thorough analysis of the subsequent history of the various radionuclides accidentally or purposely released to the ground must be presented.	II.1.1.4; II.3.12; III.1.1; III.2; Appendix II.1-B, C, E; Appendix II.3-D.2.2.2
Specific exchange and sorptive capacities, by radionuclide, for each soil type beneath Hanford.	II.1.1.2.2.5; III.2.2.3; Appendix II.3-D.2.2.2
Include changes in soil and ground-water conditions due to substantially increased irrigation, industrialization, the accidental release of chemicals into the soil, or a change in the chemical composition or volume of liquid effluents.	II.3.8; III.1; Appendix II.3-D.2.2.2
The precautions taken to prevent radioactivity in the soil from entering the groundwater via the dry wells used to monitor soil and water contamination should also be discussed.	Appendix II.3-D.2
The possibility of "leaked" radioactivity entering perched water zones and the potential of waste liquids being "channeled" to the water table due to soil inhomogeneities should be considered.	II.1.1.2.2.5; II.1.2; II.3.13.1.2; III.2.2; Appendix II.3-D.2
Consideration of the total amounts of radionuclides that have already entered the water table.	II.3.13.1.2; Appendix II.3-D.2.2.2; Appendix III-C
The amounts and distribution of radionuclides in any groundwater sediments, and the migration of radionuclides, e.g., tritium and ruthenium, to the Columbia River should be stated.	II.1.1.4.4; II.3.13; Appendix II.3-D; Appendix III-C

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Mechanisms for causing radionuclides to move upward to the soil surface should also be discussed.	II.1.1.2.2.5; Appendix II.3-D.2.2.2
Detail any indications that ^{239}Pu has escaped to the surface.	II.1.1.2.2.5; II.1.2; II.3.13.4; Appendix II.3-D.2.2.2
Separate section on the Z-trenches which have been used to receive wastes containing hundreds of kilograms of explosive and toxic ^{239}Pu .	III.2.10; Appendix II.1-B, C, E
A description of changes, if any, in operational procedures that have been made to prevent the occurrence of a similar situation in another trench.	II.1.1.2.2; III.2.50
Steps taken to reduce the likelihood of a chain reaction in Z-9 occurring now or in the future, including during the proposed "mining" operation.	II.1.1.2.2; III.2.50
All measurements of the neutron multiplication constant (K-effective) should be given for Z-9 and all other Z-trenches containing substantial amounts of plutonium.	II.1.1.2.2; III.2.50
Detail the alternative of building double-walled stainless steel tanks to receive newly generated intermediate-and high-level wastes.	V.2.1.1; V.2.1.2; V.2.4
The administration of the Hanford radioactive Waste management program by operating contractors should be comprehensively reviewed.	(The subject is covered throughout this entire Statement.)

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Dr. Terry R. Lash and Mr. John E. Bryson), 10-12-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
A description of all new procedures instituted as a result of the AEC's investigation into the recent two-month-long leak should be described in detail.	III.2.2.1; III.2.2.2; Table V-3
The decision to dehydrate all high-level radioactive liquids to "salt-cake" needs to be re-evaluated and the current program compared to alternative means of solidifying the liquid wastes.	V.2.1.3; V.2.4.2; V.2.4.3; V.2.4.4
Consider in detail the AEC's plans for retrieving the salt cake after it is formed in the underground tanks.	V.2.5
Studies that indicate the life span of tanks holding salt cake should be reviewed.	V.2.5
The permanent closing of the Purex irradiated fuel reprocessing plant in order to eliminate the further generation of and need to store high-level radioactive wastes at Hanford.	V.2.3.1; V.2.3.2

COMMENT GUIDE

Natural Resources Defense Council, Inc.

(Dr. Terry R. Lash and Mr. John E. Bryson), 10-31-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Whether and how the AEC can prevent the removal of radioactive wastes from the ground by plants and burrowing animals over the next 600 years in the case of ^{90}Sr and ^{137}Cs and during the next 250,000 years in the case of ^{239}Pu .	III.1.2.1; III.2.9

COMMENT GUIDE

Natural Resources Defense Council, Inc.

(Mr. John E. Bryson and Dr. Terry R. Lash), 1-25-74

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
(a) The fact that the AEC's radiation standards and maximum permissible concentrations are upper limits that should not be used as "acceptable" or "safe" levels.	(Not within the scope of this Statement; see Foreward.)
(b) The cost-benefit approach of the standards.	
(c) The complete lack of a "safe" level of radiation exposure.	
(d) The variation among persons in susceptibility to injury from radiation.	
Present fairly the criticisms of the existing plutonium standards by Long, Geesaman, and Morgan.	III.1.1.2.6
A complete enumeration of all significant accidental releases of radionuclides.	II.1.1.4.5; II.1.1.5; Appendix II.1-B, C, E
The amounts and types of radionuclides that were released.	II.1.1.4.5; II.1.1.5; II.1.2; Appendix II.1-B, C, E
The likely fates of the radionuclides over their toxic lives.	II.1.1.4; II.1.2; III.1.1; III.1.1.2; III.2; Appendix II.1-B, C, E

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Mr. John E. Bryson and Dr. Terry R. Lash), 1-25-74

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The probable causes of and reasons for these releases.	II.1.1.2; II.1.1.4; II.1.1.4.5; III.2; Appendix II.1-B, C, E
Estimates of potential future releases.	II.1.1.5; III.2; V
Succinctly describe this series of events (large leak) and then go on to explain fully the steps that have been taken by the AEC and its contractors to ensure that such an error is not likely to occur again.	II.1.1.2.2; III.2.2
The cost-benefit analysis in the draft statement should include an estimate of the total costs of all reasonable, long-term alternatives for managing Hanford's radioactive wastes throughout their toxic lives.	V.2.1; V.3; IX
Provide detailed projections and analyses regarding waste generation, storage, and disposal at Hanford from the present until at least the end of the century.	II.1.1.4; V.2.1
The possibility of further delays and extensions in future operations should be considered.	V
The consequences of conceivable extensions in the operating life of the N Reactor.	V
The potential of the Hanford Reservation as the site for a national radioactive waste repository.	(Not within the scope of this Statement. Subject of a separate statement.)

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.

(Mr. John E. Bryson and Dr. Terry R. Lash), 1-25-74

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The possibility that the Purex plant or another irradiated fuel reprocessing plant at Hanford will be used to process fuel elements from commercial nuclear power plants that are located at Hanford or elsewhere in the Northwest.	(Not within the scope of this Statement. Subject of a separate statement.)
Special attention, including cost-benefit analyses and a detailed phase-out schedule, should be presented for achieving at Hanford the AEC's goal of "...eliminating the routine use of surface and near-surface techniques that depend on soil to remove radioactivity from liquid wastes."	II.1.1.2.4; V
Consideration of environmental effects far removed from the Hanford site, including an evaluation of the sediments in the lower Columbia River and in the ocean around the river mouth.	II.3.13.1; III.1.3.2.3; numerous references from III.11
The fate of the actinides in the aquatic and marine environments "downstream" from Hanford should be thoroughly analyzed.	II.1.2; III.1.2.2.1; Table III.1-5
The distribution and bioconcentration of radionuclides from the Hanford Reservation that are found in water environments should be considered over their toxic lifetimes.	II.3.10; II.3.13; III.1.1.2.1; III.1.2.2; Table III.1-17
Should include a detailed soil profile for each ground disposal area.	II.1.1.4.3; II.3.13

COMMENT GUIDE (continued)

Natural Resources Defense Council, Inc.
(Mr. John E. Bryson and Dr. Terry R. Lash), 1-25-74

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
If some of the wastes poured into the ground cannot be accounted for, the best possible explanation of their disappearance and a description of any associated hazards should be provided.	II.1.1.4.3; II.3.13; III.2.2
The analysis should examine alternative means of reducing such hazards.	II.1.1.2.4; V
The statement should discuss alternative means of dealing with ("decommissioning") obsolete buildings and facilities at Hanford.	(Research and development for decommissioning is in progress; procedures have not been developed.)
Any non-AEC activities contemplated as possible in the long-run on the Hanford Reservation should be discussed.	(Not within the scope of this Statement. Subject would be covered by separate statements.)
Provide clear evidence that a systematic multidisciplinary procedure has been used in the evaluation of the environmental effects of Hanford's programs.	II.1.2
To assure professional accountability, the authors of each major section of the Statement and their professional qualifications should be listed in the draft Statement.	(The Statement was prepared in accordance with AEC regulations and the guides of the Council on Environmental Quality. The authors of all reference materials are given.)

COMMENT GUIDE

Natural Resources Defense Council, Inc.

(Mr. John E. Bryson and Dr. Terry R. Lash), 2-15-74

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Plutonium distribution, hazards, and mitigation options should be discussed regarding the Z-9 disposal trench. In particular, discuss how far the plutonium has or will migrate and the measures available to stop further migration.	II.1.90, II.1.92, II.1.94, II.1.118, III.2.50, III.2.51, III.2.52, III.2.53, V.25, II.1.C.99

EXHIBIT NO. 19

1. Letter from Zero Population Growth (Dr. L. Douglas DeNike), p. C-150
10-12-73
2. USAEC Response p. C-151
3. Comment Guide p. C-152

ZERO POPULATION GROWTH

October 12, 1973

Dr. James L. Liverman
Assistant General Manager
Atomic Energy Commission
Washington, D. C. 20545

Re: Environmental Impact
Statement on Nuclear
Waste Disposal Facilities

Dear Dr. Liverman:

In the forthcoming environmental impact statement on nuclear waste disposal facilities, I most strongly urge you to consider the topics of:

- 1) Effects of conventional and nuclear bombing of waste storage sites;
- 2) Methods to minimize spread of radioactivity following such incidents.

Inasmuch as radioactive waste would present a tempting military target to foreign aggressors for hundreds or thousands of years, it is imperative that storage methods be "hardened" to resist such attacks.

I have written a 34-page manuscript on the antisocial abuses of radioactivity which is very pertinent in this connection. It will be supplied on request, or you might obtain a copy from Mr. Lester Rogers, Director of Regulatory Standards. It will be published in abridged form in the Bulletin of the Atomic Scientists.

Very truly yours,

L. Douglas DeNire
L. Douglas DeNire, Ph.D.
Vice-President

C-150

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Dr. L. Douglas DeNike, Vice President
Zero Population Growth
1720 Pontius Avenue
Los Angeles, California 90025

Dear Dr. DeNike:

This letter supplements my letter of October 26, 1973 acknowledging your October 12, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comment concerning the effects of bombing of the waste storage sites is addressed in section III.2. In addition, the effects of such events have been investigated in detail in Long Term Hazards Analysis for In-Tank Solidification Radioactive Waste Storage Concept by Carl Unruh, BNWL-CC-1467, Battelle, Pacific Northwest Laboratories, Richland, Washington, January 1968. Copies of this document are available for review at the AEC document rooms in San Francisco, Washington, D.C. and Richland. In addition, copies may be purchased from the Technical Information Center in Springfield, Virginia.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosure:

Draft Environmental Statement, Waste Management Operations,
Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

Zero Population Growth (Dr. L. Douglas DeNike), 10-12-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Effects of conventional and nuclear bombing of waste storage sites and methods to minimize spread of radioactivity following such incidents.	III.2, Reference 17 of Section III.2

EXHIBIT NO. 20

1. Letter from North Anna Environmental Coalition
(Mrs. Arthur W. Dietrich), 10-12-73	p. C-154
2. USAEC Response	p. C-156
3. Comment Guide	p. C-157

NORTH ANNA ENVIRONMENTAL COALITION

P.O. BOX 3951 (804)282-8817
CHARLOTTESVILLE, VIRGINIA 22904
(703) 832-3983 or (804)293-6039
October 12, 1973.

Dr. James L. Liverman,
Ass't Gen'l Mgr. for Biomedical & Environmental
Research and Safety Programs,
U.S. Atomic Energy Commission,
Washington D.C. 20545

Re: FR Doc. 73-16999
Filed 8-13-73 8:45 A.M.

Dear Dr. Liverman,

From the text of material prepared by Senator Howard H. Baker, member of the Joint Committee on Atomic Energy, for the ABC-TV show "Energy Crisis" broadcast May 31, 1973, comes the following statement, "The containment and storage of radioactive wastes is the greatest single responsibility ever consciously undertaken by man... We can ill afford to fall short in our obligation to protect future generations."

I hope that when the AEC is preparing the Environmental Impact Statement on its Hanford Reservation, its South Carolina and Idaho installations, that it will come up with some definite information as to how it intends to make its storage and waste management safe and where it expects to find a final safe resting place. Considering the history of leaks at Hanford, as far back as 1958, and that the recent leak there of thousands of gallons of high-level nuclear wastes have been attributed only partly to aging storage tanks and mainly to managerial negligence and human error, not much confidence is engendered in the AEC's ability to manage thousands of pounds of wastes that civilian nuclear power plants will be generating in the years ahead. And if by 1980, as is called for by President Nixon, we are building and bringing into commercial use, Fast Liquid Metal Breeder Reactors, the amounts of Plutonium produced that will need handling and storage and keeping out of the biosphere, essentially forever will be utterly fantastic. Since Plutonium has a half life of 24,400 years, half of the mounting inventory of plutonium will still be around 24,400 years from now and still mounting. Putting this in perspective, we are now in the year 1973 AD. How then can we have the moral turpitude to leave such a legacy to future generations?

