

FOR ORIGINAL

BEFORE THE UNITED STATES NUCLEAR REGULATORY COMMISSION

In the matter of )

Shallow land burial of low- )  
level radioactive wastes )

NRC Docket No. PRM-20-7

PETITION OF THE  
NATURAL RESOURCES DEFENSE COUNCIL  
TO ADOPT INTERIM REGULATIONS GOVERNING  
DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

**POOR ORIGINAL**

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The Natural Resources Defense Council, Inc., ("NRDC"), on its own behalf and on behalf of its members, hereby petitions the Nuclear Regulatory Commission ("NRC") to act immediately to adopt interim regulations setting needed standards for shallow land disposal of low-level radioactive wastes. These regulations are needed to ensure adequately safe disposal of certain long-lived radioactive wastes, to bring NRC's regulatory provisions into conformance with safety measures already adopted by the U.S. Energy Research and Development Administration ("ERDA"), and to assure that safe disposal methods for low-level wastes can be adopted following preparation of an environmental impact statement by NRC on its entire program for disposing of low-level radioactive wastes. This petition is filed pursuant to 5 U.S.C. § 553(e) (1970) and 10 C.F.R. § 2.302 (1973).

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SUMMARY OF ACTION

Specifically, petitioner requests that NRC adopt the regulations set out in Appendix A to this petition. The proposed regulations would require the following:

A. Long-Lived, Transuranic-Contaminated Wastes

- (1) the transfer of regulatory authority over long-lived transuranic wastes from the states to NRC;
- (2) an immediate end to burial of long-lived transuranic wastes with only retrievable storage permitted;
- (3) payment of fees by persons that produce transuranic wastes to finance adequately safe permanent disposal;
- (4) establishment of a reporting and inspection system operated by NRC (with on-site, unannounced inspection by NRC inspectors) to assure accurate classification of transuranic wastes;

B. Other Low-Level Radioactive Wastes

- (5) the suspension of licensing of new or enlarged burial sites until NRC establishes site selection criteria, radioactive release standards setting

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maximum permissible migration rates for radionuclides away from disposal sites, minimum standards for environmental monitoring programs, and standards for long-term care with mechanisms to finance such care;

- (6) establishment of minimum fees to be paid effective immediately for each cubic foot of waste buried at existing sites to assure adequate funds for long-term care;

C. Solidification of Low-Level Radioactive Wastes Before Shipment

- (7) the solidification of all radioactive wastes before shipment to reduce the potential for release to the environment either through accident or sabotage.

Petitioner urges the Commission to adopt forthwith these regulations, which are needed immediately as interim measures. In the attached Memorandum, petitioner sets out the severe problems and uncertainties that have recently been identified in present methods of disposing of low-level wastes. Based on these problems, petitioner has requested that the Commission undertake a full-scale evaluation of the entire low-level waste disposal program. Before the Commission can adopt a satisfactory set of comprehensive regulations, however, new studies must be

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completed and a final environmental impact statement filed with the Council on Environmental Quality. The present petition seeks the prompt Commission action needed to preserve the capability to dispose safely of low-level wastes until the necessary studies and environmental impact statement are completed.

THE PETITIONER

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Petitioner Natural Resources Defense Council, Inc., is a non-profit, membership corporation organized under the laws of the State of New York. NRDC is a charitable organization exempt from taxation under Section 501(c)(3) of the Internal Revenue Code. NRDC's principal office and place of business is located at 15 West 44th Street, New York, New York. It maintains other offices at 917 15th Street, N.W., Washington, D.C., and at 2345 Yale Street, Palo Alto, California. NRDC has a nationwide membership of persons dedicated to the defense and preservation of the human environment and the natural resources of the United States. Other persons support NRDC's objectives by financial contributions and personal efforts.

The objectives of NRDC include:

- (a) to maintain and enhance the quality of the human environment;
- (b) to monitor federal departments and regulatory agencies to ensure that environmental values are fully considered in decisionmaking, and, in particular, to ensure that federal statutes designed to protect and

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enhance the environment are fully and properly implemented;

(c) to improve federal agency decisionmaking which affects the environment by commenting, furnishing information, and initiating and participating in administrative proceedings;

(d) to select and undertake environmental lawsuits which have a potential for establishing widely applicable precedents for saving, reclaiming, or protecting some important aspect of our national endowment, including the health and safety of the public; and

(e) to provide a central, national focus for scientists, lawyers, educators, and concerned citizens in an effort to make our courts and administrative agencies effective instruments of environmental protection.

In pursuit of its objectives, NRDC has been involved in many proceedings involving the Atomic Energy Commission and now the Nuclear Regulatory Commission.

PETITIONER'S INTEREST IN  
THE PROCEEDING

NRDC's basic interest in the captioned proceeding is twofold: (1) to protect present and future NRDC members, their

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progeny, and the public by ensuring the public is adequately protected from increased risks of cancer and genetic mutations that might be produced by improper and unsafe disposal of substantial amounts of low-level radioactive wastes; and (2) to protect present and future NRDC members, their progeny, and the public who live or travel near to disposal sites for low-level radioactive wastes by ensuring that disposal practices provide adequate protection against off-site migration of radioactivity.

BASIS FOR REQUEST

The basis for petitioner's request is set out in full in the Memorandum attached to this Petition. Briefly stated, however, petitioner alleges the following facts in support of its petition:

(1) Two of the six existing commercially operated low-level waste disposal sites have experienced migration of radio-nuclides away from the burial trenches, less than 15 years after wastes were buried.<sup>1/</sup>

(2) Evidence from one commercial disposal site suggests that plutonium has migrated from the burial site to surrounding

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<sup>1/</sup> Comptroller General of the U.S., Improvements Needed in the Land Disposal of Radioactive Wastes -- A Problem of Centuries, at 14 (General Accounting Office 1976) (hereinafter cited as GAC Report); Report of the Nuclear Regulatory Commission Review Group Regarding Maxey Flats, Kentucky Commercial Radioactive Waste Burial Ground, at 2 (July 7, 1975) (hereinafter cited as NRC Review Group Report).

areas.<sup>2/</sup>

(3) The six existing burial sites were selected without adequate study of the geological, hydrological, topographical and meteorological conditions of the areas in which the sites were located.<sup>3/</sup>

(4) Environmental monitoring programs at several existing waste disposal sites are seriously inadequate.<sup>4/</sup>

(5) Improper practices at existing burial sites have been corrected only extremely slowly and sometimes not at all.<sup>5/</sup>

(6) A radioactive liquid storage tank at one disposal site has already been the subject of sabotage or vandalism.<sup>6/</sup>

(7) Plans and funding arrangements for long-term surveillance of the disposal sites are grossly inadequate at several of the existing commercial burial grounds.<sup>7/</sup>

(8) No site selection criteria or other standards governing the operation of low-level waste burial grounds currently exist.<sup>8/</sup>

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<sup>2/</sup> U.S. Environmental Protection Agency, Preliminary Data on the Occurrence of Transuranium Nuclides in the Environment at the Radioactive Waste Burial Site, Maxey Flats, Kentucky, at 23-26, 30-31 (1976) (EPA-520/3-75-021).

<sup>3/</sup> GAO Report, supra note 1, at 9-18; U.S. Environmental Protection Agency, Comments on Environmental Statement, Liquid Metal Fast Breeder Reactor Program, at 25 (April, 1974). See, G. DeBuchanne, Geohydrologic Considerations in the Management of Radioactive Waste, in 24 Nuclear Technology 336, 358 (Dec. 1974).

<sup>4/</sup> GAO Report, supra note 1, at 22-26.

<sup>5/</sup> Id., at 26-30.

<sup>6/</sup> NRC Review Group Report, supra note 1, at 4.

<sup>7/</sup> GAO Report, supra note 1, at 34-39.

<sup>8/</sup> Id., at 13.



(9) The U.S. Energy Research and Development Administration which operates burial grounds for the low-level radioactive waste generated by the federal government has prohibited the burial of waste contaminated by transuranic elements. ERDA currently requires storage of such waste so that it can be retrieved within 20 years.<sup>9/</sup>

(10) The Atomic Energy Commission proposed regulations prohibiting the burial of transuranic-contaminated waste at commercial burial grounds in September, 1974, but never made these regulations final.<sup>10/</sup>

Petitioner alleges that both the Nuclear Regulatory Commission and the U.S. Energy Research and Development Administration have recently agreed with the General Accounting Office of Congress that the following steps are needed:

(1) "A comprehensive study of existing commercial and ERDA disposal sites to better evaluate their ability to retain radioactive waste."<sup>11/</sup>

(2) The development of standards for disposal sites "which provide clear criteria as to when radioactivity migration reaches an unacceptable level and corrective actions are needed."<sup>12/</sup>

(3) An evaluation of "the effectiveness of monitoring programs at existing disposal sites" with redesign as needed.

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<sup>9/</sup> Energy Research and Development Administration, Manual, Ch. 0511-044(d)(4) (1973).

<sup>10/</sup> 39 Federal Register 32921 (September, 1974).

<sup>11/</sup> GAO Report, supra note 1, at 13.

<sup>12/</sup> Id., at 21.

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"NRC agreed that the environmental monitoring programs at certain burial sites needed improvement."<sup>13/</sup>

(4) Regulatory action to correct specific problems, including slow progress in state action to remedy identified problems; a lack of timely and effective licensing actions; the absence of independent monitoring programs; and the absence of good recordkeeping practices at disposal sites.<sup>14/</sup>

The above facts and the Commission's own acknowledgement of the serious shortcomings in the nation's current program for disposing of low-level radioactive wastes require the Commission to take both long-term and short-term action. Broadly, NRC must undertake a thorough study of the entire low-level waste disposal program, including the preparation of an environmental impact statement pursuant to the National Environmental Policy Act of 1970. More importantly, however, the present petition is directed to the need for immediate action by the Commission.

Petitioner believes the existing evidence summarized above and set out in greater detail in the attached Memorandum compels the Commission to act promptly in the following areas to carry out its obligations under the Atomic Energy Act of 1954, 42 U.S.C. §§ 2011, et seq. (1970) and the Energy Reorganization Act of 1974, 42 U.S.C. §§ 5801, et seq. (Supp. III 1975).

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<sup>13/</sup> Id., at 25-26.

<sup>14/</sup> Id., at 26-33.

A. Transuranic-Contaminated Wastes

The evidence indicating that radionuclides have migrated less than 15 years after burial must be interpreted in light of the extreme toxicity and long half-lives of transuranic elements. The risk inherent in continued burial of transuranics compels the Commission to prohibit immediately any further burial of wastes contaminated with these radionuclides. The Commission must require that transuranic-contaminated waste be stored in a retrievable form to preserve the capability to dispose of such waste safely by whatever method the Commission ultimately determines to be required. ERDA has already required such steps in handling waste generated by the government. The AEC proposed such a prohibition for commercial wastes, but went out of existence before promulgating these regulations in final form. NRC action is now long overdue.