Further, all over the country the public will have the constant uneasy concern of the dangers brought on by the transporting of these highly radio-active wastes to storage by truck on accident prone roads and by rail.

Dixie Lee Ray stated at a News Conference of Feb. 25, 1973 "We certainly

Dr. James L. Liverman

Page 2

have to know more than we do now, but not to the extent where we have to stop everything and wait until answers are got..." When the stakes involve personal safety, and survival, genetic integrity of the human species, health, national security and even so far as potential for complete and irreversible contamination of the planet, I believe that we should "stop everything until answers are got." It is absolutely insane to continue full speed building reactors that produce more and more lethal wastes, when no one knows how or where to store them safely.

Sincerely yours,

Margaret Dietrich

(Mrs. Arthur W. Dietrich)
Secretary

C.C. Terry Lash, Staff Scientist
Natural Resources Defense Council, Inc.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Mrs. Arthur W. Dietrich, Secretary
North Anna Environmental Coalition
P.O. Box 3951
Charlottesville, Virginia 22903

Dear Mrs. Dietrich:

This letter supplements my letter of November 7, 1973 acknowledging your October 12, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

We have carefully considered your comments in the context of relating them to waste management operations at the Hanford Reservation. The enclosed comment guide identifies those sections of the statement which relate to your comments. We hope this guide will assist you in reviewing the statement.

Your concerns regarding the management of radioactive waste from power reactors have been addressed in another environmental statement, WASH-1539, a copy of which has been sent to you.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

North Anna Environmental Coalition (Mrs. Arthur W. Dietrich), 10-12-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
How it intends to make its storage and waste management safe.	II.1.1.2.4; V.2.1; Table V-3; Table V-5
Where it expects to find a final safe resting place.	V

EXHIBIT NO. 21

1. Letter from North Anna Environmental Coalition (Mrs. P. M. Allen), 10-15-73 p. C-159
2. USAEC Response p. C-161
3. Comment Guide p. C-162

NORTH ANN ENVIRONMENTAL COALITION

Dr. James L. Liverman
Assistant General Manager for Biomedical
& Environmental Research & Safety
Programs
U. S. Atomic Energy Commission
Washington, D. C. 20545

P.O. BOX 3951 (804)282-8817
CHARLOTTESVILLE, VIRGINIA 22903
(703) 832-3983 or (804)293-6039
October 15, 1973

Dear Dr. Liverman:

We are pleased to learn that you are planning a detailed environmental impact statement on waste management operations and would urge thorough investigation:

- of concentration of radionuclides by organisms
- of health patterns of people near current sites
- of the effectiveness of usual monitoring procedures
- of education of monitoring personnel to the significance of what they are measuring
- of ways to protect people in the expanding "radius of risk" from drinking contaminated ground water.

We were dismayed by the recent reports regarding leaks at Hanford, especially the Gillette account in Science of the bureaucratic negligence involved.

We are also concerned to discover that geological studies and seismic studies are often conducted after a site has been chosen--witness the Barnwell site in South Carolina. We wonder if the Savannah River Plant is in the same earthquake zone.

If the Savannah Plant is seismically at risk, it is our strong belief that no quantity of impact statements can correct that, and that abandonment of the site should be given serious consideration.

As you may know, a major Atomic Energy Commission investigation is currently taking place in Virginia because of 4 reactors sited astride a fault. Wouldn't a growing inventory of waste products be equally bad should the earth decide to move without reading the impact statement?

Needless to say, we are deeply concerned about the risks of the entire fuel cycle and grateful for every indication of caution and prudent action.

Sincerely,

June Allen (Mrs. P. M.)
NAEC Treasurer

Governor Asked to Launch

Front Page - Sun - 10/27/72
By PETER BACQUE
of The Progress Staff

North Anna Probe

One of the developers of the atomic bomb has called on Virginia's governor to launch an independent investigation into the North Anna Power Station fault and into allegations Virginia Electric and Power Co. hushed up knowledge of the fault.

In an exclusive interview with the Daily Progress Saturday, Ralph E. Lapp, the nationally famous physicist and former director of the atomic bomb project for the government set up a special investigation commission to make "an independent assessment of the risks involved and the corporate responsibility in this affair."

Lapp cited similar commissions in Illinois and Pennsylvania as precedents for the move.

Lapp worked as a divisional director in the World War II "Manhattan Project" at the University of Chicago. The Manhattan Project was the code name for the development of the first atomic bomb.

He serves as environmental consultant to the state of Pennsylvania and the U.S. Senate's Public Works Committee.

Lapp has authored more than 15 books on nuclear and related matters, including a standard college textbook on nuclear radiation.

"I believe that the state must exercise initiative and diligence in the public interest, apart from the Atomic Energy Commission's exhaustive investigation," Lapp said.

Evidence discovered by the North Anna Environmental Coalition and The Daily Progress indicating that Vepco had strong geological evidence of the fault from a period as early as 1963-71 prompted the AEC to begin its own fact-finding work on the crack in the foundations of the four reactors at Vepco's \$1 billion Louisa County plant.

Three Virginia geologists have given sworn testimony to the AEC that they discovered and identified the fault in February and March 1970. The three say they told Vepco's chief engineer at the site about the fault, expecting the company to take some action.

Vepco denies that it learned of the fault from the three at that time and has stoutly denied withholding any information from the public or the AEC.

The fault was reported by Vepco to the AEC May 17, the day the record for construction license hearings on North Anna reactors 3 and 4 was closed.

"This is no small matter," Lapp said of the charges. "Don't kid yourself. Every utility company in the country is watching what happens here."

The scientist, who lives in Alexandria, proposed that Gov. Linwood Holton, working through the State Corporation Commission, appoint a panel of "competent investigators" to study the matter.

The special commission, he said, must have "no connection, and this is important, with any public utility, the AEC or any nuclear vendor (firms supplying equipment for atomic power plants)."

"The commission must be without the suggestion of bias," he said.

The nuclear physicist divided the investigation into two areas: the risks of a nuclear accident posed by the fault and the communication of knowledge about the fault to the public.

Though he would not comment on whether he believed Vepco, saying he had not looked into that aspect of the controversy, Lapp cited recent AEC testimony before Congress' Joint Committee on Atomic Energy.

On Sept. 27, Manning Muntzing, AEC director of regulation, told the congressmen, "We are quite concerned that the company (Vepco) maybe knew something about the seismic (earthquake) characteristics there and did not disclose it to the AEC."

Lapp himself served as chief investigator for the Illinois Commerce Commission investigation into a nuclear accident at Commonwealth Edison's Dresden Nuclear Power Station in Morris, Ill. An accident, which released

radioactivity into the atmosphere occurred there June 5, 1970, and the Commission filed its report in January of this year.

Though he considers himself an advocate of the peaceful uses of the atom, Lapp is extremely cautious on matter of nuclear safety.

"The North Anna site is fairly ideal from the standpoint of public risk," Lapp said, "because of the low population density. But this does not mean there should be not be the greatest concern for those exposed to possible risks."

"Virginia has a very great stake in nuclear energy," he said. "The state, if it is to exhibit dynamic growth, must have adequate energy. I believe nuclear power is essential for this."

"Since it is the state and community that accept the risks, these should be subject to independent evaluation at the state level."

"It is extremely important that citizens have a feeling of confidence in the facilities. In the area of nuclear safety there should not even be a suspicion that everything is not 100 per cent above board," he said.

"The issue of public credibility is one of the AEC's greatest problems," Lapp said. "The fact that they have banned a site means they are trying very hard to establish credibility. The AEC cannot afford to give even the slightest appearance of cover-up or incompetence (in the North Anna matter)."

Lapp was an intervenor in AEC deliberations on locating a nuclear power plant at Newbold Island in the Delaware River—five miles from Trenton, N.J. and 10 miles north of Philadelphia, Pa.

The AEC Saturday ruled against New Jersey's Public Service and Electric Co. and ordered the site abandoned.

Lapp says he anticipates no direct personal action on the North Anna plant.

○The physicist gave the North Anna Environmental Coalition a pat on the back for its efforts at bringing the fault to light.

○"The coalition should be congratulated on a phenomenal job," he said. "The value of the environmentalists' initiative demonstrates the individual citizen need not be nakedly helpless in the face of governmental power."

The NAEC wrote Gov. Holton in September asking him to give formal support for reopening the AEC's North Anna plant hearings and to support NAEC's request that the State Water Control Board study the fault's impact on the ground water and Lake Anna.

Holton took no action on NAEC's requests. The water board granted Vepco an operating certificate for its North Anna units 1 and 2 and construction licenses for units 3 and 4.

Both the SWCB and the attorney general's office have taken the position that all matters relating to nuclear energy are the exclusive province of the Atomic Energy Commission.

The attorney general has, however, begun a technical investigation of the fault through the Virginia Division of Mineral Resources.

The Atomic Energy Commission has not made a decision on reopening hearings, pending the outcome of its regulatory staff's investigation of the fault.

The Daily Progress
Charlottesville, Va.

UNITED STATES
ATOMIC ENERGY COMMISSION

WASHINGTON, D.C. 20545

Mrs. P. M. Allen, Treasurer
North Anna Environmental Coalition
P.O. Box 3951
Charlottesville, Virginia 22903

Dear Mrs. Allen:

This letter supplements my letter of November 2, 1973 acknowledging your October 15, 1973 letter concerning the preparation of environmental statements on waste management operations at AEC sites. A copy of the draft environmental statement for waste management operations at the Hanford Reservation near Richland, Washington, is enclosed.

Your comments were given careful consideration in the preparation of the statement. The enclosed comment guide identifies those sections of the statement which relate to your comments. We hope the guide will assist you in reviewing the statement.

Thank you again for your interest in the AEC's waste management operations. We would appreciate any comments you may have on the draft statement. They can be considered in the preparation of the final statement if received within sixty days. In addition, a public hearing on the draft statement is tentatively scheduled in Richland, Washington, on December 10, 1974. A formal announcement concerning the hearing procedures will be placed in the Federal Register.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. Comment Guide
2. Draft Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington (WASH-1538)

COMMENT GUIDE

North Anna Environmental Coalition (Mrs. P. M. Allen), 10-15-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Concentration of radionuclides by organisms.	II.1.2.2.1; II.3.10; II.3.11; II.3.13; Table III.1-17; Appendix II.3-F; Appendix II.3-G; Appendix III-A
Health patterns of people near current sites.	III.1.1.2.2.2
Effectiveness of usual monitoring procedures.	II.1.2; III.2.2
Education of monitoring personnel to the significance of what they are measuring.	II.1.2; III.2.2
Ways to protect people in the expanding "radius of risk" from drinking contaminated groundwater.	IV; VI.2; VIII.2; Appendix II.3-D.2

EXHIBIT NO. 22

1. Letter from U.S. Environmental Protection Agency (Dr. W. D. Rowe), 12-4-73 p. C-164
2. Letter from U.S. Environmental Protection Agency (Dr. W. D. Rowe), 3-28-74 p. C-194
3. USAEC Response p. C-207
4. Comment Guide for 12-4-73 EPA Comments p. C-210
5. Comment Guide for 3-28-74 EPA Comments p. C-212

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

4 DEC 1973

Dr. James L. Liverman
Director, Division of Biomedical
and Environmental Research
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Liverman:

In accordance with Federal Register notice 38FR21955, dated August 14, 1973, we are pleased to provide the Commission with suggestions regarding the items which we believe should be included in the Environmental Impact Statement being prepared on waste management activities at AEC's Hanford facility. These suggestions, outlined in the enclosed report, were prepared after a review of the background information in the AEC report titled, "Management of High-Level Radiation Waste at the Hanford Site," dated September 1972.

In summary, we believe the Commission should attempt to bring together the extensive technical information available so as to permit an evaluation to be made of the potential for the release of radioactive materials to the general environment, both near and long term, as well as an evaluation of the potential off-site consequences of such releases. Specifically, we would suggest inclusion of the following:

1. Details regarding the on-site monitoring and hydrological testing programs.
2. The fundamental assumptions employed in the construction of the ground water transport model and their bases.
3. A discussion of the long-term impact of the release of radioactive materials from the site to the general environment.

Yml 12
JAN 1974

4. The analysis and relevant data which support the indefinite storage of wastes on the Hanford reservation.

5. The quantities and distribution of radionuclides beneath the cribs, swamps and tanks and an unclassified estimate of the material within the tanks themselves.

6. Identification of feasible alternative actions and their costs.

These items are amplified in the enclosed report.

We would also note that the direct discharge of radioactive liquids to the soil at Hanford appears to be in conflict with the spirit of AEC's waste management policy as expressed in WASH-1202 and the intent of EPA policy, as outlined in the Administrator's Decision Statement (ADS) No. 5. Accordingly, we feel that the continuation of such practices requires appropriate justification in the impact statement.

While the suggestions contained in our report are principally oriented towards Hanford operations, we feel that many of them are, in principle, equally applicable to the impact statements on the waste management activities at the Commission's Savannah River Plant and the National Reactor Test Station. In this regard, we have previously provided the Commission with comments on its Environmental Impact Statements filed in support of proposed additions to the waste storage facilities at both these sites which we believe should be addressed in the draft impact statements. Specifically, we stressed the desirability of storing wastes in acid form at the Savannah River Plant to facilitate subsequent solidification and requested data regarding the retrievability of solidified waste residues at both Savannah River and the NRTS. We would also suggest that cost estimates covering feasible waste management alternatives be presented in appropriately detailed fashion (e.g., costs of solidification, packaging, transport, burial) to permit a reasonable comparison of these alternatives to be made. Similarly, we feel the potential liabilities, in terms of the future costs of transfer of stored inventories of waste should be identified as a function of time.

We recognize that the information we have requested has been phrased in rather general terms. To avoid any misunderstandings and to clarify our intent, we would suggest that technical meetings be held as necessary to discuss these matters.

In this connection, we understand that outlines of the planned environmental statements for Hanford, NRTS, and Savannah River Plant are being developed. We would be pleased to review these drafts with the AEC staff. We also look forward to the briefing on the general waste management practices at the Hanford Plant which you have agreed to provide us.

Sincerely yours,

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs

Enclosures

cc:

Alex Fremling, Manager, RL, USAEC
James L. Agee, EPA, Region X
Sheldon Meyers, OFA, EPA

COMMENTS ON THE CONTENT OF AEC'S
PROPOSED ENVIRONMENTAL IMPACT STATEMENT
ON THE HANFORD SITE

U.S. ENVIRONMENTAL PROTECTION AGENCY

Office of Radiation Programs

November 1973

Background

As a result of the failure of a tank containing highly radioactive waste at AEC's Hanford production complex, EPA was provided with background information regarding waste management practices at that site. We have reviewed this information with a view towards providing comments to AEC regarding the content of their forthcoming Environmental Impact Statement, pursuant to a notice in the FEDERAL REGISTER dated August 14, 1973 (38FR21955).

The following sections briefly summarize these waste management practices, AEC's conclusions relative to their potential environmental impact, and EPA's suggestions for material to be included in the forthcoming EIS.

The waste management practices at the Hanford site are described and discussed according to the following classifications: Released Liquids, Stored Liquids, and Stored Solids.

I. RELEASED LIQUIDS

Description

Liquid wastes generated in the production and processing of plutonium have been classed as low-level, intermediate-level, and high-level wastes. High-level waste is retained in carbon-steel lined tanks and is discussed further in Section II. Both low-level and intermediate-level liquid wastes have been directly discharged to the soils on the Hanford reservation.

The low-level radioactive waste streams, which are normally not contaminated, are released to swamps and seepage basins where the liquid effluent is permitted to percolate through some 200 feet of overlying sediments into the water table. The concentrations of radioactive materials in this type of effluent have generally less than 5×10^{-5} $\mu\text{Ci}/\text{milliliter}$. Any radioactive isotopes present are partially sorbed on the underlying soils as the effluent percolates downward to the water table. This sorption delays the migration rate and reduces peak concentrations of radioactivity but does not prevent migration of contaminants into the ground water system.

Intermediate-level wastes are effluents which contain radioactive materials at concentrations less than $100 \mu\text{Ci}/\text{ml}$. These wastes have been released to covered seepage trenches, referred to as cribs. In these cribs, liquid wastes are also permitted to percolate downward through the soil to the water table. The discharge of liquid to a specific crib is continued until the concentration of radioactivity in the ground water beneath the crib reaches 10% of recommended concentration guide as set forth in AEC Manual Chapter 0524 for the

nuclides of principal concern (presumably strontium and cesium). When such concentrations have been reached, the liquid effluent is directed to a new crib.

In addition to the discharge of low- and intermediate-level wastes, failures of high-level liquid (greater than 100 $\mu\text{Ci/ml}$) waste storage tanks have provided an additional source of radioactive material in the on-site environment.

AEC Waste Management Plans - Effluent Control

As indicated in Wash-1202, Plan for the Management of AEC-Generated Radioactive Wastes, the use of natural soil columns (cribs, trenches) for the disposal of radioactive liquid will be discontinued as soon as technically and economically practical.

AEC Assessment of Environmental Impact

AEC has, through its on-site monitoring program, determined the approximate distribution of radioactivity in the ground water beneath the Hanford site. These data suggest that even after 28 years of operation, radionuclide concentrations in the ground water have never exceeded the recommended Concentration Guide for water at distances greater than 3 miles from the point of release. Concentrations have been generally less than 10% of these guides. Continued decay and dilution of the radioactive material is postulated as the ground water moves towards the Columbia River. Travel times to the river have been estimated to range from several thousands years to approximately four years depending on the point of release. AEC has estimated a travel time to the river of approximately 800 years from the T-tank farm area.

With respect to the disposal of intermediate-level wastes into cribs, AEC has indicated that preferential sorption of radionuclides in the soil column has taken place and has resulted in the accumulation of significant quantities of activity in the ground above the water table. Because of the sparse rainfall in the area (approximately 6 inches per year) AEC has concluded there is little driving force available which might cause this retained activity to migrate downward towards the water table. The implication is that these materials are stabilized and should remain outside of the biosphere indefinitely. AEC monitoring data suggest the same is true for the radioactivity released to the soil as a result of the 16 reported tank failures which have occurred over the last 15 years.

AEC has analyzed the potential impact of the radioactivity in the ground water system on the general population and has concluded that even if the entire inventory of radionuclides (existing both in the ground water system as well as in the soil columns beneath the cribs and seepage basins) were released into the Columbia River over a single day,

the dose to a Richland resident (via drinking water) would be less than 500 mrem with a 50-year dose commitment from deposited strontium-90 of less than 3 rem.

Several general observations on the behavior of radionuclides in the soil have been made by the AEC on the basis of laboratory and field tests. These are summarized by AEC as follows: (a) long-lived fission product nuclides discharged to the ground (Pu, Sr, Cs) are almost completely held by reactions with the soil within a few tens-of-feet and plutonium held within a few feet of the point of discharge, (b) relatively small quantities of long-lived emitters "bleed" from the concentration band and permeate the wet soil column extending both downward and outward from the point of discharge. The extent of such diffusion is dependent on the degree of retention of the particular elements by the soil, (c) long-lived radionuclides in this wetted column or in the ground water move very slowly, from 1/100 to 1/100,000 as fast as the ground water itself, (d) tritium and ruthenium move at about the same rate as the moisture in the wetted column or in the ground water.

From these data, AEC contractors have constructed a transport model which is intended to predict the distribution and concentration of radionuclides in the ground water system as a function of time. Based on model predictions, it is believed that tritium and ruthenium in the ground water are now beginning to enter the Columbia River although at levels which are reportedly undetectable. This ground water model is undergoing final verification. Comparison of measured isotopic concentrations in the ground water systems with model calculations have shown generally good agreement. Refinements are, however, required particularly as they apply to soil permeability and water retention characteristics. This model has been used to evaluate the potential impact of several possible uses of the water in the Hanford ground water basin including the effects of irrigation, the construction of the Ben Franklin Dam, and the use of cooling ponds for the proposed Hanford nuclear park. The model suggests that irrigation on the slope of the Rattlesnake Hills, which lie to the south of the principal disposal areas, and which are under AEC control, would produce a large rise in the water table which would encroach on the waste disposal areas, extending into or quite near the zones where most of the radionuclides are retained beneath the waste discharge points. This elevated water table would also come to within 50 feet of the bottom of the high-level waste storage tanks. Construction of the proposed Ben Franklin Dam and other irrigation activities, would produce a similar but less pronounced elevation of the water table. Thus, restrictions on land or water usage are required to assure that isotopes held within the soil would remain isolated from ground water systems.

Suggested Content of EIS

AEC conclusions relative to the potential environmental impact of waste inventories at Hanford are based on the results of the on-site monitoring program, the isotopic transport model and assumptions regarding the fate of radionuclides already released to the general environment. Consequently, any independent assessment of such conclusions requires an evaluation of these basic elements. Accordingly, we believe the environmental impact statement on Hanford waste management activities should include information which would permit:

(1) verification of the adequacy of the on-site hydrological monitoring system;

(2) an evaluation of the assumptions, with supporting geological and other data, which were employed in the construction of the ground water transport and off-site exposure model;

(3) an assessment of the off-site consequences of a spectrum of potential release mechanisms, including natural disturbances (earthquake; flooding, etc.), using as a basis the actual quantities and distribution of radioactive species present in the soils (including material released in the failure of Tank 106-T and the evaporator feed tank soil) as well as those isotopes retained in tanks.

(4) an assessment of the transit time of radionuclides to the general environment from the principal disposal areas.

Additionally, we believe that the statement should also include discussions on the following:

(1) the requirements for perpetual care and surveillance and land use restrictions including irrigation projects and the construction of the Ben Franklin Dam which may be necessary to assure continued isolation.

(2) the retrievability of the high-level wastes solidified and stored in the existing tanks.

(3) discuss anticipated impact of any facilities planned for future development at the Hanford site on the existing waste management system.

With respect to the continued use of cribs, trenches, etc., we would suggest as guidance for EIS coverage of this subject the "Recommended Data Requirements for the Environmental Injection," contained in the Administrator's Decision Statement No. 5, dated February 6, 1973 (copy attached). Although this statement was written specifically to cover

well injection it establishes the basic requirements for EPA review of subsurface fluid disposal practices.

II. STORED LIQUID WASTES

Description

Of principal significance is the storage of the high-level liquid radioactive wastes. These wastes, generated continuously over the 30-year history of Hanford operations are of two types, self-boiling and non-boiling. These wastes have been stored in 150 carbon-steel-lined concrete tanks ranging in volume from 50,000 to one million gallons. Liquid wastes from plutonium production processes are introduced to the tanks as alkaline slurries. The suspended solids in these wastes have settled to form sludges in the tank bottom. This sludge is reported to contain the bulk of the strontium and plutonium while the supernate contain the bulk of the cesium. These tanks, the vast majority of which are not provided with double containment, performed well for the first 15 years of operation, corrosion data having indicated a tank life of about 50 years.

Since 1959, leaks have been confirmed in at least 16 of these tanks. The liquids which escaped into the surrounding soil contained approximately 240,000 as well as other significant fission products. The leaks were controlled by pumping the supernate to spare tanks. AEC monitoring data have indicated that in all cases the released activity has been retained in the soil within 80 feet of the tank (about 100 feet above the water table) and that once a leak is stopped, further movement of radionuclides towards the water table is negligible under prevailing or projected climatic conditions.

In an effort to improve the safety of tank storage systems, new tanks are to be provided with double containment. Moreover, to reduce the mobility of the liquid wastes in the singly contained tanks, operations were initiated several years ago to remove 80-90% of the principal heat emitters, strontium and cesium, from self-boiling, high-level wastes. These isotopes will be separately packaged and provided with high-integrity storage. The residual liquid containing the remaining strontium, cesium, and other radionuclides including plutonium, are to be returned to the waste tanks and after a period of 4-5 years could be evaporated to a damp salt cake, thereby decreasing the inherent mobility of the wastes and the potential for leakage. (Separation of strontium and cesium is necessary to prevent undesirably high temperatures in the salt cake. Non-boiling wastes do not require such separation and will be evaporated to a salt cake directly.) To date, approximately 60 million gallons of liquid waste have been converted to 22 million gallons of salt cake.

AEC Assessment of Environmental Impact

The in-tank solidification program is acknowledged to be an interim measure pending a determination of the acceptability of maintaining these wastes on the Hanford reservation in perpetuity or the development of another acceptable permanent disposal method. AEC is engaged in evaluating other long-term or perpetual storage techniques for Hanford generated wastes. These have included conversion to a solid with offsite shipment, confinement in high integrity engineered structures and burial as a concentrated slurry in caverns mined deep in the basalt beneath the Hanford reservation. Demonstration and implementation of these techniques appears difficult within the next 10 to 15 years, even under an accelerated schedule. Consequently, AEC believes that this program of in-tank solidification represents the most expeditious method for reducing the mobility of these stored liquid wastes, thereby reducing the potential for adverse environmental impact. AEC states that the wastes, converted to solid form within the existing tanks will be in a retrievable form. These materials could be excavated by sophisticated mining techniques should it ever be determined necessary to remove them to another permanent disposal system.

AEC Waste Management Plans

Wash-1202, Plan for the Management of AEC-Generated Radioactive Wastes, calls for conversion of all high-level liquid wastes to a salt cake in existing tanks. This process should be on a current basis by 1976 and existing inventories will be totally converted to a salt cake by 1983. As noted, various alternatives for the permanent storage of these wastes are being studied.

Suggested Content of EIS

In reviewing AEC's plans for the management of the stored liquid wastes, the principal concern relates to the potential for the release of these material to the general environment and to the retrievability of the product of the In-tank Solidification Program (ITS). It is suggested that data be presented which analyze the potential impact of natural disturbances appropriate to the site (floods, earthquake, etc.) on the stored wastes. Similarly, since the ITS program is an interim measure data and analyses should be provided regarding the retrievability of the ITS product. To provide for a comparison of alternative courses of action management options for these liquid wastes which might be available, we would suggest that the costs of such alternatives be developed with particular emphasis on the method of management proposed for commercially-generated high-level waste, on accelerated ITS program and retrieval of the product of the ITS.