To implement this prohibition, the Commission must adopt regulations which revoke the right of the states to regulate disposal of wastes containing transuranics and reassert the Commission's authority over such wastes. In addition, the Commission must require that such wastes be stored so that they will remain retrievable for at least 20 years and that industries producing such wastes pay a fee to finance safe terminal disposal. Subject to revision after study by the Commission, this fee should be set immediately at \$57 per cubic foot of waste.<sup>15/</sup>

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<sup>15/</sup> See, Ramsey, Daly, Blasewitz, Cooley, Richardson, Overview of Management Programs for Plutonium-Contaminated Solid Waste in the U.S.A., in Management of Plutonium-Contaminated Solid Wastes, at 76 (OECD Nuclear Energy Agency, 1974).

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the Commission must establish an enforcement mechanism to assure that all such wastes are properly identified. Adequate enforcement will require an inspection system staffed by NRC inspectors that carries a physical measurement of wastes to guarantee proper identification.

B. Suspension of Licensing of New Burial Grounds

The U.S. Environmental Protection Agency, the U.S. Geological Survey, the General Accounting Office and others have now identified extreme uncertainties as to whether the present sites selected for disposal of low-level waste provide acceptable isolation. These uncertainties bear directly on questions of public health and safety and require that the Commission not license further disposal sites until it has established the following standards:

- \* Minimum site selection criteria for proposed sites based on topographical, geographical, ecological, geological, hydrological and meteorological characteristics;
- \* Radioactive release standards for burial sites establishing maximum permissible migration rates for radionuclides which, if exceeded, will require corrective action;
- \* Standards establishing minimum requirements for environmental monitoring programs at disposal sites; and
- \* Specifications of the type of long-term surveillance required at disposal sites and of

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the fees that must be paid per cubic foot of waste buried to finance the costs of long-term care and surveillance.

C. Immediate Payment of Interim Fees to Cover Long-Term Care

Currently, persons shipping low-level waste to the NRC-licensed disposal site at Sheffield, Illinois pay only five cents per cubic foot of waste buried to cover the cost of perpetual care of the site. These funds are now placed in the general treasury of the State of Illinois which owns the land on which the disposal site is located. The GAO's low-level waste report found that this fee was too low to generate the money necessary to pay for perpetual care of the site. Moreover, since the money isn't paid into a special account but into the Illinois' general treasury, there is no guarantee that the fees paid will be available for long-term care.<sup>16/</sup>

Based on charges established by the State of New York and proposed by a special study committee in South Carolina,<sup>17/</sup> the Commission should immediately require that disposal site licensees collect a minimum charge of fifteen cents per cubic foot of waste buried to pay for perpetual care of the disposal site. This charge should be revised as soon as the Commission can complete a

<sup>16/</sup> See GAO Report, supra note 1, at 34-36.

<sup>17/</sup> See GAO Report, supra note 1, at 35; Grant, Hite, and Shealy, "Economic Analysis of Funding Arrangements for Maintenance, Surveillance, and Contingency Costs Associated with Burial of Low-Level Radioactive Wastes in South Carolina." (Dec. 1974).

thorough study and review of the financing necessary to fund adequately perpetual care of the disposal site. In addition, the Commission should not permit further burial unless these funds are deposited by the land owner into a special, interest-bearing escrow account dedicated to the sole purpose of financing safe perpetual management of the disposal site.

D. Extension of these Requirements to States

The Atomic Energy Act permits the Commission to delegate to the states the authority to regulate, among other things, low-level waste disposal sites. Such delegation is authorized only if the states' programs are (1) adequate to protect public health and safety, and (2) compatible with the Commission's program for the regulation of radioactive materials. See 42 U.S.C. § 2021(d) (1970). The Commission should adopt a regulation finding that the interim regulations proposed in this petition are essential to protect the public health and safety and central to the Commission's program for the regulation of radioactive materials. Such a regulation would have the effect of requiring that the states, which regulate five of the six existing burial sites, adopt equivalent regulations that (1) suspend the issuance of new licenses for disposal sites and (2) require immediately the payment of fees adequate to cover long-term costs.

Failure of a state to act would in effect require the Commission to initiate proceedings under section 274(j) of the Act, 42 U.S.C. § 2021(j) (1970), to terminate its agreement to delegate regulatory power to the state involved.

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E. Prohibition of Shipment of Liquids

Experience at the disposal sites strongly suggests that the presence of liquids in low-level wastes has been the critical factor in producing migration of radionuclides from the location where they were buried.<sup>18/</sup> In addition, in what was apparently a deliberate act of vandalism or sabotage, the contents of a tank of radioactive liquid was released into the ground at one disposal site.<sup>19/</sup> Since the waste was liquid, it could not be effectively recovered. Plainly, burial of radioactive liquids should not be permitted. But equally importantly, shipment and storage of low-level radioactive waste in liquid form creates an unnecessary risk of release of the radioactivity to the environment. To eliminate this unnecessary hazard, the Commission should act immediately to require that all radioactive waste material shipped to a disposal site be shipped as a solid.

CONCLUSION

For the reasons summarized above and set out at greater length in the attached Memorandum, petitioners request the Commission to adopt the regulations set out in Appendix A to

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<sup>18/</sup> See GAO Report, supra note 1, at 14-15.

<sup>19/</sup> NRC Review Group Report, supra note 1, at 4.

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this Petition, or their equivalent.

Respectfully submitted,

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DATED: August 6, 1976

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APPENDIX

PROPOSED REGULATIONS

A. Proposed Regulations Requiring Interim NRC Regulation of the Storage of All Transuranic Wastes, Requiring Retrievable Storage of All Such Wastes, Requiring Payments to Cover Future Disposal Costs, and Providing for Reporting and Inspection of the Classification of Such Wastes.

1. Section 150.15(a) of 10 C.F.R. Part 20 is amended to a new subparagraph (7) to read as follows:

§ 150.15 Persons not exempt

(a) \* \* \*

\* \* \* \*

(7) The disposal or storage of transuranic elements (atomic number greater than 92) on land.

2. Section 20.302 of 10 C.F.R. Part 20 is amended by adding new paragraphs (d) and (e) to read as follows:

§ 20.302 Method for obtaining approval of proposed disposal procedures

\* \* \* \*

(d)(1) Pending determination by the Commission of adequately safe means for permanent isolation of wastes containing or contaminated with transuranic elements, the Commission shall not authorize non-retrievable disposal of such wastes on land. The Commission will not approve any application for a license or license amendment for interim storage of transuranic elements (atomic number greater than 92) except as provided in subparagraph (2).

(d) (2) Waste containing or contaminated with transuranic elements may not be stored at disposal sites unless

(i) such waste is consigned to specially marked areas of the burial site;

(ii) every container of such waste is clearly labeled on its exterior surface to indicate total transuranic and radioactive content, the concentration and chemical form of the transuranic and other significant radionuclides present in the container in the greatest concentrations, combustibility, compactibility, and container weight;

(iii) permanent records are maintained for each waste container reflecting the general nature of its contents, total transuranic and radioactive content, the concentration and chemical form of the transuranic and other significant radionuclides present in the container in the greatest concentrations, combustibility, compactibility, container weight, and storage location, and each waste container is labeled so that the waste contained can be identified by cross-reference to such

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permanent records; and

(iv) such waste is packaged in containers so designed and constructed that, after 20 years of storage:

(A) there will be no release of radioactive material from the container;

(B) the effectiveness of the packaging will not be significantly reduced;

(C) the labeling on the outside of each container will be readily identifiable; and

(D) the container will withstand expected stresses involved in retrieval operations and shipment to a final repository with no release of radioactive material.

(d)(3) As used in this paragraph, wastes containing or contaminated with transuranic elements means those wastes contaminated with alpha-emitting radionuclides with atomic number greater than 92 to greater than 10 nanocuries/gram (10 microcuries/kilogram), subject to the following conditions and understandings:

(i) These radionuclides include, but are not limited to, plutonium,

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and transplutonium nuclides;

(ii) The activity density may be averaged over the contents of individual shipping containers, such as 55-gallon drums, including materials added for shielding or sorption of liquids. Late discovery (for example, on recalculation of data) that an individual container is above this level will not be considered as necessitating its retrieval provided there is reasonable assurance that the average of the container and the balance of the associated containers is below the 10nCi/g level;

(iii) No material may be added to waste material for the purpose of reducing the concentration of transuranic radionuclides. Addition of materials needed for sorption of liquids or for shielding shall not be considered as material added for the purpose of reducing the concentration of transuranic radionuclides; and

(iv) For typical Pu-239 waste at this activity density, it is recognized that indirect measurements or estimates and administrative controls must be used instead of direct external measurements. An example of

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such administrative controls is the establishment of specific in-plant working areas from which typical wastes have been established by suitable studies as either being above or below the control value.

- (d) (4) (i) Within 90 days of the effective date of these regulations, every licensee proposing to ship licensed or other radioactive material to a licensed burial ground for disposal or storage on land shall file with the Commission a description of the direct or indirect measuring procedures, estimating procedures, or administrative controls that will be used to identify those wastes containing or contaminated by transuranic elements and those wastes not so contaminated. The Commission shall not approve such methods unless it determines they are substantially certain to identify accurately those wastes containing or contaminated with transuranic elements.

(ii) Effective 180 days after the effective date of this regulation, no licensee shall ship wastes containing or contaminated with licensed or other radioactive

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material to a burial site for disposal or storage on land unless the radioactive content of such waste has been measured, estimated or determined by methods approved by the Commission.

(iii) At least once annually, a Commission inspector shall make an unannounced inspection tour of each licensee generating waste materials containing or contaminated with licensed or other radioactive materials to determine whether the approved procedures are being followed and, by appropriate physical measurement, whether the approved procedures actually result in the accurate identification of all wastes containing or contaminated with transuranic elements.

(e)(1) The Commission shall not approve any application for a license to receive waste materials containing or contaminated with transuranic elements for storage on land unless the licensee obligates himself to collect a financial fee applicable to such wastes as required by subparagraph (e)(2).

(e)(2) Prior to accepting, for retrievable storage, any waste containing or contaminated with transuranic elements, each licensee

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shall require the person shipping such wastes to pay a special fee in the amount of \$50 per cubic foot of such waste delivered for burial.

(e) (3) The amount of this fee shall be revised by the Commission within one year of the effective date of this paragraph to assure that the fee will be sufficient to cover potential costs of ultimate disposal of the waste, including the cost of:

- (i) Storage and retrieval of the wastes;
- (ii) Packaging of the wastes for shipment to a final repository;
- (iii) Loading of the wastes and shipment to a final repository; and
- (iv) A pro rata share of the projected cost of constructing and operating a final repository.
- (v) An allowance for extraordinary costs that may be necessitated by future safety considerations.

(e) (4) The amount of the fee shall be revised by the Commission based on the best projection of anticipated terminal disposal methods and costs, and shall be reviewed annually by the Commission to adjust for changes in projected terminal disposal methods and costs.

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(e)(5) The fee shall be placed in a special trust account by the licensee to be available to finance appropriately safe disposal of the transuranic wastes stored by the licensee.

3. The introductory paragraph and paragraph (a) of § 20.304 are amended to read as follows:

§ 20.304 Disposal by burial in soil

No licensee shall dispose of licensed material by burial in soil unless:

(a) The total quantity of licensed and other radioactive materials buried at any one location and time does not exceed at the time of burial, one thousand times the amount specified in Appendix C of this part and does not contain and is not contaminated with transuranic elements (atomic number greater than 92); and

\* \* \* \*

3. Proposed Regulation Prohibiting Licensing of Additional Land Disposal Sites Until the Commission has Developed Needed Criteria for Site Selection, Disposal Site Radiation Standards, Site Monitoring Programs, and Long-Term Care Requirements and Funding Arrangements

§ 20.302 of 10 C.F.R. Part 20 is amended by adding a new paragraph (f) to read as follows:

§ 20.302 Method for obtaining approval for proposed disposal procedures

(f) The Commission will not approve any application for a license (or the renewal of a license) to receive waste material containing licensed or other radioactive material from other persons for disposal on land or permit any licensee holding such a license to expand operations until the Commission has published

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regulations setting forth the criteria for the following:

- (1) Minimum site selection criteria in terms of the geographical, topographical, geological, meteorological, hydrological, and ecological characteristics of proposed sites;
- (2) Radioactive release standards for disposal sites establishing maximum permissible migration rates for radionuclides which, if exceeded, will require corrective action;
- (3) Standards establishing minimum requirements for environmental monitoring programs at disposal sites; and
- (4) Regulations specifying the type of long-term surveillance required and establishing the amounts that the disposal site licensee must contribute per cubic foot of waste buried to pay for the costs of long-term care.

C. Proposed Regulations Requiring Interim Payment of Fees To Assure Adequate Long-Term Care and Surveillance of Disposal Sites, and Requiring Reports on Burials of Licensed Material not sent to Disposal Sites

1. Section 20.302 of 10 C.F.R. Part 20 is amended by adding a new paragraph (g) to read as follows:

§ 20.302 Method for obtaining approval of proposed disposal procedures

\* \* \* \*

(g) No licensee shall continue to receive licensed or other radioactive materials from other persons for disposal on land pursuant to a license issued under this section unless:

(1) The licensee obligates itself to pay fifteen cents for each cubic foot of waste buried to the owner of the burial site to cover the costs of long-term surveillance and care;

(2) The owner of the burial site has agreed to establish an escrow account dedicated to perpetual care and surveillance of the disposal site to receive the payments required under subparagraph (g) (1).

The Commission will undertake immediately a study to determine whether the amount specified in subparagraph (1) is sufficient to cover all costs for perpetual care and maintenance of the site and will revise the figure accordingly.

2. Part 20 of 10 C.F.R. is amended by adding a new § 20.404 to read as follows:

§ 20.404 Reports of burial of licensed materials

(a) Any licensee that disposes of licensed material by burial in soil pursuant to § 20.304 shall make a report to the Commission within 30 days of the

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close of each calendar year on the nature and quantities of material involved in such burials.

(b) The reports required by paragraph (a) shall be based upon the records maintained pursuant to section 20.401 (b) and shall report the total volume of material buried during the reporting period and describe to the greatest extent practical the amount and type (by radionuclide if practical) of licensed material contained therein. If the reports are not based on actual physical measurement of the radioactive materials present in the buried waste, the reports shall describe any estimating or indirect measurement procedures utilized.

D. Proposed Regulations Extending Requirements to Agreement State Program

Section 20.302 of 10 C.F.R. Part 20 is amended by adding a new paragraph (h) to read as follows:

§ 20.302 Method for obtaining approval of proposed disposal procedures

\* \* \* \*

(h) The Commission hereby declares and finds that the requirements set forth in its regulations governing disposal procedures for disposal of licensed or other radioactive materials on land set forth in 10 C.F.R. Part 20, at §§ 20.301, 20.302, and 20.304 are essential to

protect the public health and safety and are central to the Commission's program for the regulation of source, by-product and special nuclear materials.

E. Proposed Regulation Requiring Solidification of All Liquid Radioactive Wastes Before Shipment to a Commercial Waste Disposal Site

A new section 71.43 is added to Title 10, Code of Federal Regulation, Chapter 1, to read as follows:

§ 71.43 Solidification of radioactive waste shipments to licensed waste disposal sites

Notwithstanding any other provisions of this Part, all waste material containing or contaminated with licensed or other radioactive materials shipped to licensed commercial burial grounds for storage or disposal, shall be shipped as a solid.

F. Regulations Prohibiting Disposal of Transuranic Contaminated Waste at Sea

Section 20.302(c) of 10 C.F.R. Part 20 is amended to read as follows:

§ 20.302 Method for obtaining approval of proposed disposal procedures

\* \* \* \*

(c) The Commission will not approve any application for a license for disposal of licensed material at sea unless the applicant shows that such material does not contain and is not contaminated with transuranic elements and that sea disposal offers less harm to man or the environment than other practical alternative methods of disposal.

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BEFORE THE UNITED STATES NUCLEAR REGULATORY COMMISSION

Petition for Rulemaking and Request )  
for a Programmatic Environmental )  
Impact Statement Regarding NRC )  
Licensing of Disposal of Low-Level )  
Radioactive Wastes )  

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MEMORANDUM OF POINTS AND AUTHORITIES  
IN SUPPORT OF THE  
NATURAL RESOURCES DEFENSE COUNCIL'S  
PETITION FOR RULEMAKING AND REQUEST  
FOR A PROGRAMMATIC ENVIRONMENTAL  
IMPACT STATEMENT

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BEFORE THE UNITED STATES NUCLEAR REGULATORY COMMISSION

Petition for Rulemaking and Request )  
for a Programmatic Environmental )  
Impact Statement Regarding NRC )  
Licensing of Disposal of Low-Level )  
Radioactive Wastes )  

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MEMORANDUM OF POINTS AND AUTHORITIES  
IN SUPPORT OF THE  
NATURAL RESOURCES DEFENSE COUNCIL'S  
PETITION FOR RULEMAKING AND REQUEST  
FOR A PROGRAMMATIC ENVIRONMENTAL  
IMPACT STATEMENT

I. INTRODUCTION AND SUMMARY

Highly toxic radioactive wastes are produced at many stages in the uranium fuel cycle. Until very recently, however, research efforts, regulatory actions and public attention were focused almost exclusively on the problem of how to store the high-level radioactive wastes left over when irradiated fuel rods ("spent fuel") from nuclear power plants are chemically processed to recover fissionable uranium and plutonium. The large potential hazards posed by the other radioactive wastes produced in the nuclear fuel cycle have been largely ignored. In March, 1975, the Natural Resources Defense Council (NRDC)



petitioned the Nuclear Regulatory Commission (NRC) to take action to assure adequate handling of uranium mill tailings.<sup>1/</sup> This Memorandum concerns another major waste disposal problem that requires immediate attention and appropriate regulatory response -- the disposal of "low-level" radioactive wastes.

Currently, low-level radioactive wastes are generally delivered to commercial companies for disposal by burial in shallow earthen trenches. These disposal practices are now regulated on an inadequate ad hoc basis, without sufficient technical analysis of the hazards posed by the wastes and the long-term adequacy of the means of disposal. The past inadequate regulation of commercial low-level burial sites has already produced a potentially dangerous situation that may lead to unnecessary, unwarranted and unhealthful contamination of the human environment by the long-lived radionuclides in the wastes. Unless the NRC immediately takes corrective steps and adopts a comprehensive regulatory program for managing low-level radioactive wastes, serious fouling of the environment may occur, posing a grave potential threat to the public health and safety.

By the end of 1975, more than 13 million cubic feet of radioactive wastes, containing about 80 kilograms of plutonium, had been buried in six locations throughout the United

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<sup>1/</sup> 40 Fed. Reg. 20983 (May 14, 1975); 41 Fed. Reg. 22430 (June 3, 1976).

States.<sup>2/</sup> These wastes include a wide variety of materials, such as paper trash, ion exchange resins, glassware, etc., containing many different radioactive elements and isotopes.

Unfortunately, procedures once claimed to be safe are now proving inadequate and potentially dangerous.<sup>3/</sup> Recent events and studies strongly suggest that shallow land burial is not an acceptable disposal practice for all the radioactive wastes that are currently classified as low-level. Indeed, the Energy Research and Development Administration (ERDA) has prohibited the permanent burial of transuranic wastes at government facilities and has an active program for exhuming some transuranic wastes and evaluating the possibility of retrieving more such wastes.<sup>4/</sup>

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<sup>2/</sup> Hearings on Low-Level Radioactive Waste Disposal Before The Conservation, Energy, and Natural Resources Subcomm. of the Comm. on Government Operations, 94th Cong., 2d Sess., at 213 (1976) [hereinafter cited as Hearings]. Low-level radioactive waste is also being buried by the federal government at many of its nuclear installations around the country. The U.S. Energy Research and Development Administration operates "major" burial operations at its Hanford Reservation in Washington, the Idaho National Engineering Laboratory (INEL), the Los Alamos Scientific Laboratory, the Oak Ridge National Laboratory, and the Savannah River Plant. Id., at 237-239. The present Memorandum addresses only the commercial low-level waste disposal program and does not address many similar problems which exist in the government's program.

<sup>3/</sup> Id., at 90, 112-114.

<sup>4/</sup> U.S. Atomic Energy Commission, Draft Environmental Statement, Management of Commercial High-Level and Transuranium Contaminated Radioactive Wastes, September 1974, at 2.4-10 (WASH-1539); U.S. Energy Research and Development Administration, Draft Environmental Statement, Waste Management Operations, Idaho National Engineering Laboratory, Idaho, June 1976, at 11-221-22 (ERDA-1536).

The inadequacies of the present regulatory program can be traced primarily to three factors: (1) no detailed, comprehensive assessment has been made of the hazards posed by radionuclides contained in low-level waste; (2) there has been virtually no analysis of the specific land burial methods and procedures which should be utilized; and (3) insufficient study has been made of the geology, hydrology, and other important environmental factors of burial site areas. As a result, some radioactive materials with extremely long half-lives have been placed in low-level waste burial trenches without sufficient assurance that they will remain effectively isolated from the environment for the necessary hundreds, thousands, or even hundreds of thousands of years. In fact, recent studies strongly suggest that measurable migration of radionuclides has already occurred at two of the existing commercial burial sites.<sup>5/</sup>

If the nation's reliance on nuclear power to generate electricity continues to grow, enormously increased amounts of low-level wastes will soon be generated. Furthermore, the magnitude of the low-level waste burial problem may soon be substantially increased by a decision currently under consideration by NRC, to permit large-scale reprocessing of spent fuel and recycling of plutonium. Because of the potentially large environmental and health hazards, it is imperative that NRC undertake an extensive and careful study before further disposal

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<sup>5/</sup> See pages 28-32, infra.

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of certain wastes proceeds.

The Comptroller General of the United States has recently submitted a report to Congress which substantiates the need for a detailed risk-benefit study of land disposal of radioactive wastes. This report stated the General Accounting Office's conclusion as follows:

"Because (1) disposal sites must retain radioactivity for an extremely long time, (2) migration has already been detected at some sites, and (3) the USGS and EPA earth scientists have questioned the adequacy of the studies made at some existing sites, a comprehensive study should be undertaken at both ERDA-owned and commercial sites. If the public is willing to accept the risks of land disposal of radioactive materials, it has a right to assurance that radioactivity will be disposed of only at sites which are expected to retain it and prevent it from becoming a public hazard. The public also has a right to expect at least a consensus among earth scientists that disposal sites are suitable." <sup>6/</sup>

Such a study must include a broadly based examination of the environmental risks posed by low-level waste disposal and a thorough analysis of all possible alternative means of safely disposing of these wastes, with detailed evaluations of the environmental and economic consequences of each alternative. The logical forum for this examination is a programmatic

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<sup>6/</sup> Comptroller General of the United States, Report to the Congress, Improvements Needed in the Land Disposal of Radioactive Wastes -- A Problem of Centuries, at 17 (January 11, 1976) (REP-76-34) [hereinafter cited as GAO Report].