III. STORED SOLID WASTES

Description

A variety of solid radioactive wastes such as failed equipment paper, scrap materials, ion exchange resins, etc., generated in the Hanford facilities have been consigned to shallow land burial grounds or placed in special underground tunnels. The wastes have been generally placed in trenches typically 25 feet in depth and covered with up to 10 feet of earth. AEC feels that once buried, these wastes should not present a potential source of population exposure or environment contamination principally because of the sparse rainfall and the low probability of other transport processes which might cause migration of radioactive materials to the biosphere.

AEC Waste Management Plans

With respect to the burial of solid radioactive wastes, AEC has established a policy, applicable to its own operations, which requires the storage of plutonium contaminated wastes in a form which will permit contamination-free retrieval for a period of at least 20 years. Such wastes are presently being stored in lined and covered trenches.

Suggested Content of EIS

It appears that the radioactive waste materials stored in shallow land burial grounds must, in terms of their potential environmental impact, be considered on the same basis as the liquids retained in the soil columns and the solidified wastes in the tank farm areas. Consequently, the EIS data requirements would be similar, particularly with respect to future land use restrictions.

ENVIRONMENTAL PROTECTION AGENCY

Administrator's Decision Statement #5

Introduction

The Environmental Protection Agency, in concert with the objectives of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq.; 35 Stat. 816 et seq.; Pub. L. 92-500) ". . . to restore and maintain the chemical, physical, and biological integrity of the Nation's water" has established an EPA policy on "Subsurface Emplacement of Fluids by Well Injection" which was issued internally as Administrator's Decision Statement No. 5. The purpose of the policy is to establish the Agency's concern with this technique for use in fluid storage and disposal and its position of considering such fluid emplacement only where it is demonstrated to be the most environmentally acceptable available method of handling fluid storage or disposal. Publication of the Policy as information establishes the Agency's position and provides guidance to other Federal Agencies, the States, and other interested parties.

Accompanying the Policy Statement are "Recommended Data Requirements for Environmental Evaluation of Subsurface Emplacement of Fluids by Well Injection." The purpose of these requirements is to provide guidance for potential injectors and regulatory agencies concerning the kinds of information required to evaluate the

prospective injection well system; and to insure protection of the environment. The Recommended Data Requirements require sufficient information to evaluate complex injection operations for hazardous materials, but may be modified in scope by a regulatory agency for other types of injection operations.

The EPA recognizes that for certain industries and in certain locations the disposal of wastes and the storage of fluids in the subsurface by use of well injection may be the most environmentally acceptable practice available. However, adherence to the Policy requires the potential injector to clearly demonstrate acceptability by the provision of technical analyses and data justifying the proposal. Such demonstration requires conventional engineering and other analyses which indicate beyond a reasonable doubt the efficacy of the proposed injection well operation.

Several issues within the Policy should be highlighted and explained to avoid confusion. One of the goals of the Policy is to protect the integrity of the subsurface environment. In the context of the Policy Statement, integrity means the prevention of unplanned fracturing or other physical impairment of the geologic formations and the avoidance of undesirable changes in aquifers, mineral deposits or other resources. It is recognized that fluid emplacement by well injection may cause some change in the environment and, to some extent, may preempt other uses.

Emplacement is intended to include both disposal and storage. The difference between the two terms is that storage implies the existence of a plan for recovery of the material within a reasonable time whereas disposal implies that no recovery of the material is planned at a given site. Either operation would require essentially the same type of information prior to injection. However, the attitude of the appropriate regulatory agency toward evaluation of the proposals would be different for each type operation. The EPA policy recognizes the need for injection wells in certain oil and mineral extraction and fluid storage operations but requires sufficient environmental safeguards to protect other uses of the subsurface, both during the actual injection operation and after the injection has ceased.

The Policy considers waste disposal by well injection to be a temporary means of disposal in the sense that it is approved only for the life of an issued permit. Should more environmentally acceptable disposal technology become available, a change to such technology would be required. The term "temporary" is not intended to imply subsequent recovery of injected waste for processing by another technology.

ADMINISTRATOR'S DECISION STATEMENT NO. 5

EPA Policy On Subsurface Emplacement Of Fluids By
Well Injection

This ADS records the EPA's position on injection wells and subsurface emplacement of fluids by well injection, and supersedes the Federal Water Quality Administration's order COM 5040.10 of October 15, 1970.

GOALS

The EPA Policy on Subsurface Emplacement of Fluids by Well Injection is designed to:

1. Protect the subsurface from pollution or other environmental hazards attributable to improper injection or ill-sited injection wells.
2. Ensure that engineering and geological safeguards adequate to protect the integrity

of the subsurface environment are adhered to in the preliminary investigation, design, construction, operation, monitoring and abandonment phases of injection well projects.

3. Encourage development of alternative means of disposal which afford greater environmental protection.

PRINCIPAL FINDINGS AND POLICY RATIONALE

The available evidence concerning injection wells and subsurface emplacement of fluids indicates that:

1. The emplacement of fluids by subsurface injection often is considered by government and private agencies as an attractive mechanism for final disposal or storage owing to: (1) the diminishing capabilities of surface waters to receive effluents without violation of quality standards, and (2) the

apparent lower costs of this method of disposal or storage over conventional and advanced waste management techniques.

Subsurface storage capacity is a natural resource of considerable value and like any other natural resource its use must be conserved for maximal benefits to all people.

2. Improper injection of municipal or industrial wastes or injection of other fluids for storage or disposal to the subsurface environment could result in serious pollution of water supplies or other environmental hazards.
3. The effects of subsurface injection and the fate of injected materials are uncertain with today's knowledge and could result in serious pollution or environmental damage requiring complex and costly solutions on a long-term basis.

POLICY AND PROGRAM GUIDANCE

To ensure accomplishment of the subsurface protection goals established above it is the policy of the Environmental Protection Agency that:

1. The EPA will oppose emplacement of materials by subsurface injection without strict controls and a clear demonstration that such emplacement will not interfere with present or potential use of the subsurface environment, contaminate ground water resources or otherwise damage the environment.

All proposals for subsurface injection should be critically evaluated to determine that:

- (a) All reasonable alternative measures have been explored and found less satisfactory in terms of environmental protection;

(b) Adequate preinjection tests have been made for predicting the fate of materials injected;

(c) There is conclusive technical evidence to demonstrate that such injection will not interfere with present or potential use of water resources nor result in other environmental hazards;

(d) The subsurface injection system has been designed and constructed to provide maximal environmental protection.

(e) Provisions have been made for monitoring both the injection operation and the resulting effects on the environment;

(f) Contingency plans that will obviate any environmental degradation have been prepared to cope with all well shut-ins or any well failures;

(g) Provision will be made for supervised plugging of injection wells when abandoned and for monitoring to ensure continuing environmental protection.

3. Where subsurface injection is practiced for waste disposal, it will be recognized as a temporary means of disposal until new technology becomes available enabling more assured environmental protection.
4. Where subsurface injection is practiced for underground storage or for recycling of natural fluids, it will be recognized that such practice will cease or be modified when a hazard to natural resources or the environment appears imminent.
5. The EPA will apply this policy to the extent of its authorities in conducting all program activities, including regulatory activities, research and development, technical

assistance to the States, and the
administration of the construction grants
State program grants, and basin planning
grants programs and control of pollution at
Federal facilities in accordance with
Executive Order 11507.

Attachment:

Recommended Data Requirements for

Environmental Evaluation of Subsurface

Emplacement of Fluids by Well Injection

RECOMMENDED DATA REQUIREMENTS FOR ENVIRONMENTAL EVALUATION

OF SUBSURFACE EMPLACEMENT OF FLUIDS BY WELL INJECTION

The Administrator's Decision Statement No. 5 on subsurface emplacement of fluids by well injection has been prepared to establish the Agency's position on the use of this disposal and storage technique. To aid in implementation of the policy a recommended data base for environmental evaluation has been developed.

The following parameters describe the information which should be provided by the injector and are designed to provide regulatory agencies sufficient information to evaluate the environmental acceptability of any proposed well injection. A potential injector should initially contact the regulatory authority to determine the preliminary investigative and data requirements for a particular injection well as these may vary for different kinds of injection operations. The appropriate regulatory authority will specify the exact data requirements on a case by case basis.

(a) An accurate plat showing location and surface elevation of proposed injection well site, surface features, property boundaries, and surface and mineral ownership at an approved scale.

(b) Maps indicating location of water wells and all other wells, mines or artificial penetrations, including but not limited to oil and gas wells and exploratory or test wells, showing depths, elevations and the deepest formation penetrated within twice the calculated zone of influence of the proposed project. Plugging and abandonment records for all oil and gas tests, and water wells should accompany the map.

(c) Maps indicating vertical and lateral limits of potable water supplies which would include both short and long-term variations in surface water supplies and subsurface aquifers containing water with less than 10,000 mg/l total dissolved solids. Available amounts and present and potential uses of these waters, as well as projections of public water supply requirements must be considered.

(d) Descriptions of mineral resources present or believed to be present in area of project and the effect of this project on present or potential mineral resources in the area.

(e) Maps and cross sections at approved scales illustrating detailed geologic structure and a stratigraphic section (including formations, lithology and physical characteristics) for the local area, and generalized maps and cross sections illustrating the regional geologic setting of the project.

(f) Description of chemical, physical, and biological properties and characteristics of the fluids to be injected.

(g) Potentiometric maps at approved scales and isopleth intervals of the proposed injection horizon and of those aquifers immediately above and below the injection horizon, with copies of all drill-stem test charts, extrapolations, and data used in compiling such maps.

(h) Description of the location and nature of present or potentially useable minerals from the zone of influence.

(i) Volume, rate, and injection pressure of the fluid.

(j) The following geological and physical characteristics of the injection interval and the overlying and underlying confining beds should be determined and submitted:

(1) Thickness;

(2) areal extent;

(3) lithology;

(4) grain mineralogy;

(5) type and mineralogy of matrix;

(6) clay content;

- (7) clay mineralogy;
- (8) effective porosity (including an explanation of how determined);
- (9) permeability (including an explanation of how determined);
- (10) coefficient of aquifer storage;
- (11) amount and extent of natural fracturing;
- (12) location, extent, and effects of known or suspected faulting indicating whether faults are sealed, or fractured avenues for fluid movement;
- (13) extent and effects of natural solution channels;
- (14) degree of fluid saturation;
- (15) formation fluid chemistry (including local and regional variations);

(16) temperature of formation (including an explanation of how determined);

(17) formation and fluid pressure (including original and modifications resulting from fluid withdrawal or injection);

(18) fracturing gradients;

(19) diffusion and dispersion characteristics of the waste and the formation fluid including effect of gravity segregation;

(20) compatibility of injected waste with the physical, chemical and biological characteristics of the reservoir; and

(21) injectivity profiles.

(k) The following engineering data should be supplied:

(1) Diameter of hole and total depth of well;

- (2) type, size, weight, and strength, of all surface, intermediate, and injection casing strings;
- (3) specifications and proposed installation of tubing and packers;
- (4) proposed cementing procedures and type of cement;
- (5) proposed coring program;
- (6) proposed formation testing program;
- (7) proposed logging program;
- (8) proposed artificial fracturing or stimulation program;
- (9) proposed injection procedure;
- (10) plans of the surface and subsurface construction details of the system including

engineering drawings and specifications of the system (including but not limited to pumps, well head construction, and casing depth);

(11) plans for monitoring including a multi-point fluid pressure monitoring system constructed to monitor pressures above as well as within the injection zones; description of annular fluid; and plans for maintaining a complete operational history of the well;

(12) expected changes in pressure, rate of native fluid displacement by injected fluid, directions of dispersion and zone affected by the project;

(13) contingency plans to cope with all shut-ins or well failures in a manner that will obviate any environmental degradation.

(1) Preparation of a report thoroughly investigating the effects of the proposed subsurface

Injection well should be a prerequisite for evaluation of a project. Such a statement should include a thorough assessment of: 1) the alternative disposal schemes in terms of maximum environmental protection; 2) projection of fluid pressure response with time both in the injection zones and overlying formations, with particular attention to aquifers which may be used for fresh water supplies in the future; and 3) problems associated with possible chemical interactions between injected wastes, formation fluids, and mineralogical constituents.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

Mr. Alex Fremling, Manager
Richland Operations Office
U.S. Atomic Energy Commission
Richland, Washington 99352

Dear Alex:

I would like to express my thanks to you, members of your staff, and the personnel from Battelle's staff for the excellent briefings and tour of the Hanford activities which you conducted for me and my staff last month. The considerable time and effort expended by the AEC and Battelle was very evident in the highly competent and professional manner in which we were briefed.

After my staff returned and had time to reflect on the information they had received, I requested them to prepare a report on our visit including our concerns and principal questions. A copy of that report is enclosed for your information. We have also received several requests from the public for any report we may have on that meeting. I am also including for your information a copy of the typical letter by which we are furnishing copies of the report to the public.

I believe that our visit to Hanford will prove to be of great value to my staff in preparing for the review of the Hanford EIS. By visiting the actual site and engaging in informative staff-to-staff discussions, the technical personnel who will be tasked with conducting our detailed review will be able to prepare responsible comments within a minimal time period. I have directed my staff that, as you suggested, they may contact their counterparts at Hanford directly to resolve further detailed technical matters.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "W. D. Rowe", with a long horizontal flourish extending to the right.