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environmental impact statement covering all aspects of the low-level waste disposal program.

Moreover, aside from the obvious wisdom of undertaking this analysis, the National Environmental Policy Act of 1970, 42 U.S.C. §§ 4321 et seq. (1970), requires such a statement. In preparing this analysis, NRC must view the problem in its broadest and most comprehensive terms, considering all relevant questions and reasonable alternatives without being confined by past practices and decisions.

Until this important study has been completed and its results evaluated, immediate regulatory steps must be taken to assure (1) that the practices permitted in the interim are safe, and (2) that these interim disposal practices do not foreclose options that may be adopted at the conclusion of the study. Specifically, pending issuance of the final environmental impact statement, NRDC is petitioning NRC to adopt regulations that require the following:

- (1) Retrievable storage of all transuranic solid waste and fee payments by persons that produce such wastes to finance safe permanent disposal;
- (2) Suspension of licensing of additional low-level waste disposal sites until four types of safety and environmental protection standards have been promulgated;
- (3) Payment of higher fees by persons producing

low-level radioactive wastes to pay for necessary perpetual care and surveillance of existing sites; and

- (4) Solidification of all low-level radioactive wastes before shipment to any disposal site (i.e., a prohibition of the shipment of low-level wastes in liquid form).

This Memorandum examines briefly the past history of low-level waste disposal and the potential dangers presented by such wastes, and sets forth (1) the basis for NRDC's conclusion that NEPA requires NRC to prepare this statement immediately, (2) the critical questions which must be addressed by the required programmatic EIS, and (3) the reasons NRC should adopt the suggested interim regulations contained in NRDC's Petition for Rulemaking.

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## II. BACKGROUND -- THE PROBLEM OF LOW-LEVEL RADIOACTIVE WASTE DISPOSAL

The proposed generation of electricity at increasing numbers of nuclear power plants would inevitably result in the production of vast quantities of various radioactive elements. This radioactivity would, in turn, contaminate a wide variety of materials during the operation of power plants, the processing of irradiated fuel ("spent fuel"), and the manufacture of new fuels. The radioactive wastes produced at these various stages of the nuclear fuel cycle have been divided by the industry and the federal government into two categories: "high-level" and "low-level" wastes. Those materials defined as high-level wastes<sup>7/</sup> are produced exclusively at reprocessing plants and consist of the intensely radioactive residue remaining after the spent fuel has been physically and chemically treated in order to extract unfissioned uranium and plutonium.

Low-level wastes<sup>8/</sup> are essentially defined as all radioactive waste materials which are not classified as high-level wastes, and consist of an extremely wide variety of contaminated materials, including, for instance, paper trash,

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<sup>7/</sup> Current regulations define "high-level liquid radioactive wastes" as "those aqueous wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuels." 10 C.F.R. Part 30, Appendix F. No other category of radioactive waste is defined in existing regulations.

<sup>8/</sup> In this Memorandum, the term "low-level waste" is used to identify all wastes, other than high-level wastes, that cannot be released to the unrestricted environment.

packaging material, broken glassware, building rubble, protective clothing, mops, ion exchange resins, shielding, control rods, and heavy machinery.<sup>9/</sup> Compared to high-level wastes, low-level radioactive wastes represent a much larger volume of material and a much greater diversity of physical and chemical forms.

Since 1962, everything not classified as high-level waste has been permitted by federal regulation to be buried at commercial waste burial sites in shallow earthen trenches. These commercial burial facilities are located on land owned by either the federal government or one of the states. The locations of these facilities are listed below:<sup>10/</sup>

<u>LOCATION</u>	<u>YEAR LICENSED</u>
Beatty, Nevada	1962
Morehead, Kentucky (Maxey Flats)	1963
West Valley, New York	1963
Richland, Washington	1965
Sheffield, Illinois	1967
Barnwell, South Carolina	1971

<sup>9/</sup> The category of "other than high-level" radioactive wastes includes, among other things, the following:

- \* Transuranic (alpha)
  - Cladding Hulls
  - Miscellaneous alpha solids
  - Miscellaneous alpha-beta-gamma solids
- \* Miscellaneous beta-gamma solids
- \* Noble gases
- \* Iodine
- \* Tritium
- \* Decommissioning solids

<sup>10/</sup> O'Connell and Holcomb, U.S. Environmental Protection Agency, "A Summary of Low-Level Radioactive Wastes Buried at Commercial Sites Between 1962-1973, with Projections to the Year 2000," 15 Radiation Data and Reports, at 766 (December 1974) [hereinafter cited as O'Connell & Holcomb].



Under current plans, when the disposal facilities are "filled," complete control of the land will revert to the government that owns it. The state or federal government will then be responsible for monitoring the wastes to detect any movement of significant radioactivity off-site, and for taking any corrective action required to protect the population and environment from excessive exposure to radioactivity. These custodial functions will be required until the radioactivity decays to "safe" levels. Depending on the quantities of particular radionuclides in the wastes, disposal sites may have to be monitored for tens of thousands of years.

Recent developments strongly suggest that the existing program for disposing of low-level wastes may not adequately protect the public health and safety. NRDC believes that the rapidly growing volume of low-level wastes, the extreme toxicity of the radioactive materials involved, and recent reports of the inadequacies in current disposal operations demonstrate the need for a complete reassessment of low-level waste disposal practices.

A. Low-Level Radioactive Wastes Pose Substantial Environmental and Health Hazards.

1. Large Amounts Of Radioactive Materials Contaminate The Rapidly Growing Volume Of Low-Level Wastes.

The low-level wastes consigned to commercial burial grounds come from many sources including university and industrial

research centers, medical diagnostic and treatment facilities, military installations, and, increasingly, nuclear power reactors. These wastes include a broad range of materials and radionuclides. The materials vary from paper, plastic and glass, to concrete and steel, to ion exchange resins. The radioactive elements contained in the wastes include fission products, such as cesium-137 and strontium-90; fission by-products, such as plutonium-239; activation products, such as cobalt-60; as well as natural radionuclides, such as radium-226. The half-lives of the radionuclides range from a few months to tens of thousands of years.

The volume of this low-level radioactive waste is already extremely large and rapidly growing. By 1976, more than thirteen million cubic feet of waste had been buried.<sup>11/</sup> Moreover, the amount of material buried each year has doubled in the last five years from one million to two million cubic feet per year and most projections expect the rate to rise to an average annual volume of about 14 million cubic feet per year between 1980 and 1990.<sup>12/</sup>

The Nuclear Regulatory Commission and the Environmental Protection Agency both estimate that the low-level (non-alpha) wastes accumulated by the nuclear power industry by the year 2000 will be approximately 330 to 350 million cubic feet.<sup>13/</sup>

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<sup>11/</sup> Hearings, supra note 2, at 213.

<sup>12/</sup> GAO Report, supra note 6, at 5.

<sup>13/</sup> Hearings on Radioactive Wastes Before the Joint Comm. on Atomic Energy, 94th Cong., 1st Sess., at 32, 43 (Nov. 19, 1975).

Substantial uncertainty and disagreement, however, exists within the federal government as to how much transuranic contaminated low-level wastes,<sup>14/</sup> both in terms of volume and radioactivity, will be generated in the future.<sup>15/</sup>

NRC projects that about 5.4 million cubic feet of transuranic-contaminated wastes will accumulate by the year 2000, while EPA estimates that the country will be faced with the problem of disposing of more than 65 million cubic feet of such wastes by the turn of the century.<sup>16/</sup> Scientists at the Oak Ridge National Laboratory predict an intermediate value of 16 million cubic feet.<sup>17/</sup> These estimates all assume that each 1000 MWe light water reactor in the United States will generate approximately 40,000 cubic feet of "other than high-level" wastes (not including enrichment and decommissioning wastes)

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<sup>14/</sup> Transuranic or "alpha" wastes are usually defined in this country as radioactive wastes containing at least 10 nanocuries (10<sup>-9</sup> curies) of transuranic radionuclides per gram of material.

<sup>15/</sup> The overall uncertainty in the amounts and types of low-level radioactive wastes derives from differences of opinion about (1) the size and nature of the commercial nuclear power industry; (2) the lack of large-scale commercial operational information about the radioactive contamination associated with materials which come in contact with radioactivity; (3) the inherent difficulties in predicting future technological changes in processing techniques in an infant industry; and (4) different viewpoints about the margin of safety involved in burying different types of wastes in shallow earthen trenches.

<sup>16/</sup> Hearings, *supra* note 13, at 32, 45. Both estimates assume commercial development of the liquid metal fast breeder reactor and extensive plutonium recycle.

<sup>17/</sup> Blomeke, Kee & Nichols, Projections of Radioactive Wastes To Be Generated By The U.S. Nuclear Power Industry, at 3, 55-67, 91-94 (ORNL-EM-395) (Feb. 1974).

during each year it operates.<sup>18/</sup> Inclusion of decommissioning wastes could more than triple the average annual generation of other than high-level wastes.<sup>19/</sup>

The total accumulation of low-level wastes at commercial disposal sites may prove to be significantly greater than these already large figures indicate. First, previous estimates of waste generation rates have been low by factors of ten or more. For example, one commercial site, expected to bury approximately 750 curies per year, has in practice disposed of between 22,000 and 710,000 curies per year in by-product material alone. Second, based solely on an extrapolation of historical data, U.S. EPA scientists have estimated that the total waste volume that may be received at commercial disposal facilities could be roughly one billion cubic feet by the year 2000,<sup>20/</sup> a volume that would "cover a four-lane highway from coast-to-coast one foot deep."<sup>21/</sup>

All of these extremely rough estimates of the amount of low-level wastes likely to exist in the year 2000 are large in comparison with the existing accumulation of 13 million

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<sup>18/</sup> See, e.g., U.S. Atomic Energy Commission, Proposed Final Environmental Impact Statement, Liquid Metal Fast Breeder Reactor Program, WASH-1535, Volume II, p. 4.6-14 (Dec. 1974); Mann, Goldberg & Hendricks, "Low Level Solid Radioactive Waste in the Nuclear Fuel Cycle," at 2 (prepared for presentation at the American Nuclear Society winter meeting, Nov. 16-21, 1975, San Francisco, California).

<sup>19/</sup> Mann, Goldberg & Hendricks, supra note 18, at 12.

<sup>20/</sup> O'Connell & Holcomb, supra note 10, at 760.