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs (HM-558)

2 Enclosures

Report of the AEC Briefing and Tour of Waste
Management Activities at the AEC Hanford Facility
February 14-15, 1974

Background

The AEC agreed on December 13, 1973, to hold a briefing and tour for EPA staff members at Richland, Washington on waste management activities at the Hanford site and the forthcoming EIS. This meeting was publically announced in the Federal Register, Vol. 39, No. 27, page 4800 - Thursday, February 7, 1974. It was similar to the briefing and tour of the National Reactor Testing Station held on January 22 and 23, 1974, and the scheduled briefing and tour of the Savannah River facilities scheduled for March 12 and 13, 1974. The Hanford meeting was open to the public and the press.

Attendees:

The following EPA Headquarters, Region X, laboratory, and state personnel attended the briefing and tour:

EPA-HQ-

Dr. William D. Rowe, Deputy Assistant Administrator
for Radiation Programs

Mr. James Dieckhoner, Chief
Advanced Technology and Studies Branch
Technology Assessment Division (TAD)
Mr. Harry Calley, Chief
Operations Analysis Branch, Field Operations
Division (FOD)
Mr. James Hardin, Staff Officer, (FOD)
Mr. G. Lewis Meyer
Hydrologist, TAD
Mr. Mark Semler, Health Physicist
Criteria & Standards Division (CSD)
Ms. Katherine Schirmer, Office of Hazardous
Materials Control (OHMC) (Attended only the
briefing)

Enclosure 1

EPA-Region X-

Mr. J. Edward Cowan, Chief
Radiation and Noise Branch
Mr. John Sceva, Geologist
Dr. William Lappenbusch, Radiation Biologist
Ms. Carolyn Wilson, Sanitary Engineer

EPA-National Environmental Research Center Las Vegas

Mr. Donald Henricks, Assistant Director
for Radiation Operations
Mr. Robert Kaufmann, Hydrologist

State of Washington- Mr. Terry Strong, Acting Section Head, Radiation,
Chemical, and Physical Hazards Section, Washington
Radiation Control Program
Mr. Robert R. Mooney, Head, Environmental Radiation
Laboratory, Washington Radiation Control Program
Mr. John R. Raymond, Supervisor, Waste Investigation
Division, Washington Department of Ecology

Activities:

A copy of the detailed agenda for the briefing and tour is attached together with a list of the AEC and AEC Contractor participants in the briefings and tour (Dr. Edward Alpen, Director BNW, did not participate as indicated).

February 14, 1974

Mr. Alex Fremling, Manager, AEC Richland Operations gave a brief presentation covering the development of Hanford from 1943 to the present. The main purpose for the facility was the production of plutonium for the weapons program. At one time there were 8 graphite moderated production reactors operating, but now there is only one. He stressed that the management of wastes has been and will continue to be a major activity at the site. All wastes stored at Hanford, with the exception of a small amount of low level solid waste, originated there. No commercial power plant wastes are stored at Hanford. According to their studies, the waste management activities at Hanford have had a minimal impact on the public and the off-site environment. He acknowledge that some areas are currently contaminated to a level such that they may, realistically, have to be perpetually dedicated to this activity.

Mr. Frank Standerfer, Assistant Manager for Programs, AEC Richland Operations, then briefed the attendees on the management of wastes at Hanford. He described the site as covering 570 square miles and as having an average of six inches of precipitation per year. He repeated the statement that only one production reactor (the "N" reactor) is presently operating and that its continued operation past 1977 is in doubt.

The aim of the AEC is to stop the use of "cribs" or trenches as soon as other treatment/storage systems are available. The AEC's specific plans in this area, including the treatment systems to be employed and basic information on the time frame involved will be included in the draft statement. The use of cribs for plutonium bearing wastes was discontinued in 1973. At present there are 152 underground storage tanks in use, ranging in capacity from 54,500 to 1,000,000 gallons and located six to nine feet beneath the surface. There have been 16 tank failures since 1958.

The Hanford policy is to let high level wastes sit in the tanks in liquid form for five years to allow the short half-lived radio-isotopes to decay, before being processed further and solidified. The wastes are transported to the "B" plant in the 200 East Area for treatment, and in a recently completed section of the plant the cesium and strontium are separated and encapsulated.

The solidification program initially used immersion heaters which were lowered into the tanks. Now they use a recently completed evaporator complex in the 200 West Area. Up to the present time 74,000,000 gallons of waste have been evaporated leaving 3,000,000 gallons of salt cake and sludge in the tanks. There remains 47,000,000 gallons of liquid waste still in the tanks to be evaporated. If the "N" reactor shuts down in 1977, then the last of its wastes can be evaporated by 1982. Current R & D program are addressing the problem of how the salt cakes can be treated further to remove the remaining waster and modify the wastes into an even more stable physical and chemical form.

The situation with the Z-9 trench was discussed. This trench received the plutonium bearing liquid waste from the plutonium finishing plant in the 200 West Area. In 1973 the AEC issued an EIS describing a program to attempt to reprocess the dirt in the trench to recover the plutonium. The EIS noted that under extreme circumstances the trench could go critical. It now appears that the analysis which led to that conclusion was incorrect and that criticality is not feasible. It was

stated that, as of May 1973, no more plutonium waste is disposed of into cribs or trenches, it is sent to an evaporator after any initial cooling period. The AEC still plans to complete the planned recovery of the plutonium contained in this trench.

Mr. Carl Unruh, Manager, Occupational and Environmental Safety Department of Battelle Northwest Laboratories presented a briefing on the Environmental Monitoring Activities at Hanford. He said that as of the time of this meeting only data through 1972 were available, and that 1973 data will be out in May 1974.

The sources, routes, and level of exposure are routinely examined for the following pathways:

- The Columbia River	- External Radiation
- Drinking Water	- Milk
- Groundwater	- Sea Foods
- The Atmosphere	- Other Foods

Each of these pathways were discussed in detail.

In the study of the groundwater pathway, it was stated that samples are obtainable from 102 wells in the 200 West Area, 115 wells in the 200 West Area, and about 100 wells in the rest of the areas.

Plutonium is routinely monitored for in the environment in both the soil and vegetation. In both, the on- and off-plant levels are equal (0.1×10^{-8} to 2×10^{-8} $\mu\text{Ci Pu/gm}$ in soil and 0.03×10^{-8} to 1×10^{-8} $\mu\text{Ci Pu/gm}$ in vegetation). Plutonium in excess of natural background has been found in the immediate area of the chemical reprocessing plants.

Mr. Jay Eliason, Manager, Land Resources Systems Section, Battelle Northwest Laboratories, presented a briefing on the movement of fluids and radionuclides in hanford sediments. He described the geology and hydrology of the Hanford site and the predominant characteristics of it which contribute to the movement of radioactive materials through the ground to the Columbia River.

He described the current computerized groundwater modeling system and presented examples of the calculated travel times to the river for wastes which enter the ground water beneath the tank farms from leaks

or other accidents. He also presented a study of the tritium levels in the groundwater. In the study the computerized prediction model was given the levels as of several years ago and was asked to predict the tritium movement for each succeeding year. These predictions were compared with the actual measured values and a good correlation was observed.

Mr. Richard Hames, Chief Counsel, Richland Operations Office and Mr. Carl Unruh of Battelle then discussed the forthcoming EIS on Hanford's waste management programs. Mr. Hames focused on the history of the NRDC (National Resources Defense Counsel) law suit against the AEC which led to this EIS. Mr. Unruh outlined what specific items would be covered in the EIS and how it is planned to be organized. Mr. Hames stressed that this will not be the last EIS for Hanford, but rather will act as a base to which the impact of future activities can be added.

In his discussion, Mr. Unruh mentioned that the EIS will consider several postulated accidents including (1) a waste tank explosion, (2) a "B" plant filter failure, and (3) a Waste Tank dome collapse. In the discussion of alternatives, the EIS will include: (1) continuation of the current program, (2) cessation of the generation of wastes and treatment operations and the building of more liquid storage tanks for the new waste, (4) shutdown of the whole site and restoration of it to as close to the original condition as possible, (5) shutdown of the Purex plant, shutdown of the N-reactor and processing of its fuel offsite, and (b) shutdown of the plant, operation of the N-reactor and processing of its fuel offsite.

It is estimated that the preparation of the Hanford EIS will end up costing about \$1,000,000 and taking 15-20 man-years of effort over a nine month period. The effort started in the Fall of 1973, the draft EIS is scheduled to be issued in the Summer of 1973, the draft EIS is scheduled to be issued in the Summer of 1974, and the final EIS is scheduled to be issued in the Fall of 1974.

Following the prepared briefing by the AEC and Battelle personnel, an open question and answer period was held. EPA was given an opportunity to ask their questions prior to the general audience being given the opportunity to ask questions. To facilitate questioning, Dr. Rowe instructed all EPA attendees to give their questions to Jim Dieckhoner and have him pose all of the questions to the AEC/Battelle panel.

The EPA questions covered the entire range of the topics covered in the briefings but generally centered on three areas of concern: (1) The source of possible environmental contamination including the current waste inventory, details of the waste management operations, and possible future sources of waste; (2) the validity of the ground-water transport model for predicting the pathways and transit times for the movement of waste to offsite areas; and (3) the ability of the monitoring/surveillance system to detect and accurately measure the offsite impact.

February 15, 1974

Mr. Alex Fremling conducted a bus tour of the Hanford site. On the way to the first stop, the N-reactor, he pointed out the FFTF, 300 Area, site of the Hanford 2 commercial nuclear power station, general geologic features, and the sites of former production reactors.

At the N-reactor an inplant tour was conducted by Mr. Charles Harrington, President, United Nuclear Industries, Inc., operators of the facility. Discussions during the tour disclosed that liquid wastes from the reactor are routinely discharged to a crib, but can be held and sent to the B plant for treatment.

The bus tour continued to the 200 West Area and included pauses at the T tank farm for a briefing on the 106 T tank leak, and at the Z-9 trench, before a stop at the Evaporator/Crystallizer for a briefing. (An EIS for this facility was reviewed during 1973.)

The bus tour continued to the 200 West Area, passing the site leased for low-level solid land burial, and stopping at the Purex plant. During the briefing at Purex it was stated that the plant is waiting for the next load of N-reactor fuel and is not currently operating. The fuel is processed in the Purex plant with the plutonium and uranium going to the 200 West Area for processing, the neptunium shipped to the AEC's Savannah River facility, and the waste sent to the B plant.

The bus tour then went to the B plant and Waste Encapsulation Facility for a briefing. At this facility the Cs and Sr is removed from the liquid waste and stored as a solid in steel cylinders underwater. At present this facility is undergoing "cold" testing.

The bus tour then went to its final stop at the Battelle laboratory for a briefing and demonstration of the Groundwater Modeling Computer System. The capabilities of this system were explained and demonstrated.

After the tour, staff discussions were held between AEC, EPA, Washington State, and the AEC contractor personnel. At this time specific clarifying questions were posed by all participants. EPA comments on the specific proposed EIS outline were discussed. The AEC provided copies of documents evaluating the criticality of the Z-9 trench and results of the T-106 tank leak. The AEC and its contractors requested clarification and guidance as to how EPA wished them to calculate "health effects", which, as Dr. Rowe mentioned during the previous day's question and answer period, was the preferred method of presenting the potential impact of a radiation activity on the population.

The following comments on the outline were presented and discussed:

1) In the discussion of present facilities, the draft statement should include a description of the pipeline network used to transport radioactive liquids, with an analysis of the present condition of the lines, preventive maintenance protocols, and leak detection methods.

2) From the proposed outline it was not clear whether Hanford plans to adopt and install, in the future, any noble gas control systems for the N-reactor of the fuel reprocessing facility. If such systems are not planned, then the draft statement should evaluate the off-site consequences of such releases, both from the short term dose effects and the long term environmental dose commitment perspectives.

3) In the discussion of surface and groundwater hydrology, the draft statement should include information on the use of water from aquifers in the area, if such use exists.

4) The draft statement should present dose calculations in modular form. Each parameter in the dose calculations should be developed independently, justified and referenced. The calculations should then be displayed in clear fashion so that they can be independently verified. This is particularly important with regard to all dose conversion factors which convert concentrations to dose or dose rates.

5) The cost data for the waste management facilities described should be included.

6) The meteorological data for the site should include information on the probability and duration of the wind persistence for use in accident analyses.

7) In the discussion of alternatives, the outline indicates that alternative sites, plant designs, and operational systems for each waste stream will be considered. It is recommended that alternatives be considered only for various categories of radioactive waste (i.e., low level, intermediate level, and high level waste).

8) If it is not too late in the preparation schedule for the draft statement, we suggest that the following reorganization of the outline may lead to the development of an easier read and reviewed document:

- 1.0 Introduction
- 2.0 Plant and Waste Management Facilities
- 3.0 Characterization of the Existing Environment
- 4.0 Effluent Source Term
 - 4.1 Waste Inventories
 - 4.2 Radiation Waste Discharges to the Environment
 - 4.3 Nonradiation Waste Discharges to the Environment
- 5.0 Exposure Pathways
- 6.0 Environmental Impact
 - 6.1 Radiation Dose Calculations
 - 6.2 Non-Radiological Effects Calculations
 - 6.3 Accidents
- 7.0 Environmental Measurements and Monitoring Programs
- 8.0 Section IV
- 9.0 Section V
- 10.0 Section VI
- 11.0 Section VII
- 12.0 Section VIII
- 13.0 Section IX
- 14.0 Section X
- 15.0 Summary
- 16.0 Appendices

It is also suggested that the index system be changed from I. A. 1 to 1, 1.0, 1.1, etc.