<sup>21/</sup> Hearings, supra note 2, at 4.

cubic feet at commercial low-level waste disposal sites.<sup>22/</sup>

Regardless of the precise figures, it is clear that the amounts of low-level waste being generated are escalating rapidly and will expand enormously by the end of the century. As a congressional subcommittee observed,

"Low-level waste . . . continues to represent a major aspect of the total radioactive waste management and disposal problem . . . , and it will assume even greater proportions in future years as the quantity of such material increases." <sup>23/</sup>

<sup>22/</sup> The distribution of wastes accumulated by 1973 and the projected dates for reaching the disposal capacities of existing sites are shown in the following table:

Low-Level Waste Burial Sites and Quantities of Buried Wastes (1973)

<u>Site</u>	<u>Volume of Waste (million cubic ft)</u>	<u>Projected Termination Date</u>
Morehead, Kentucky (Maxey Flats)	3.4	1998
West Valley, N.Y.	2.0	1981
Barnwell, S.C.	0.8	1993
Sheffield, Ill.	1.0	1981
Beatty, Nevada	1.4	1992
<u>Richland, Wash.</u>	<u>0.6</u>	1994
Total	9.2	

These dates are derived assuming that no compaction of wastes occurs prior to burial and that the sites are not enlarged. O'Connell & Holcomb, supra note 10, at 766.

<sup>23/</sup> House Report No. 94-1320, 94th Cong., 2d Sess., at 1, 3 (1976).

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2. The Radionuclides in Low-Level Wastes Are Extremely Toxic.

Little argument or evidence is needed to establish the toxicity of the radioactive materials contained in low-level radioactive wastes. Per unit weight, radioactive elements can be thousands or millions of times more toxic than their non-radioactive counterparts. Radionuclides are often bioconcentrated thousands of times, and even hundreds of thousands of times by plants and animals. And, once released, there is no way to prevent the radiation from emanating from the radionuclides. This last property in particular has been recognized as requiring special precautions in the handling of radioactive wastes. A scientist with the World Health Organization stated the issue well:

"[T]here is a technical consideration which justifies a cautious approach to the setting of permissible levels [for radioactive pollutants], and which does not obtain with most other pollutants: it is the inability to destroy the radioactive toxic character. Many genetically active chemicals are known, for example, which might seem to require the same cautious approach. Yet it seems likely that most of them would not survive waste treatment or natural processes to appear unchanged in the diet, and indeed it is likely that many of them would be destroyed in the environment. No such processes destroy the radioactive nature of waste products and we have to rely on dispersal and dilution processes of the environment with proper regard to the opposing forces of re-concentration. Particularly with wastes containing the very long-lived radionuclides, a

mistake or error of judgment in setting permissible levels for environmental disposal could lead to a permanently hazardous situation requiring drastic methods of almost permanent control." 24/

Indeed, based on the toxicity of the radionuclides included in radioactive wastes, the Committee on Resources and Man of the National Academy of Sciences formulated the following first principle on which any long-term program of radioactive waste disposal should be based:

"All radioactive materials are biologically injurious. Therefore, all radioactive wastes should be isolated from the biological environment during their periods of harmfulness." 25/

Furthermore, plutonium and other transuranic elements will be present in low-level wastes in significant quantities -- elements which a group of scientific experts recently emphasized "are frequently considered to be among the most toxic agents known to man."26/ The potential long-term hazards posed by transuranic low-level wastes were publicly recognized

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24/ Kenny, "The Degree of Treatment Required for Low- and Intermediate-Level Radioactive Wastes to Prevent the Hazardous Pollution of the Environment," in Practices in the Treatment of Low- and Intermediate-Level Radioactive Wastes, Proceedings of a Symposium held in Vienna, 6-10 December 1965, at 46 (International Atomic Energy Agency) (1966) (emphasis added).

25/ National Academy of Sciences-National Research Council, Committee on Resources and Man, Resources and Man, at 235 (1968).

26/ National Academy of Sciences, Assessing Potential Ocean Pollutants to the Ocean Affairs Board, A Report of the Study Panel on Assessing Potential Ocean Pollutants to the Ocean Affairs Board, Commission on Natural Resources, National Research Council, at 32 (1975). See also, Bowen, "Transuranic Elements and Nuclear Wastes," 18 Oceanus, at 43-54 (1974).

by NRC Commissioner Edward A. Mason in a speech last year:  
"Due to the long radioactive half-lives of several of the transuranic isotopes, they pose some of the most difficult problems in the long-term management of radioactive wastes from nuclear power operations."<sup>27/</sup>

And while plutonium probably represents the transuranic radionuclide posing the greatest hazard, there is not sufficient data to state this unequivocally.

"[The] emphasis on plutonium is clearly a reflection of the general consensus that, in terms of amounts available, projected usage, extent of anticipated accidental human exposure, and radiotoxicity, plutonium is the most formidable radionuclide in the periodic table."<sup>28/</sup>

However, a recent report by a scientist with EPA states that  
". . . americium may become a greater environmental liability than the most investigated transuranic element, plutonium."<sup>29/</sup>

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<sup>27/</sup> "Remarks by Edward A. Mason, Commissioner, U.S. Nuclear Regulatory Commission, for Delivery to the Annual Conference of the Atomic Industrial Forum, San Francisco, California, November 18, 1975," reprinted in U.S. Nuclear Regulatory Commission, News Release No. 42, at 6 (week ending November 23, 1975).

<sup>28/</sup> The Metabolism of Compounds of Plutonium and Other Actinides, A report prepared by a Task Group of Committee 2 of the International Commission on Radiological Protection, ICRP Publication 19, at 1 (1972).

<sup>29/</sup> Brown, "Americium--Its Behavior in Soil and Plant Systems," at 6 (EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada (EPA-60013-76-005) (January 1975)). See, also Martell, "Actinides in the Environment and Their Uptake by Man," at 8 (National Center for Atmospheric Research, Boulder, Colorado (NCAR-TN/STR-110)) (May 1975).



The amounts of these materials in low-level wastes will be comparable to the plutonium content of high-level wastes if plutonium recycle is adopted. Using the total amount of plutonium as a hazard index, the transuranic low-level wastes would therefore pose a long-term potential hazard similar to high-level wastes. Two scientists at the University of California-Berkeley recently stated the problem as follows:

"The amounts of plutonium [in low-level wastes] are significant, and careful attention must be given to a waste management program which assures adequate control of all these wastes. On the basis of equal protection to the environment, the management of low-level plutonium wastes may be a more difficult problem than management of high-level wastes, because of the comparable quantities of plutonium and because of the much larger volume of material involved in the low-level waste." 30/

These same scientists further concluded:

"These plutonium losses to low-level wastes [during plutonium recycle] are not environmental releases, as acceptable environmental releases must be many orders of magnitude less than the losses to these wastes. Therefore, the wastes associated with these process losses must be subjected to permanently protected storage or disposal.

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30/ Bigford and Ang, "The Plutonium Fuel Cycles," 29 Health Physics, at 457 (1975). (At a recent symposium an EPA representative also stated that the ". . . transuranium-contaminated low-level waste may be a more critical long-term environmental problem than the long-term problem of high-level waste." Russell, "Potential Environmental Advantages From Partitioning of Radioactive Wastes" in Proceedings of Nuclear Regulatory Commission Workshop on The Management of Radioactive Waste: Waste Partitioning as an Alternative, June 8-10, 1976, at Battelle-Seattle Research Center, Seattle, Washington, at 85.)

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Permanent isolation of the plutonium from the environment is as important for these low-level wastes as it is for the high-level reprocessing wastes." <sup>31/</sup>

In short, the toxicity of the radionuclides in low-level wastes cannot be disputed. In particular, the low-level wastes will contain vast quantities of plutonium and other actinides capable of producing cancer and genetic mutations if released in extremely small quantities over time periods on the order of 250,000 years.

3. Current Scientific Knowledge  
Raises Grave Uncertainties  
About Potential Migration of  
Radioactivity

Whether any of the projected vast quantities of toxic radionuclides in low-level wastes would reach the general environment when buried depends critically on the future behavior of these radionuclides in soil and the subsurface environment. But accurately predicting the potential human exposures due to releases of both short-lived and long-lived radionuclides into the environment has proved difficult. For instance, in assessing the behavior of the relatively short-lived radionuclide ruthenium, an EPA researcher recently concluded,

"As the available data concerning the biological behavior of ruthenium

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<sup>31/</sup> Pigford and Ang, supra note 30, at 457, 467.

are reviewed, it becomes apparent that many questions concerning the qualitative identity and behavior of this element still exist . . . . It is generally agreed that ruthenium may become a greater environmental liability than had been originally anticipated. As a result, a complete documentation of its distribution, fate, and behavior in our environment is essential, especially in view of our expanding nuclear industry." 32/

The necessarily greater uncertainties in accurately predicting the behavior of radionuclides with long half-lives raise particularly serious questions since these materials will persist in the environment for such extended periods of time. In order to make such predictions, many assumptions are needed, for instance, about the chemical form and biological accessibility of radionuclides that may be exposed to a variety of environmental conditions over long periods of time. These assumptions are necessarily based on relatively short-term laboratory and field studies. For instance, quantitative predictions about the adsorption of radionuclides to soil particles depends primarily on very unsatisfactory data. These data come either from laboratory experiments with short, relatively sterile soil columns or on the measurement of radioactivity in the environment released under relatively uncontrolled circumstances. Unfortunately, data obtained from such studies are inadequate for determining with confidence the long-

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32/ Brown, "Ruthenium: Its Behavior in Plant and Soil Systems," at 2, 3 (EPA, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada (EPA-60013-76-019) (February 1976)).

term effects of releases of waste radionuclides into the biosphere.

The scientific knowledge that does exist reveals great uncertainty. A panel of scientists, working under the auspices of the National Academy of Sciences, recently reviewed the existing literature on the behavior of plutonium and other transuranic elements in the oceans. They concluded that the belief that plutonium and other transuranics are tightly held to soil particles and therefore not likely to move significant distances is not well founded. For instance, they state that, "In our estimation, the biological data are not yet sufficient to show the extent of chemical remobilization of the  $^{239}\text{Pu}$ , and we found no studies of  $^{241}\text{Am}$ ."<sup>33/</sup> Furthermore, the scientists found that, "Studies of marine and fresh water sediment columns indicate, as do those of soil columns, unexpected vertical mobility of  $^{239}\text{Pu}$  and  $^{241}\text{Am}$ ."<sup>34/</sup> The scientists also stated that, "Several lines of argument lead to the conclusion that sediment  $^{239}\text{Pu}$  is remobilized in a form more available to organisms."<sup>35/</sup> Regarding the marine environment, they found that, "We are almost ignorant of the biological or environmental significance of the behavior of transuranic elements once they are incorporated into marine sediments."<sup>36/</sup>

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<sup>33/</sup> Assessing Potential Ocean Pollutants, supra note 26, at 47.

<sup>34/</sup> Id. (citations omitted).

<sup>35/</sup> Id.

<sup>36/</sup> Id., at 48.

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Other research scientists have also pointed out the importance of understanding the mobility of plutonium in the environment and the deficiencies in existing information that prevent us from having that understanding:

"The plutonium which is now deposited on land can be transported by erosion to the streams for ultimate deposition in lakes and the oceans. The biogeochemical cycling of this man-made radionuclide is of fundamental importance in assessing the hazard potential to man through the food chain. Only limited information is now available on the interactions of plutonium in the natural aqueous environment." <sup>37/</sup>

The NAS scientists were also concerned that plutonium which had been in the environment for some time would be converted to a chemical form more readily absorbed through the intestine of animals, including man, than the insoluble plutonium oxide forms that are originally found in radioactive wastes. In reviewing work about the accumulation of plutonium-239 in marine algae, they said, "An important question also raised by these studies is that of the availability of a plant's physiologically-accumulated plutonium or americium to grazers. We know of no relevant data to resolve this question. Furthermore, these scientists point out that the absorption of plutonium-239 from the gastrointestinal tract may be a factor

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<sup>37/</sup> Schell and Watters, "Plutonium in Aqueous Systems," 29 Health Physics, at 339 (1975).

<sup>38/</sup> Assessing Potential Ocean Pollutants, supra note 26, at 43.

of one hundred or more higher for the very young or immature intestine or when very soluble forms of plutonium are administered.<sup>39/</sup>

The inadequacy of existing information was also stressed by researchers seeking to formulate computer models to predict the effects of waste disposal operations: "For many of the transplutonium elements, valid data on biological transfer and accumulation factors are scarce . . . ."<sup>40/</sup> This conclusion . . . supported by a recent EPA report that found, "The limited amount of available information is not adequate to select precise parameters for estimating concentrations of plutonium in vegetation, due to root uptake and foliar deposition."<sup>41/</sup>

Many of the researchers reporting the results of their work at a recent symposium stressed the potential hazards of plutonium in the environment, the indications that plutonium can be solubilized or mobilized over time, and the

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<sup>39/</sup> Id., at 33.

<sup>40/</sup> Soldat, Baker and Corley, "Applications of a General Computational Model for Composite Environmental Radiation Doses" in Environmental Behavior of Radionuclides Released in the Nuclear Industry, Proceedings of a Symposium held in Aix-En-Provence, 14-17 May 1973, at 496 (1973).

<sup>41/</sup> Bernhardt and Eadie, "Parameters for Estimating the Uptake of Transuranic Elements by Terrestrial Plants," at 2 (EPA Las Vegas Facility, Las Vegas, Nevada (ORP/LV-76-2) (March 1976)).

need for more research.<sup>42/</sup> Another scientist, after presenting

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<sup>42/</sup> See generally, International Atomic Energy Agency and U.S. Energy Research and Development Administration, "International Symposium on Transuranium Nuclides in the Environment," San Francisco, California, November 17-21, 1975. For instance, scientists from India concluded that further study is needed to understand the biological and geochemical significance of plutonium in sediments, since they are the depositories of all plutonium released to the aquatic environments. (Pillai and Mathew, "Plutonium in Aquatic Environment -- Its Behavior, Distribution and Significance," at 20.) EPA scientists reported that "[O]nce plutonium enters the soil, the importance of plant assimilation as a pathway of plutonium to man is likely to increase with time, and it may well be that within several decades, plutonium uptake by plants will increase to higher levels than is currently projected." (Beckert and Au, "Plutonium Uptake By A Soil Fungus And Transport To Its Spores," at 5.)

Scientists at the Oak Ridge National Laboratory found that

"There have been very few studies which focus on the nature of the reactions which occur between plutonium and environmental constituents. . . the chemistry of Pu in the environment will be strongly affected by the formation of complexes. . . . [B]io-geochemical cycling mechanisms involving organic complexes may be more influential in maintaining Pu in forms which are potentially transferrable to biota." (Bondietti, Reynolds and Shanks, "Interaction of Plutonium with Complexing Substances in Soils and Natural Waters," at 2, 17.)

Other EPA scientists reported their finding that ". . . relatively insoluble forms of plutonium may be solubilized to a considerable degree in the gastrointestinal tract of cattle." (Smith, Barth, Patzer, "Grazing Studies on a Plutonium Contaminated Range of the Nevada Test Site," at 4.) These concerns that plutonium may become mobilized and become available for uptake by plants and animals are given emphasis by the finding that plutonium has been detected tens and hundreds of meters from the low-level waste burial trenches at Maxey Flats. See pp. 30-32, infra.

a paper on the possible release of radioactive wastes after burial, stated that ". . . there has been no comprehensive study of the long-term behavior of the [released] radionuclides in the biosphere. . . ." <sup>43/</sup>

In sum, there are two general categories of information that are currently insufficient for reliably projecting the future behavior of long-lived waste radionuclides in the biosphere. First, we are largely ignorant of the physical and biological pathways of the transuranic elements that may lead to human exposure in the distant future. Second, there is insufficient information to rule out the possibility that biological processes may convert plutonium to soluble forms that are absorbed by the human gastrointestinal tract by factors of 100 to 1000 times more easily than insoluble compounds, such as plutonium dioxide. <sup>44/</sup>

The U.S. can confidently predict that large quantities of low-level radioactive waste containing significant quantities of toxic radionuclides will be generated in the coming years. Although insufficient data exists at the

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<sup>43/</sup> Burkholder, "Nuclear Waste Partitioning Incentives" in Proceedings of Nuclear Regulatory Commission Workshop on The Management of Radioactive Waste: Waste Partitioning as an Alternative, June 8-10, 1976 at Battelle-Seattle Research Center, Seattle, Washington at 475-76.

<sup>44/</sup> See, Assessing Potential Ocean Pollutants, supra note 26, at 33; The Metabolism of Compounds of Plutonium and Other Actinides, supra note 23, at 13.



present time to justify firm predictions about the behavior of these radioactive materials emplaced in shallow earthen trenches for disposal, it is clear that the potential for severe environmental contamination exists. The existing base of scientific knowledge simply does not provide any firm basis for confidence that migration of radioactivity from shallow land disposal areas will not occur. It is necessary to examine our experience to date from that perspective.

B. U.S. Experience With Low-Level Burial Sites Has Been Increasingly Plagued By Problems And Uncertainties.

1. Inadequate Preliminary Studies and Off-Site Migration Have Recently Been Acknowledged.

As the volume of material delivered to the six commercial burial sites has grown, experience at the sites has been extremely disquieting. The original studies (investigating topographic, geologic, meteorologic, and hydrologic conditions) undertaken to demonstrate each site's acceptability have been called inadequate by both the U.S. Environmental Protection Agency and the U.S. Geological Survey.<sup>45/</sup>

Indeed, one USGS geologist testified in a congressional hearing that the selection of disposal sites for low-level radioactive wastes had been "almost random:"

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<sup>45/</sup> U.S. Environmental Protection Agency, Comment on Atomic Energy Commission, Draft Environmental Statement, Liquid Metal Fast Breeder Reactor Program, WASH-1335, at 25 (April 1974); Hearings, supra note 2, at 139.

"MR. MOREHEAD. The untenable part of this whole process [selection of low-level waste burial sites] is the almost random selection of sites with economic factors having undue weight in the decision. Is that correct?

MR. DEBUCHANANNE. That is my opinion.

MR. MOREHEAD. Let's take the Maxey Flats site. Based on your investigation there would you have recommended it as a site, particularly in view of the fact that almost 50 inches of rainfall prevails there per year?

MR. DEBUCHANANNE. At the present state of our knowledge, I think we would have hesitated to recommend that as a preliminary site." 46/

In addition, operating practices followed at the six commercial sites have been inconsistent, at times plainly undesirable, and even shockingly lax. Government inspections have revealed wide variations in specific burial procedures, improperly large amounts of contaminated water in trenches, improper backfilling of the trenches, improper use of holding pits for contaminated water pumped from waste disposal trenches, contaminated water disposed of improperly, gravely inadequate record-keeping practices, and incomplete environmental monitoring programs. 47/

Perhaps most dramatically, officials at the Beatty, Nevada, site discovered this spring that employees had removed substantial amounts of contaminated materials from the site

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46/ Hearings, supra note 2, at 140.

47/ GAO Report, supra note 6, at 26-29.

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and had utilized contaminated equipment for construction work and other activities off the site.<sup>48/</sup> Discovery of this activity required the state and federal governments to institute a broad scale search of the area surrounding the disposal site to recover "hot" material. Officials of the Environmental Protection Agency described the Beatty situation in the following terms:

- \* "Large quantities of radioactive materials sent to the site for burial were diverted from the site for private use."
- \* "Concrete was found at several locations which contained low levels of gamma-emitting radio-nuclides."
- \* "There were many items which contained enough radioactive material to pose health hazards."
- \* "While it was confirmed that radioactive items had been removed from the NECO site to areas beyond the Beatty vicinity, it was considered impractical to begin a systematic survey in these areas without more specific information."
- \* "There exists the possibility of higher exposures from radioactive materials in areas not covered by the survey."<sup>49/</sup>

Against this background of apparent inadequate initial studies and inconsistent and at times undesirable disposal

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<sup>48/</sup> Hearings, supra note 2, at 230.

<sup>49/</sup> U.S. Environmental Protection Agency, Office of Radiation Programs, Radiation Survey in Beatty, Nevada and Surrounding Area (March 1976), at 1-2 (ORP/LV-76-1, Las Vegas Facility).

practices, two of the six commercial sites have experienced significant migration of radionuclides away from the burial sites. Thus, the U.S. Geological Survey has reported,

"Of the 11 solid waste burial grounds in use today [including five ERDA sites], waste managers have reported migration in excess of predictions of radioactive nuclides at Maxey Flats, Kentucky (1974); West Valley, New York (1975); and [ERDA's site at] Oak Ridge, Tennessee [1975].

It is probable that some of the other burial grounds also release radioactive nuclides to some extent. The releases to date are not known to constitute a major health problem, but they do indicate that something has not worked as planned.

The burial sites were intended to contain radionuclides for hundreds or even thousands of years, yet, in the first twelve years of operations, migration beyond expectations of radionuclides has been detected at several sites." <sup>50/</sup>

At West Valley, New York, problems with excessive accumulation of water in the burial trenches and seepage of low levels of radioactivity off-site led to a decision by the commercial operator of the site, Nuclear Fuel Services (NFS), to suspend burial operations in March 1975.<sup>51/</sup> According to the New York State Department of Environmental Conservation, excess levels of tritium in a stream adjacent to the burial area had

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<sup>50/</sup> Hearings, *supra* note 2, at 137 (Statement of George D. DeBuchananne).

<sup>51/</sup> New York State Environment, April 1, 1975 (publication of the New York State Department of Environmental Conservation).

been noted in 1972.<sup>52/</sup> By 1975, accumulated water had been detected seeping out of trenches in the north portion of the site, and trenches in the south portion of the site had one to two feet of water. Studies of the site are now being conducted by both the state and federal governments, and negotiations are underway between the state and the company over the steps that must be taken to treat the radioactive liquid that has accumulated.<sup>53/</sup>

The second commercial site at which migration has been found is the site at Maxey Flats, Kentucky. A study by the Kentucky Department for Human Resources concluded that "[t]he radioactive waste disposal site at Maxey Flats, Kentucky is contributing radioactivity to the environment."<sup>54/</sup> Tritium levels of "approximately 300 times the mean ambient tritium concentration" were found in test wells in the unrestricted environment,<sup>55/</sup> and gamma logs confirmed the presence of cesium-134, cesium-137, and cobalt-60 "in several predominant discrete zones below the soil surface."<sup>56/</sup> Strontium-89 and strontium-90 were detected in water samples taken approximately two miles from the site center, while no strontium was observed in water

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<sup>52/</sup> Letter from Thomas J. Cashman, Director, Bureau of Radiation, New York State Department of Environmental Conservation, to Robert Kreiss, NRDC, August 25, 1975.