Dr. Rowe and Mr. Fremling participated in a formal press conference at the same time the meeting between the staffs was taking place.

Conclusions

The information presented by the AEC and Battelle was extremely useful and clarified many minor technical issues related to EPA reaching a judgment as to the environmental acceptability of the waste management activities at Hanford. On the basis of previously available information and that presented at this meeting, it appears that the forthcoming EIS on Hanford should address all pertinent topic areas with, perhaps, three exceptions, namely, the impact in terms of the environmental dose commitment, the impact of the ultimate disposition of obsolete contaminated facilities, and the practicability of recovering waste already disposed of.

Our primary concern with the present and future environmental impact of the waste management activities at Hanford is with the effectively irreversible potential public health commitment from long-lived radionuclides. EPA feels that, while the annual dose to individual members of the public or to the total population in the area may be small, the most valid representation of the potential impact would be in terms of the total "environmental dose commitment." Simply defined, this is the sum of all doses to individuals over the entire time period the material persists in the environment in a state available for interaction with humans. A recently published EPA document, "Environmental Radiation Dose Commitment An Application To The Nuclear Power Industry" EPA-520/4-73-002, contains a discussion of the development of the concept and its application.

During the briefings and the tour, it was clearly evident that there are many facilities on the site which will either never be put into an operational status again or will, in all likelihood, soon be retired. Almost all of these are radioactively contaminated to some degree. Some, especially the fuel reprocessing buildings may not be able to be decontaminated to a level which would allow conventional decommissioning and disposition. While this topic may not be considered wholly germane to a discussion of the waste management activities at Hanford, we feel that it cannot be ignored. The question bears directly on any discussion of alternatives which includes the eventual return of the site to the public domain.

Another matter of concern, closely related to the final decommissioning of obsolete facilities, is the practicability of retrieving wastes already disposed of. These wastes certainly would include those discharged into shallow land burial sites, those sent to on-site discharge ponds, those put into cribs or trenches, and those which have leaked from buried tanks or transfer lines to the soil. Engineering problems and costs which would be involved in recovering, treating, repackaging, and transporting these wastes may be such that it may not be practicable to relocate them. If this is the case, then it should be recognized at this time that they constitute a permanent commitment of land and the other resources attendant to their care in perpetuity. Likewise, due to the very large volumes of in-tank solidified high level waste which are now present and which will eventually be formed from the remaining liquid waste, the same arguments may be valid. Even though discussion still continues in the AEC as to the feasibility of constructing an official federal repository for solidified commercial high level waste, for the reasons cited above, it may already be too late to consider that program as being of any help to the situation at Hanford.

In order to assist in gaining the proper perspective on this problem, the AEC should conduct a scoping study of the situation surrounding this practicability question. If indeed we are faced with a foreclosure of alternatives at Hanford, as far as retrieval and removal are concerned, then the situation should be faced, the commitment recognized, and further actions programmed on that basis.

During the course of the informal staff discussions during and following the briefings and tour, one additional point was raised which warrants further comment. Draft environmental statements will be issued this Spring and early Summer addressing the impact of waste management operations at the AEC's facilities at the National Reactor Testing Station and the Savannah River Plant in addition to the Hanford statement. While EPA will do its utmost to complete its review and submit its comments within the stipulated time period, it is felt that EPA must be primarily responsive to its NEPA responsibility to perform the most complete technical analysis possible. This may mean that the EPA comments may not be submitted within the requested time frame. This will most likely be certainly true if the review periods for these statements overlap. If such becomes the case, EPA will notify the AEC of the situation and request an extension of the formal submission date. Since these facilities are currently operational, and not awaiting some licensing action, the submission of a technically complete set of comments by EPA, reflecting the considered judgement of this Agency, on whatever reasonable time frame is necessary, will be a more proper reflection of EPA responsibility under NEPA than an incomplete set of comments submitted primarily to conform with an artificial deadline. Bearing this in mind, and considering the importance of the activities at these three sites, an initial review period of between sixty and ninety days should be established by the AEC for the review of these statements.

on whatever reasonable time frame is necessary, will be a more proper reflection of EPA responsibility under NEPA than an incomplete set of comments submitted primarily to conform with an artificial deadline. Bearing this in mind, and considering the importance of the activities at these three sites, an initial review period of between sixty and ninety days should be established by the AEC for the review of these statements.

(Sample Letter)

Dear

In accordance with your request concerning the joint EPA-AEC meeting on waste management activities at the Hanford site, I am enclosing an informal EPA report. This report was prepared from notes taken at the briefing and tour on February 14-15, 1974. Accordingly, some of the precise information may have been incorrectly recorded and transcribed, but the major program activities, philosophies, and technical approaches should be accurate.

The information contained in the section entitled "Conclusions" are preliminary thoughts at the present time. The actual draft environmental impact statement (EIS) to be issued by the AEC may well address these concerns, but may also bring to light other concerns. EPA's formal comments which will be prepared following receipt of the EIS will represent this agency's position of these activities at Hanford; the views contained in the enclosed report do not. They are simply current staff thoughts on the matter, based on the limited information now available.

We welcome your interest in this matter, and if this office can be of any further assistance to you please let us know.

Sincerely yours,

E. David Harward, Director
Technology Assessment Division

Enclosure 2

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Dr. W. D. Rowe
Deputy Assistant Administrator
for Radiation Programs
United States Environmental Protection Agency
Washington, D.C. 20460

Dear Dr. Rowe:

Enclosed for your review and comment is a copy of the USAEC's draft Environmental Statement on Waste Management Operations at the Hanford Reservation, Richland, Washington (WASH-1538). At your request, we are also sending copies of this statement directly to other EPA organizational units for their review as noted on the enclosure.

We have carefully considered the comments and suggestions contained in your letter of January 4, 1974 and the comments offered in your March 28, 1974 letter to Mr. Alex Fremling, Manager, Richland Operations Office. We have enclosed comment guides based upon comments contained in your two letters to assist you in locating those sections of the statement which relate to your comments. We hope that these guides will assist your staff in reviewing the statement.

As we have previously discussed with members of your staff copies of documents referenced in this statement are available for review at AEC Public Document Rooms in Washington, D.C.; San Francisco, California; and Richland, Washington. Please let me know if we can provide additional information to assist you in reviewing the statement.

Dr. W. D. Rowe

- 2 -

Thank you again for your comments and suggestions on the AEC's
Waste Management Operations Environmental Statements.

Sincerely,

James L. Liverman
Assistant General Manager
for Biomedical and Environmental
Research and Safety Programs

Enclosures:

1. List of EPA organizational units receiving copies of the statement
2. Comment Guides
3. Draft Environmental Statement, Waste Management Operations,
Hanford Reservation, Richland, Washington (WASH-1538)

cc: Sheldon Meyers, OFA, EPA
James L. Agee, EPA, Region X
Alex Fremling, Mgr., RL, AEC

Distribution List for Draft Environmental Statements

Addressee:	Number of copies
Chief, ASTB (HM-559) Technology Assessment Division Office of Radiation Programs Room 637 <u>East Tower</u> 401 M Street, S.W. Washington, D.C. 20460	(6)
Mark O. Semler Eastern Environmental Radiation Facility U.S. Environmental Protection Agency P.O. Box 3009 Montgomery, Alabama 36109	(1)
Bruce J. Mann Chief, Evaluation Branch Office of Radiation Programs, LVF P.O. Box 15027 Las Vegas, Nevada 89114	(5)
Sheldon Meyers (A-104) Attn: Mr. Jackson Anderson Office of Federal Activities Room 535 <u>West Tower</u> 401 M Street, S.W. Washington, D.C. 20460	(2)
Kenneth E. Biglane, Director (AW-448) Oil and Hazardous Materials Division Attn: Ms. Geri Werdig Office of Water Programs Operations 2818 Waterside Mall 401 M Street, S.W. Washington, D.C. 20460 -	(3)
Dr. Gordon Everett (EG-329) Office of Enforcement and General Counsel Room 1115A <u>West Tower</u> 401 M Street, S.W. Washington, D.C. 20460	(1)
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Attn: Mr. George Shultz
National Environmental Research Center
Columbia Parkway Building
Cincinnati, Ohio 45268

Mr. Jack Keeley (2)
Robert S. Kerr Environmental Research Laboratory
P.O. Box 1198
Ada, Oklahoma 74820

COMMENT GUIDE

U.S. Environmental Protection Agency (Dr. William D. Rowe), 12-4-73

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number. Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Continued direct discharge of radioactive liquids to the soil requires appropriate justification in the impact statement.	II.1.1.1.3; III.1; V
Verification of the adequacy of the on-site hydrological monitoring system.	II.3.8; Appendix II.3-D
An evaluation of the assumptions, with supporting geological and other data, which were employed in the construction of the groundwater transport and off-site exposure model.	Appendix II.3-D; Appendix III-A; Appendix III-D
An assessment of the off-site consequences of a spectrum of potential release mechanisms, including natural disturbances (earthquake, flooding, etc.), using as a basis the actual quantities and distribution of radioactive species present in the soils (including material released in the failure of Tank 106-T and the evaporator feed tank soil) as well as those isotopes retained in tanks.	III.1; III.2
An assessment of the transit time of radionuclides to the general environment from the principal disposal areas.	II.1.1.4.4; III.1.1; III.2.2.3; Appendix II.3-D; Appendix III-C

COMMENT GUIDE (continued)

U.S. Environmental Protection Agency (Dr. William D. Rowe), 12-4-73

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
The requirements for perpetual care and surveillance and land use restrictions including irrigation projects and the construction of the Ben Franklin Dam which may be necessary to assure continued isolation.	IV; VI; VII
The retrievability of the high-level wastes solidified and stored in the existing tanks.	II.1.1.2.2; V (Research and development on retrievability is currently in progress)
Discuss anticipated impact of any facilities planned for future development at the Hanford site on the existing waste management system.	II.1.1.2.4; V
Analyze the potential impact of natural disturbances appropriate to the site (floods, earthquake, etc.) on the stored wastes.	III.2.11; Appendix II.3-C
The costs for liquid wastes alternatives be developed with particular emphasis on the method of management proposed for commercially-generated high-level waste, on accelerated ITS program and retrieval of the product of the ITS.	V.2; IX

COMMENT GUIDE

U.S. Environmental Protection Agency (Dr. William D. Rowe), 3-28-74

Data in the Hanford Statement which relate to the specifically identified items listed below are referenced by document section number.

Separate comments are supplied if appropriate.

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Present dose calculations in modular form. Each parameter in the dose calculations should be developed independently, justified and referenced.	III.1.1; Appendix III-A; Appendix III-B; Appendix III-C; Table III-A-5, 6, 7, 8; Table III-B-5
The cost data for the waste management facilities described should be included.	II.1.1.2.4; Table II.1-4
The meteorology data for the site should include information on the probability and duration of the wind persistence for use in accident analyses.	II.1.2; II.3.9; Tables II.3-E-7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17
Another matter of concern, closely related to the final decommissioning of obsolete facilities, is the practicability of retrieving wastes already disposed of.	(Research and development is being initiated and conducted on decommissioning and retrievability. Procedures have, therefore, not been developed.)
The draft Statement should include a description of the pipeline network used to transport radioactive liquids, with an analysis of the present condition of the lines, preventive maintenance protocols, and leak detection methods.	II.1; III.2.5; Appendix II.1-C; Table II.1-C-7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

COMMENT GUIDE (continued)

U.S. Environmental Protection Agency (Dr. William D. Rowe), 3-28-74

<u>Suggestions or Comments</u>	<u>Reference Section Number</u>
Should evaluate the off-site consequences of noble gas releases, both from the short-term dose effects and the long-term environmental dose commitment perspectives.	III.1; V.4; Table II.1-B-11
Discussion of surface and ground-water hydrology should include information on the use of water from aquifers in the area.	II.3.8; Appendix II.3-D

GLOSSARY OF TERMS

GLOSSARY OF TERMS

The explanation of terms used in the Hanford Environmental Impact Statement is prepared according to the general usages developed during operations on the Hanford site. Where possible, the explanations are developed also in accordance with established standards.

The information is arranged alphabetically, including terms which are constructed by joining several words. For example, "salt cake" is listed under s and "low-level waste" under l.

A

abiotic - caused by non-living entities

activation - the induction of radioactivity in material by irradiation with neutron radioactive material, a radiation generating machine, or a nuclear reactor

activity - a measure of the rate at which a material is emitting nuclear radiations; usually given in terms of the number of nuclear disintegrations occurring in a given quantity of material over a unit of time, the standard unit of activity is the curie (Ci)

adiabatic lapse rate - the rate of decrease of temperature with height of dry air lifted with no external heat losses or gains through an atmosphere in hydrostatic equilibrium

alpha radiation - an emission of particles (helium nuclei) from a material undergoing nuclear transformation; the particles have a nuclear mass number of four and a charge of plus two

alpha waste - waste material which is contaminated by radionuclides which emit alpha particles, particularly transuranic elements

anastomosing channels - branching or interlacing channels forming an inter-connecting system

anticline - an uparched fold in which the rock strata dip away from the fold's axis; the opposite of syncline

antithetic - as applied to faults, indicates faults with dips in the opposite direction from the dip of the enclosing rocks

A (CONT'D)

aquifer - a subsurface formation containing sufficient saturated permeable material to yield significant quantities of water

atomic number - the number of protons in the nucleus of each chemical element

alluvial fan - rock deposit laid down by streams flowing from mountains into low-land regions

B

background radiation - the level of radioactivity in an area, which is produced by sources other than the one of specific interest; in the Hanford region, the background radiation is produced by naturally occurring radioactive materials in the crust of the earth, cosmic radiations, and the fallout from nuclear weapons tests

base case - the activities as presently planned; in environmental impact considerations and cost/benefit analyses, the detailed plan of actions for which impact is assessed and to which reasonable alternatives will be compared

benthic organisms (benthos) - those organisms dwelling on the bottoms of bodies of water

beta radiation - essentially weightless charged particles (electrons and positrons) emitted from the nucleus of atoms undergoing nuclear transformation

bioconcentration (bioaccumulation) - the process whereby an organic system selectively removes an element from its environment and accumulates that element in a higher concentration

biological oxygen demand (BOD) - a measure of the organic pollution of water, determined by the extent to which bacteria and other contained organisms in a water sample will use dissolved oxygen in a given period of time; therefore, a measure of the residual oxygen in the water for use by other organisms such as fish

biomass - the total mass of living and dead organisms present in an area, volume, or ecological system

biota - the plant and animal life of a region

biotic - caused by living organisms

body burden - the amount of a specified radioactive material or the summation of the amounts of various radioactive materials present in an animal or human body at the time of interest

boiling waste - high-level liquid radioactive waste containing radionuclides (principally ^{90}Sr and ^{137}Cs) which provide sufficient decay heat to be near the liquid's boiling point; such liquid usually requires some supplemental means of cooling

B (CONT'D)

bottoms (tank) - the more concentrated material remaining in Hanford high-level liquid radioactive waste tanks after the bulk of the contents have been pumped out for solidification or transfer to other storage tanks; also refers to specific tanks used to collect such bottoms waste from several other tanks

breccia - rock composed of angular fragments cemented together

burial ground - an area specifically designated for the subsurface disposal of solid waste or excess materials; at Hanford such sites are used to temporarily isolate the material from the environment

byproduct material - radioactive material produced in a nuclear reactor, ancillary to the reactors main purpose of producing power or fissile materials; fission products are usually considered to be byproduct material

C

caisson - a vertically oriented cylindrical structure used for the subsurface disposal or storage of materials

caliche - an accumulation of calcareous material formed in soil or sediments in arid regions

cask - a container designed for the transporting of radioactive materials, the design usually includes special shielding, handling, and sealing features to provide positive containment of the materials and to minimize exposure of personnel

chemical oxygen demand (COD) - a measure of the extent to which all chemicals contained in a water sample use dissolved oxygen in a given period of time; therefore, a measure of residual dissolved oxygen in the water available for use by organisms such as fish

chemical processing - chemical treatment of materials to separate specific usable constituents; at Hanford, the separation by chemical means of plutonium from uranium and fission products resulting from irradiation of the uranium in a nuclear reactor

coliform (count, number) - a measure of the bacterial content of water; a high coliform count indicates potential contamination of a water supply by human waste.

concentration guide - the average concentration of a radionuclide in air or water to which a worker or member of the general population may be continuously exposed without exceeding appropriate radiation dose standards (see maximum permissible concentration)

confined aquifer - a subsurface water bearing region having defined relatively impermeable upper and lower boundaries and whose pressure is significantly greater than atmospheric throughout

C (CONT'D)

contamination (contaminated material) - the deposition, solvation, or infiltration of radionuclides on or into an object, material, or area whereupon the area, material, or object is considered "contaminated"

controlled area - any specific region of the Hanford Reservation into which entry by personnel is regulated by physical barrier or procedure

counts per minute (cpm) - the number of events per unit time recorded by an instrument designed to detect radioactive particles; especially used to indicate the relative amount of radioactive contamination

crib - a linear excavation of about 15 ft in depth along the bottom of which is laid a perforated pipe, after which the ditch is backfilled with broken rock or other loose material and then covered by soil and a membrane which is impermeable to liquids; the pipe is then used to distribute intermediate-level liquid wastes along the crib

critical - the condition in which a material is undergoing nuclear fission at a self-sustaining rate; the critical mass of a material is that amount which will self-sustain nuclear fission when placed in an optimum arrangement in its present form; the minimum critical mass is the amount of a fissile isotope that will self-sustain nuclear fission when placed in optimum conditions

criticality safety - those procedures and understandings necessary to the handling of fissile materials in a manner that will prevent them from reaching a critical condition

curie (Ci) - a unit of radioactivity defined as the amount of a radioactive material that has an activity of 3.7×10^{10} disintegrations per second (d/s); millicurie (mCi) = 10^{-3} curie; microcurie (μ Ci) = 10^{-6} curie; nanocurie (nCi) = 10^{-9} curie; picocurie (pCi) = μ curie = 10^{-12} curie; femtocurie (fCi) = 10^{-15} curie

D

daughter products - the nuclides formed by the radioactive disintegration of a first nuclide (parent)

deactivated - the condition of a facility or disposal site where steps have been taken to preclude further operation or the further addition of waste materials

decay chain - the sequence of radioactive disintegrations in succession from one nuclide to another until a stable daughter is reached

decay heat - the thermal energy produced in a material by its own radioactive disintegrations

decontamination - the selective removal of radioactive material from a surface or from within another material

D (CONT'D)

decommissioning - the process of removing a facility or area from operation and decontaminating and/or disposing of it.

diastrophism - the process by which the crust of the earth is deformed producing mountains, faults, etc.

dielthermal region - that portion of a body of water whose temperature varies with the daily fluctuating light cycles

dip-slip fault - a fault in which one wall has moved up or down the face of the fault relative to the other; contrasts to strike-slip fault

disintegrations per minute (dpm) - the number of radioactive decay events occurring per unit time in a given amount of material

disposal - the planned release or placement of waste in a manner that precludes recovery

ditch - a linearly oriented excavation; often used for the temporary diversion or disposal of process waste streams

dome - a roughly symmetrical upfold (anticlinal uplift) with beds dipping radially outward with roughly equal amounts from a given point; with the development of an axis, a dome becomes an anticline

dose - a general term indicating the amount of energy absorbed from incident radiation by a specified mass

dose commitment - the integrated dose which results from an intake of radioactive material when the dose is evaluated from the beginning of intake to a later time (usually 50 years); also used for the long term integrated dose to which people are considered committed because radioactive material has been released to the environment

drum - a metal or composition cylindrical container used for the transportation, storage, and disposal of waste materials

dry well - a bore hole that does not sink deep enough to reach groundwater; used to monitor the movement of liquid waste released near the surface and to check for possible leaks in underground waste storage tanks

dummy - a mock-up of a production reactor fuel element, which contains no uranium and is used only for spacing fuel

E

- ecology - that branch of biological science which deals with the relationships between organisms and their environment
- ecosystem - an assemblage of biota (community) and habitat
- enterococci (count) - a measure of the number of a particular group of bacteria present in a water sample; these bacteria are associated with the fecal material of warm blooded animals. an indication (more specific than coliform count) of potential contamination of water by human wastes
- environmental surveillance - a program to monitor the impact on the surrounding region of the discharges from industrial operations
- evapotranspiration - the combined loss of water from soil by evaporation from the soil and from the surfaces of plant structures
- excursion - a sudden rapid increase of power produced when a reactor or other system of fissile material undergoes a sudden increase in reactivity
- exposure - the condition of being made subject to the action of radiation

F

- fallout - those radioactive materials deposited on the earth's surface and in the atmosphere following the detonation of nuclear weapons
- fanglomerate - a mixture of heterogeneous sediments originally deposited in an alluvial fan, subsequently cemented into rock
- fast flux (fast neutron) - a stream of neutrons having energies (velocities) near that imparted to them by a fission event; when applied to nuclear reactors, refers to those using high velocity neutrons to cause successive fission events
- fertile isotope - a nuclide which is particularly capable of being transmuted into another useful nuclide (especially ^{238}U which is transmuted in production reactors to plutonium)
- fissile - material capable of undergoing fission by any process
- fissionable - material capable of undergoing fission by slow neutrons
- fission (nuclear) - the division of a nucleus into two nuclides of lower mass, usually accompanied by the expulsion of gamma rays and neutrons
- fission products - the nuclides formed by the division of a heavier nucleus; most usually in a nuclear reactor

F (CONT'D)

- five hundred year storm - those weather conditions which are characteristic of the worst storm having occurred in an area at any time during the past 500 years used to indicate the probability of recurrence
- food-chain - a linear sequence of successive utilizations of nutrient energy by a series of species
- food-web - the concept of nutrient energy transfers (including decomposition) between species in an ecosystem
- fractionization - the process of removing specific constituents (such as strontium and cesium) from liquid waste
- French drain - a rock filled encasement with an open bottom to allow seepage of liquid waste into the ground
- fuel (nuclear, reactor) - fissionable material used as the source of power when placed in a critical arrangement in a nuclear reactor
- fuel separation (fuel reprocessing) - processing of irradiated (spent) nuclear reactor fuel to recover useful materials as separate products, usually separation into plutonium, uranium, and fission products

G

- gamma radiation - electromagnetic energy emitted in the process of a nuclear transition
- gamma scan - process of measuring the energy spectrum of the gamma rays emitted by a material in order to determine its constituent nuclides
- gastronitestinal dose (GI) - the dose to the stomach and lower tract of humans and animals via external exposure or via internal transport of radioactive material
- GeigerMuller Tube - a gas-filled tube used to detect radiation events by the ionization pulse produced in the gas; used on a GM counter
- glacio-fluviatile - pertaining to streams flowing from glaciers, or the deposits made from such streams
- graben - a geological structure which is a generally linear block bounded by faults on each side, along which the block has dropped, relative to the sides
- groundwater - water which exists or flows below the surface (within the zone of saturation)

H

- habitat - the abiotic characteristics of the place where biota live (see community)
- half-life - the time required for the activity of a radionuclide to decay to half its value; used as a measure of the persistence of radioactive materials, each radionuclide has a characteristic constant half-life
- high efficiency particulate air filter (HEPA) - an air filter capable of removing at least 99.97% of the particulate material in an air stream
- high-heat waste - liquid radioactive waste which generates sufficient fission product decay heat to cause self-boiling and self-concentration (see self-boiling waste)
- high-level liquid waste - fluid materials, disposed of (by storage in underground tanks) from Hanford operations, which are contaminated by greater than 100 $\mu\text{Ci/ml}$ of mixed fission products or more than 2 $\mu\text{Ci/ml}$ of ^{137}Cs , ^{90}Sr , or long-lived alpha emitters
- hood - a canopy and exhaust duct used to confine hazardous materials in order to reduce the exposure of industrial workers
- hydraulic conductivity - the parameter relating the volumetric flux to the driving force in flow through a porous media (particularly water through soil); a function of both the porous medium and the properties of the fluid
- hydraulic potential - a measure of the force present to cause groundwater flow; related to the height of the column of water above the point at which the potential is being measured and the elevation of the point relative to mean sea level
- hydrostatic equilibrium - the state of a fluid where no relative motion occurs between fluid elements and the pressure at any point is equal to the weight of a unit cross-section of a column of fluid above that point.
- hypothetical maximum individual (max man) - a postulated person who is assumed to receive the maximum credible radiological dose through each of the exposure pathways from the source being considered (such as swimming often in a body of water, eating large quantities of fish obtained from that water, and drinking a large amount of water from the same source)

I

inactive - the condition of a facility or disposal site which is not presently being operated or to which materials are not being added

intermediate-level liquid waste - fluid materials, disposed as a result of Hanford operations, which contain from 5×10^{-5} $\mu\text{Ci/ml}$ to $100 \mu\text{Ci/ml}$ of mixed fission products, including less than $2 \mu\text{Ci/ml}$ of ^{137}Cs , ^{90}Sr , or long-lived alpha emitters

inversion - a condition where temperature increases with height in the atmosphere

ion exchange - process for selectively removing a constituent from a waste stream by reversibly transferring ions between an insoluble solid and the waste stream; the exchange medium (usually a column of resin or soil) can then be washed to collect the waste or taken directly to disposal; for example, a hot water softener

irradiation - exposure to radiation by being placed near a radioactive source; usually in the case of fuel materials, being placed in an operating nuclear reactor

isotherm - a line joining points having the same temperature

isotope - nuclides with the same atomic number, (i.e., the same chemical element) but with different atomic masses; although chemical properties are the same, radioactive and nuclear properties may be quite different for each isotope of an element

K

K_{eff} (multiplication factor) - a measure of the degree of sequential change in the number of fission events in a system containing fissionable material; when the multiplication factor is one or greater, a self-sustaining chain reaction is possible; defined by the ratio of the average number of neutrons produced by fission in each generation to the total number of corresponding neutrons lost by absorption and leakage