<sup>53/</sup> *Id.*; see also, New York State Environment, April 1, 1975; New York Times, June 14, 1975.

<sup>54/</sup> *Id.*, at 17.

<sup>55/</sup> *Id.*, at 5.

<sup>56/</sup> *Id.*, at 3.

samples taken from a group of control sampling stations.<sup>57/</sup> Soil analyses "indicate an approximately 200 times higher concentration of Pu-238 and 25 times higher concentration of Pu-239 in the soils at the immediate Maxey Flats site area over that of the control samples collected in the Franklin and Fleming County area."<sup>58/</sup>

While the six-month Maxey Flats study was unable to pinpoint migration routes of the radioactive elements, it indicated that the movement could be through any or all of four major routes: surface run off, atmospheric fallout from the evaporator plume, migration through geologic fissure systems, and lateral movement through the soil zone.<sup>59/</sup> Kentucky is now considering a study costing \$1 million to assess radionuclide migration more fully. Based on available data in 1975, EPA scientists concluded without qualification that plutonium contamination exists "in and around the Maxey Flats burial site," that the plutonium "has migrated or moved from the trenches," and that "other radioactive contaminants are moving or migrating also."<sup>60/</sup> In testimony prepared in 1976 after its initial report was released, EPA indicated that

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<sup>57/</sup> Id., at 11.

<sup>58/</sup> Id., at 16.

<sup>59/</sup> Id., at 17.

<sup>60/</sup> U.S. Environmental Protection Agency, Office of Radiation Programs, "Preliminary Data on the Occurrence of Transuranium Nuclides in the Environment at the Radioactive Waste Burial Site Maxey Flats, Kentucky," at 51 (EPA-520/3-75-021) (February 1976).

subsequent data "supports even more strongly the contention that subsurface migration may be occurring at the site."<sup>61/</sup> EPA concluded in somewhat of an understatement that "containment of the waste in shallow land burial grounds is not being realized."<sup>62/</sup>

Subsequent analyses by the U.S. Geological Survey and the Nuclear Regulatory Commission have also confirmed that migration of radioactivity off-site has occurred.<sup>63/</sup>

2. Virtually All Independent Studies Have Recognized The Inadequacy Of The Present Program

The acknowledged migration of radioactivity off-site at two disposal areas has led to numerous recent examinations of the low-level waste program. Uniformly these examinations have concluded that the present program is not adequate and that the need for additional study, analysis, and reevaluation of the present program is urgent.

But the recognition of the deficiencies in the current disposal practices is not new. As early as the mid-1960's, experts operating under the aegis of the National Academy of Sciences made strong statements against the practice of disposing of low-level wastes in shallow earthen trenches. In 1966, the NAS Advisory Committee on Geologic Aspects of Radio-

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<sup>61/</sup> Hearings, supra note 2, at 112.

<sup>62/</sup> Id., at 113.

<sup>63/</sup> Id., at 210, 137.

active Waste Disposal, in a report to the Atomic Energy Commission, generally disapproved of radioactive waste disposal to the accessible environment:

"The Committee thinks that the current practices of disposing of . . . all manner of solid wastes directly into the ground above or in the fresh-water zones, although momentarily safe, will lead in the long run to a serious fouling of man's environment. Such methods represent a concept of easy disposal that has had and will continue to have great appeal to operators, but we fear that continuation of the practices eventually will create hazards that will be extremely difficult and expensive to eliminate. Although the ion-exchange capabilities of natural earth materials under disposal sites will retain quantities of radionuclides and provide a safe container for the shorter-lived ones, it would appear to be prudent to reserve a large portion of the capacity for accidental releases -- especially in humid regions where the water table is shallow and distances between disposal sites and discharge points are small." <sup>64/</sup>

The Committee expressed concern that undue reliance was placed on the ability of soils to retain the radioactivity over the hundreds of years required for decay to innocuous levels:

"The ion-exchange equilibria are reversible, and under changing conditions desorption could replace adsorption. Such a changed situation might result from man's future activities which would

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<sup>64/</sup> Committee on Geologic Aspects of Radioactive Waste Disposal, Division of Earth Sciences, National Academy of Sciences-National Research Council, "Report to the Division of Reactor Development and Technology, United States Atomic Energy Commission," at 70 (May 1966).



affect the hydrologic systems in the aquifers as dams are built, irrigation is accelerated or extended into new areas, or groundwater aquifers are subjected to higher withdrawal rates, all of which are not only possible but likely happenings in forthcoming decades. Climatic changes in future centuries may also be sufficient to alter substantially the hydrology in an aquifer and thereby affect its sorption capacity." <sup>65/</sup>

In 1969, M. King Hubbert, a former chairman of the NAS Advisory Committee to the AEC, reviewed the Committee's concerns with land disposal of radioactive wastes:

"In 1955, at the request of the Atomic Energy Commission, an advisory Committee on the Geologic Aspects of Radioactive Waste Disposal was established by the Division of Earth Sciences -- National Research Council. This committee, which included geologists, groundwater hydrologists, and mining and petroleum engineers, served until 1967, and made a succession of study visits to most of the AEC establishments concerned with management and disposal of radioactive wastes. The committee formulated three general principles on which any long-term program of disposal of radioactive wastes should be based. These principles may be paraphrased as follows:

1. All radioactive materials are biologically injurious. Therefore, all radioactive wastes should be isolated from the biological environment during their periods of harmfulness, which for the long-

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<sup>65/</sup> Id., at 66.

lived isotopes exceeds 600 years.

2. The rate of generation of radioactive wastes is roughly proportional to the rate of power production from nuclear-fission reactors. In the period of its work, the committee regarded the rate of nuclear power and related radioactive-waste production as being on the very low portion of a steep exponential-growth curve. The committee therefore reasoned that no waste-disposal practice, even if regarded as safe at an initially low level of waste production, should be initiated unless it would still be safe when the rate of waste production becomes orders of magnitude larger.

3. No compromise of safety in the interest of economy of waste disposal should be tolerated.

These principles are still valid.

. . . [M]ost present practices in the disposal of radioactive wastes other than high-level violate the first of the three principles stated above, and probably the second also. These wastes are not being isolated from the biological environment at present, and it is questionable to what extent the same practices can be continued when the rate of waste production becomes 10 or 100 times larger than it is at present without causing serious hazard." <sup>66/</sup>

In recognition of the problem, the NAS Committee on Resources and Man in 1969 endorsed the following opinion on the inadequacy

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<sup>66/</sup> Hubbert, "Energy Resources" in Committee on Resources and Man, Division of Earth Sciences, National Academy of Sciences-National Research Council, Resources and Man, W. H. Freeman, at 235-236 (1969) (emphasis in original).

of low-level waste disposal practices:

"Much progress has been made within the last decade by the U.S. Atomic Energy Commission in the processing and safe underground disposal of low-volume, high-level wastes. Less satisfactory progress has been made in the handling of the voluminous low-level wastes and solid trash. In fact, for primarily economic reasons, practices are still prevalent at most Atomic Energy Commission installations with respect to these latter categories of waste that on the present scale of operations are barely tolerable, but which would become intolerable with much increase in the use of nuclear power." <sup>67/</sup>

In order to avoid this "intolerable" disposal of plutonium-containing radioactive wastes, researchers at Battelle Northwest Laboratories later advised the U.S. Environmental Protection Agency that "low-level wastes . . . containing significant quantities of long-lived radionuclides should be stored in Federal repositories." <sup>68/</sup>

Some of the most important inadequacies of commercial low-level waste burial operations were discussed in even greater detail in a report prepared in 1968 for the AEC. <sup>69/</sup> For instance, the report indicated that, although five commercial burial

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<sup>67/</sup> Id., at 8.

<sup>68/</sup> Battelle Pacific Northwest Laboratories, Program For The Management of Hazardous Wastes, Final Report, at 228 (July 1973) (EPA Contract # 68-01-0762).

<sup>69/</sup> Morton, Environmental and Sanitary Engineering Branch, Division of Reactor Development and Technology, U.S. Atomic Energy Commission, Land Burial of Solid Radioactive Wastes: Study of Commercial Operations and Facilities, WASH-1143 (1968).

grounds had been licensed, "there are no universally accepted criteria as to what combinations [of natural environmental conditions] are best for land burial of radioactive wastes."<sup>70/</sup> Also, even though there had been "several occurrences of burning and associated explosions in drums containing pyrophoric waste materials," published reports on these potential hazards and possible preventive measures did not exist.<sup>71/</sup> (These problems have yet to be adequately resolved.)

The eight-year-old AEC report also highlighted the threat posed by the accumulation of surface water in burial trenches once the wastes settled after burial. (It was precisely this eventuality that recently caused the release of radioactivity in the environment at the disposal sites at West Valley, New York and Maxey Flats, Kentucky.) The report suggested that the shrinkage problem posed a potential hazard over the long-term and recommended that the question ". . . should be studied as early and as definitively as possible."<sup>72/</sup> In fact, the report found that, "many unresolved problems can be foreseen which make it very difficult to plan or estimate the cost of adequate maintenance and safety measures extending into the distant future."<sup>73/</sup>

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<sup>70/</sup> Id., at 48.

<sup>71/</sup> Id., at 23.

<sup>72/</sup> Id., at 46.

<sup>73/</sup> Id., at 45.

As experience has confirmed the reality of the problems and fears set out in these early reports, studies of the question have proliferated and the criticism of current disposal programs has intensified. The Government Accounting Office, the U.S. Environmental Protection Agency, the U.S. Geological Survey and the House Committee on Government Operations have all recently concurred that the low-level disposal program faces numerous unresolved and serious problems.

The General Accounting Office's survey of the government's program for land disposal of low-level wastes came to the following conclusions:<sup>74/</sup>

- \* No systematic site selection criteria existed to establish the best locations for disposal sites;
- \* Disposal sites had "not been selected on the basis of detailed studies and evaluations of the hydro-geological characteristics" of the site, but rather on the basis of convenience and economics.
- \* Insufficient information existed to demonstrate that radioactivity would not migrate from existing sites.
- \* No standards have been developed for determining when radioactivity migration at disposal sites reaches unacceptable levels.
- \* Lack of information about site hydrology and geology have prevented the establishment of effective monitoring programs at disposal sites.
- \* A host of administrative problems, including slow correction of identified problems, a lack of timely and effective

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<sup>74/</sup> GAO Report, supra note 6, at 9, 11-12, 13, 19, 22-23, 26-29, 36-37.

licensing action by state and federal regulators, and poor record keeping practices at disposal sites.

- \* A failure by the state and federal governments to establish long-term-care requirements for commercial disposal sites and to assure the adequacy of existing funding provisions to meet such requirements.
- \* The complete absence of a policy or a program on the part of the federal government for systematically taking corrective action at disposal sites once problems are identified.

In light of the problems identified, GAO recommended strongly that the federal government undertake the following steps:<sup>75/</sup> (1) study existing disposal sites to evaluate their ability to retain existing wastes; (2) develop site-selection criteria for selecting future sites; (3) establish standards for determining when radioactivity migration at disposal sites reaches unacceptable levels; (4) improve site monitoring programs; (5) improve management practices at existing sites and regulations over those sites; (6) establish in detail long-term-care requirements for commercial disposal sites and require that adequate funding be provided; and (7) develop a policy on federal involvement for correcting migration problems at commercial disposal sites.