L

leaching trench - an excavation used for the disposal of liquids so that the soil will remove contaminants while allowing water and other solvents to pass through

lithologic - pertaining to the characteristics and study of rocks

L (CONT'D)

loess - a homogeneous, nonstratified, unindurated sediment, largely silt, deposited primarily by the wind

long-lived isotope - a radioactive nuclide which decays at such a slow rate that a quantity of it will exist for an extended period; usually radionuclides whose half-life is greater than 3 years

low-heat waste - liquid radioactive waste which does not generate sufficient fission product decay heat to boil or self-concentrate

low-level liquid waste - fluid materials, disposed of at Hanford, which are contaminated by less than 5×10^{-5} $\mu\text{Ci/ml}$ of mixed fission products

M

macrophytes - the plant life of a body of water which is larger than microscopic

man-rem - used as a unit of population dose; often the average dose per individual expressed in rems times the population affected

maximum permissible concentration (MPC) - the average concentration of a radionuclide in air or water to which a worker or member of the general population may be continuously exposed without exceeding an established standard of radiation dose limitation

metasediments - sedimentary rocks, such as sandstones and shales, that were subjected to metamorphism sufficient to modify but not to obliterate evidence of their sedimentary origin

metavolcanics - volcanic rocks, such as tuffs and lavas, that were subjected to metamorphism sufficient to modify but not obliterate evidence of their volcanic origin

monocline - a downward flexure in otherwise horizontal strata without any corresponding upfold to form a syncline or anticline

N

neutron - a particle existing in or emitted from the atomic nucleus; it is electrically neutral and has a mass approximately equal to that of a stable hydrogen atom

neutron activation - the process of irradiating a material with neutrons so that the material itself is transformed into a radioactive nuclide

nitrogen oxides (NO_x) - a mixture of nitrogen-oxygen containing compounds formed as gaseous waste effluents during the combustion of most fossil fuels

nuclear fission - see fission

nuclear radiation - particles and electromagnetic energy given off by transformations occurring in the nucleus of an atom

nuclear reactor - a device constructed of fissionable material such that a chain of fission events can be maintained and controlled to meet a particular purpose

N (CONT'D)

nuclide - a species of atom having a specific mass, atomic number and nuclear energy state

nucleus - the positively charged center of an atom

P

palagonite - a hydrated basaltic glass that, in the Pasco Basin, was commonly formed when molten basalt entered water; indicative of an aqueous environment, often associated with pillow lava

partitioning - the process of separating liquid waste into two or more fractional solutions

penetrating radiation - forms of radiant energy which are capable of passing through significant thicknesses of solid material; these usually include gamma rays, x rays and neutrons

periphyton - organisms that live attached to underwater surfaces

permissible dose - that dose of ionizing radiation which, in the light of present knowledge, carries negligible probability of causing severe somatic injury or genetic effect

pH - a measure of the relative acidity or alkalinity of solution; a neutral solution has a pH of 7 acids have pH's of 7 to 1, bases have pH's of 7 to 14

phytoplankton - microscopic plants that live drifting in a body of water

pillow lava - basaltic material congealed in rounded masses, indicative of submarine flows or eruptions

population dose (population exposure) - the summation of individual radiation doses received by all those exposed to the source or event being considered

power reactor - a nuclear reactor designed to produce heat for conversion to electrical energy or mechanical propulsion

present worth - the present worth for a series of expenditures related to a plan of action is the amount of money that would need to be invested on a certain date at a fixed rate of interest in order to provide the required funding to accomplish the action; at the end of the action, the balance of invested money has been reduced to zero and the amount of money invested plus the interest on that money equals the total expenditure to accomplish the action

production reactor - a nuclear reactor designed for transforming one nuclide into another; usually, a conversion of natural uranium into plutonium

Purex - the facility and process which uses steps of solvent extraction and ion exchange for the separation of plutonium and uranium from irradiated production fuels

R

rad - a special unit of measure for the absorbed dose of radiation; one rad equals 100 ergs absorbed per gram of material

radiation (ionizing) - particles and electromagnetic energy emitted by nuclear transformations which are capable of producing ions when interacting with matter; gamma rays and alpha and beta particles are primary examples in Hanford waste

radiation survey - evaluation of an area or object with instruments in order to detect, identify and quantify radioactive materials and radiation fields present

radiation zone - area which contains radioactive materials in quantities significant enough to require control of personnel entry to the area

radioactive (decay) - property of undergoing spontaneous nuclear transformation in which nuclear particles or electromagnetic energy are emitted

radioiodines - isotopes of iodine which are radioactive

radionuclide - a nuclide which is radioactive

radiotoxicity - the property of a material of being able to adversely affect biological organisms through the mechanism of nuclear radiation

radwaste - waste materials which are radioactive

reactivity - a measure of the capability of a system to maintain criticality; systems with high reactivity are capable of undergoing rapid excursions of increasing power; systems with low reactivity will undergo slower excursions; systems with negative reactivity will not become critical

reactor - a nuclear reactor

Redox - a facility and the process for separating plutonium and uranium from irradiated reactor fuels by using successive steps of chemical Reduction Oxidation together with solvent extraction

regolith - rock "waste" or surface mantle of unconsolidated rock debris; in the Pasco Basin, the basin-fill sediments that are the parent materials of the local "soils"

release limit (release guide) - a control number which regulates the concentration or amount of radioactive material released to the environment in an industrial situation; usually dose to persons in the environment derived from environmental behavior of the released material so that the dose is kept below a selected control value

rem - a unit of measure for the dose of ionizing radiation which gives the same biological effect as one roentgen of X rays; one rem approximately equals one rad for X, gamma, or beta radiation

R (CONT'D)

reprocessing - chemical processing of irradiated nuclear reactor fuels to desired constituents

retention basin - an excavated and lined area used to hold contaminated fluids until radioactive decay reduces activities to levels permissible for release

retired facility - a facility which has been shutdown with no intentions of restarting and which has had appropriate controls and safeguards placed on it

roentgen - a unit of measure of ionizing electromagnetic radiation (x and gamma); one roentgen corresponds to the release by ionization of 83.8 ergs of energy per gram of air

rupture - a breach of the metal cladding of a production reactor fuel element thereby releasing radioactive materials to reactor cooling streams

S

salt cake - the solid residue resulting from a concentration of high-level liquid waste in Hanford underground waste storage tanks

sanitary landfill - a burial operation for the purpose of disposing of sanitary sewage

sanitary sewage - human wastes and other nonradioactive material for disposal to preserve public health

scintillation (counter) - light flashes produced in crystalline material by ionizing radiation; measurement of the level of activity of the source

seepage pond - an artificial body of surface water formed by discharge from Hanford process operations

seismicity - the tendency for the occurrence of earthquakes

self-boiling waste - high-level liquid radioactive waste whose constituent radionuclides contribute sufficient decay heat to cause the solution to boil and/or self concentrate

shielding - bulkheads, walls, or other constructions used to absorb radiation in order to protect personnel or equipment

short-lived isotope - a radioactive nuclide which decays so rapidly that a given quantity is transformed into its daughter products within a short period (usually those with a half-life of days or less)

slug - a fuel element for one of the Hanford production reactors

smear - a means of measuring loose surface contamination on an object by wiping it with paper, gauze, etc., and then measuring the disintegrations per minute on the wipe with an instrument

solid wastes (radioactive) - either solid radioactive material or solid objects which contain radioactive material or bear radioactive surface contamination

S (CONT'D)

- sorptive capacity - the measure of a material's ability to sorb specific constituents from a liquid as it passes through the material
- source material - uranium or thorium or any ores which contain at least 0.05% of uranium or thorium
- source term - the quantity of radioactive material, released by an accident or operation, which subsequently causes exposure after some mechanism of transmission or deposition
- special nuclear material (SNM) - plutonium, ^{233}U , ^{235}U , or uranium enriched to a higher percentage than normal of the 233 or 235 isotopes
- special work procedure (SWP) - a formally written procedure for the conduct of work involving radioactive materials
- stability (atmospheric) - a description of the atmospheric forces on a parcel of air following vertical displacement in an atmosphere otherwise in hydrostatic equilibrium; if the forces tend to return the parcel to its original level, the atmosphere is stable; if the forces tend to move the parcel further in the direction of displacement, the atmosphere is unstable, and if the air parcel tends to remain at its new level the atmosphere has neutral stability
- standby - the condition where a facility or burial ground, etc., is placed in a non-operating condition but is maintained in readiness for subsequent operation
- storage basin - a water-filled facility for holding irradiated reactor fuels with the water acting as a shield
- strike-slip fault - a fault in which the movement (offset) has been parallel to the fault's strike; contrasts to dip-slip fault
- sulfur oxides (SO_2 , SO_3) - compounds formed as waste effluents during the burning of some fossil fuels
- synclinal valleys - a structure formed by down warping in geological formations; in a syncline, the rock strata dip towards the fold's axis; the opposite of anticlines which, in central Washington, commonly form ridges

T

- tank - a large metal container located underground for storage of liquid wastes
- tank farm - an installation of interconnected underground containers (tanks) for storage of high-level waste
- taxon (pl. taxa) - a unit of classification (usually biological) of any degree of specificity or generality; e.g., family, order or subspecies
- tectonic - of, pertaining to, or designating the rock structures resulting from deformation of the earth's crust

T (CONT'D)

terminated - the condition of a waste disposal site in which its use is to be discontinued because its capacity has been reached (or for other reasons) specific conditions to be met upon terminating a site are established by AEC Manual RL Appendix 0510

tracer - a radionuclide(s) or chemical introduced in minute quantities to a system or process for the purpose of using radiation or chemical detection techniques to follow the behavior of the process or system

transmutation - the process whereby one nuclide changes (or is changed) into another; usually by the addition of nuclear particles

transuranium - nuclides having an atomic number greater than that of uranium (i. e., greater than 92)

transmissivity - a coefficient relating the volumetric flow through a unit width of groundwater to the driving force (hydraulic potential); a function of both the porous medium, fluid properties, and saturated thickness of the aquifer

trench - a ditch used for the disposal of solid radioactive waste or low-level liquid waste

trophic levels - pertains to groupings of organisms according to characteristics of their intake of nutrition

turbidity - a measure of the degree to which sediments and other foreign matter are suspended in water (cloudiness)

U

unconfined aquifer - an aquifer that has a water table or surface at atmospheric pressure

V

vadose zone - the unsaturated region of soil between the ground surface and the water table

V-trench - a concrete-lined, earth-covered excavation for storing drums containing transuranic bearing solid radioactive waste

W

water table - upper boundary of an unconfined aquifer surface below which saturated groundwater occurs; defined by the levels at which water stands in wells that barely penetrate the aquifer

wind rose - a diagram designed to show the distribution of prevailing wind directions at a given location; some variations include wind speed groupings by direction

Z

zooplankton - microscopic animals that live drifting in a body of water

LIST OF ELEMENTS

ELEMENT	SYMBOL	ATOMIC NUMBER	ELEMENT	SYMBOL	ATOMIC NUMBER
actinium	Ac	89	mercury	Hg	80
aluminum	Al	13	molybdenum	Mo	42
americium	Am	95	neodymium	Nd	60
antimony	Sb	51	neon	Ne	10
argon	Ar	18	neptunium	Np	93
arsenic	As	33	nickel	Ni	28
astatine	At	85	niobium	Nb	41
barium	Ba	56	nitrogen	N	7
berkelium	Bk	97	nobelium	No	102
beryllium	Be	4	osmium	Os	76
bismuth	Bi	83	oxygen	O	8
boron	B	5	palladium	Pd	46
bromine	Br	35	phosphorus	P	15
cadmium	Cd	48	platinum	Pt	78
calcium	Ca	20	plutonium	Pu	94
californium	Cf	98	polonium	Po	84
carbon	C	6	potassium	K	19
cerium	Ce	58	praseodymium	Pr	59
cesium	Cs	55	promethium	Pm	61
chlorine	Cl	17	protactinium	Pa	91
chromium	Cr	24	radium	Ra	88
cobalt	Co	27	radon	Rn	86
columbium	Nb	(see niobium)	rhenium	Re	75
copper	Cu	29	rhodium	Rh	45
curium	Cm	96	rubidium	Rb	37
dysprosium	Dy	16	ruthenium	Ru	44
einsteinium	Es	99	samarium	Sm	62
erbium	Er	68	scandium	Sc	21
europium	Eu	63	selenium	Se	34
fermium	Fm	100	silicon	Si	14
fluorine	F	9	silver	Ag	47
francium	Fr	87	sodium	Na	11
gadolinium	Gd	64	strontium	Sr	38
gallium	Ga	31	sulfur	S	16
germanium	Ge	32	tantalum	Ta	73
gold	Au	79	technetium	Tc	43
hafnium	Hf	72	tellurium	Te	52
helium	He	2	terbium	Tb	65
holmium	Ho	67	thallium	Tl	81
hydrogen	H	1	thorium	Th	90
indium	In	49	thulium	Tm	69
iodine	I	53	tin	Sn	50
iridium	Ir	77	titanium	Ti	22
iron	Fe	26	tungsten	W	74
krypton	Kr	36	uranium	U	92
lanthanum	La	57	vanadium	V	23
lawrencium	Lw	103	wolfram	W	(see tungsten)
lead	Pb	82	xenon	Xe	54
lithium	Li	3	ytterbium	Yb	70
lutetium	Lu	71	yttrium	Y	39
magnesium	Mg	12	zinc	Zn	30
manganese	Mn	25	zirconium	Zr	40
mendelevium	Md	101			