While the GAO's report contains the most comprehensive indictment of current policies, its criticisms are supported in many respects by the scientific investigations of EPA

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<sup>75/</sup> Id., at ii-iii.

and the USGS. Based on its investigations, EPA found that "actual exposures to population groups from natural, transuranic waste, and low-level waste involve more immediate public health problems" than high-level wastes.<sup>76/</sup>

EPA scientists told congressional investigators that it was true that "our present shallow surface burial methods . . . are just not suitable for containing even the low-level radioactive wastes."<sup>77/</sup> EPA has, therefore, called for the formulation of additional standards and for an examination of the need to limit the quantities of radionuclides that are allowed to be buried. Such limits, EPA has suggested, might be based on half lives, relative biological hazards, new packaging requirements, or site engineering controls.<sup>78/</sup>

The United States Geological Survey has been equally explicit in indicating that our current low-level disposal program has not lived up to needed high standards. A USGS study prepared in 1974 emphasized the need for more data to evaluate the safety of existing sites and strongly criticized the continuing failure of the government to adopt and follow conservative site selection criteria.<sup>79/</sup> More pointedly, it found a "panacealike aura" surrounding claims that the radioactivity from low-level waste disposal sites would not migrate on the theory that radioactive

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<sup>76/</sup> Hearings, supra note 2, at 27.

<sup>77/</sup> Id., at 116.

<sup>78/</sup> Id., at 113.

<sup>79/</sup> Papadopoulos & Winograd, Storage of Low-Level Radioactive Wastes in the Ground: Hydrogeologic and Hydrochemical Factors (U.S. Environmental Protection Agency Open-File Report 74-344; 1974).

materials would be held tightly by the surrounding soil. The USGS scientists detailed the inadequacies of such claims and called it "mandatory" that:

"a) intensive hydrogeologic and hydro-chemical studies precede choice of all new sites and that they be completed at any existing, but heretofore un-studied, sites; and b) that intensive radiochemical monitoring of ground and surface waters be done during and after the lifetimes of all operational sites." 30/

In a recent and comprehensive statement presented to a congressional subcommittee, the USGS made the following points:

- \* "It now seems apparent that, on hindsight, even considering the state of technology at the time, more attention was given to the economics of handling the material, and to the cost, location, and ready availability of the site for burial use, than was given to the ultimate fate of the waste. This philosophy of lead disposal prevailed through the 1950's and into the 1960's." 31/
- \* Only in 1975 did the USGS begin a program intended to lead to more comprehensive criteria for the evaluation of existing and proposed waste disposal sites. 32/
- \* "In the future, it is essential that radioactive wastes be separated by types and length of time the wastes will remain radioactive, so that every site will not have to be designed for hundreds of thousands of years of retention." 33/
- \* Based on problems already identified "remedial or stop-gas types of operations will probably have to be maintained on a continuing basis for as long as the lifetime of the toxicity of the waste

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30/ Id., at 24.

31/ Hearings, supra note 2, at 134.

32/ Id., at 139.

33/ Id., at 135.



materials."<sup>34/</sup>

- \* "Older sites that are not suited for burial should be phased out of operation as quickly as suitable sites meeting modern criteria become operational."<sup>35/</sup>
- \* While the migration of radioactivity at certain sites has been low to date, "it would not be unreasonable to expect an increase in the concentration of the migration of radionuclides in the future."<sup>36/</sup>

Most recently, the House Committee on Government Operations, following a full-scale investigation of the government's low-level waste disposal program, issued a report severely criticizing the existing program and calling on the government agencies involved to undertake immediate administrative action to cope with the problems identified. After noting "the scope and seriousness" of the low-level waste problem, the report comes to one central conclusion:

"The performance of existing disposal systems designed for containment have not been uniformly good and thus no assurance can be given or conclusion drawn with regard to protection from potential future health hazards. The unanimous judgment of the witnesses was that there is a critical need for a comprehensive study and review of all existing disposal sites, concerning their fitness to continue to receive radioactive wastes. The need to develop and employ much more

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<sup>34/</sup> Id., at 133.

<sup>35/</sup> Id.

<sup>36/</sup> Id., at 137.

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comprehensive site selection criteria regarding the choice of any new low-level radioactive waste sites is also clearly evident." 37/

Emphasizing that "a number of potentially serious problems have been identified," the House Committee Report pointedly identified four major problem areas in the present program. First, the Committee pointed out that "migration of radioactive wastes has occurred," and may still be occurring. The Committee concluded that the failure of many existing disposal sites to perform in a "uniformly good" manner was attributable to the absence of adequate geologic and hydrologic information on the site's characteristics.<sup>38/</sup> Second, the Committee sharply criticized the failure to develop systematic site selection criteria, concluding that the fault lay "within the failure of any federal government agency directly or indirectly involved in disposal site criteria study and determination, to step forward and provide energetic leadership in a critical area of public policy."<sup>39/</sup> Moreover, the Committee observed that the information needed is still lacking, "despite the obvious need to initiate remedies at the earliest possible time" and that the needed government effort "is proceeding glacially."<sup>90/</sup>

Third, the Committee found that the current "disposal

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<sup>37/</sup> House Report No. 94-1320, 94th Cong., 2d Sess., at 4 (1976).

<sup>38/</sup> Id., at 7, 9.

<sup>39/</sup> Id., at 9-10.

<sup>90/</sup> Id., at 11.

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systems have continued to exhibit a wide variety of deficiencies and a lack of uniformity and performance."<sup>91/</sup> Yet, the Committee complained, all of the government agencies involved have failed to develop and enforce standards for determining when acceptable levels of radioactivity migration have occurred and when necessary corrective efforts must be initiated. Finally, the Committee pointed out the extreme inadequacy of current long-term care requirements provided for both by the federal government and the state governments. The Committee found few state government agencies equipped to handle the responsibilities involved in long-term care of decommissioned disposal sites.<sup>92/</sup>

In summarizing its findings, the Committee concluded that the management and monitoring of low-level waste disposal sites was currently "a fairly primitive art,"<sup>93/</sup> and called for studies to resolve three primary problems:

"[F]irst, it is now quite clear that sharper criteria need to be established regarding waste form specifications, such as solid or liquid radioactive waste migration (i.e., movement from initial point of burial), and disposal site selection. Second, the steps to be taken following decommissioning of various disposal sites once they are full should be determined. Third, important financial arrangements

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<sup>91/</sup> Id.

<sup>92/</sup> Id., at 12.

<sup>93/</sup> Id., at 15.

necessary to guarantee long-term care of decommissioned sites by state or federal authorities need further definition.<sup>94/</sup>

3. The Past Regulatory Scheme Has Provided Inadequate Assessment Of The Problems Associated With Low-Level Waste Disposal.

Five of the six existing low-level disposal sites are regulated by the states in which they are located, while one site -- the Illinois burial ground -- is regulated directly by the NRC.<sup>95/</sup> Nevada, Kentucky, New York, Washington, and South Carolina have licensed commercial disposal sites pursuant to the Agreement State Program authorized by the Atomic Energy Act of 1954, as amended. Section 274(g) of that Act, 42 U.S.C. § 2021c, provides that, by formal agreement, states may assume regulatory authority over limited amounts of nuclear materials regulated by the Atomic Energy Act. The Act specifically directs, however, that radioactive waste is to be regulated by the AEC (now NRC) if the Commission believes that the hazards or potential hazards are sufficient to require federal regulation. 42 U.S.C. § 2021c(4) (1972).

Nonetheless, because five of the six burial grounds were located in agreement states when the disposal sites were established, no federal review or licensing proceeding was apparently undertaken when the burial grounds commenced opera-

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<sup>94/</sup> Id., at 6.

<sup>95/</sup> NRC also retained regulatory control over the disposal of certain amounts of special nuclear material, primarily plutonium, at the sites in Nevada and Washington.

tions. Nor has the AEC or NRC under the agreement state program produced any careful analysis of the practices at low level burial sites.<sup>96/</sup> Thus, the states have been left to deal independently, often inconsistently, and often superficially given limited resources, with the problems of low-level waste disposal.

Perhaps the most glaring regulatory failure has been the inability or unwillingness of the AEC/NRC to determine the types of radioactive waste that can safely be disposed of by shallow burial. In September, 1974, the AEC implicitly acknowledged this failure of the low-level waste disposal program. At that time, the Commission proposed to ban shallow land burial of all transuranium-contaminated waste.<sup>97/</sup> Yet even this proposal was made on an ad hoc basis without any analysis of overall low-level disposal practices. Indeed, this proposed change was analyzed primarily from the standpoint of the burden it would impose on the federal government to store transuranium-contaminated low-level waste at a federal repository.

NRC has not yet published even these limited regulations in final form. As a result, inconsistent state regulations still control disposal of transuranics at commercial burial

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<sup>96/</sup> Regulation of the agreement state program has been uneven and in many cases lax. The AEC long failed to develop specific criteria for use by its personnel in evaluating compatibility and adequacy. AEC also periodically inspected state personnel and procedures -- but at very infrequent intervals. AEC/NRC has continued to offer little guidance to states administering their own licensing and inspection programs.

<sup>97/</sup> 34 Fed. Reg. 32421 (1974).

grounds. South Carolina, New York, and Kentucky were the first to prohibit the burial of all transuranics and at present only the Richland, Washington, site still permits such disposal.<sup>98/</sup> Although this policy could change at any site at the discretion of a state. The Federal government's own policy -- adopted in 1972 by the AEC and continued now by ERDA -- forbids the burial of any transuranic-contaminated wastes at government nuclear facilities.<sup>99/</sup> Such wastes are instead stored in retrievable containers for ultimate disposal at some future time. Moreover, some transuranic-contaminated wastes that have been buried at INEL are being exhumed.<sup>100/</sup>

The House Government Operations Committee found the regulatory oversight of low-level waste disposal operations distressingly lax. The House Committee called the Agreement States program "akin to fiction"<sup>101/</sup> to the extent any pretense existed that states were provided assistance under that program. Indeed, the Committee found the current pattern of regulatory authority over these disposal operations bordering on chaos. In its Report, the Committee criticized existing authority for being "dispersed" and "without consistent direction," and found coordination and cooperation among Federal agencies

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<sup>98/</sup> Hearings, supra note 2, at 234.

<sup>99/</sup> U.S. Energy Research and Development Administration, Manual § 0511-04d(4) (1973).

<sup>100/</sup> U.S. Atomic Energy Commission, Open Environmental Statement, supra note 4.

<sup>101/</sup> House Report No. 94-1320, 94th Cong., 2d Sess., at 12 (1976).

lacking.<sup>102/</sup>

The House Committee specifically suggested that NRC consider reasserting its regulatory authority over all commercial disposal operations and even evaluate the possibility of direct federal operation of the sites.<sup>103/</sup> The Committee Report argues that the assertion of federal authority may be justified for three reasons: (1) the states do not have the necessary technical expertise or the funding capability to secure it; (2) the need for uniform national standards cannot be achieved under the present regulatory structure; and (3) the problem of radioactive waste disposal is a national problem, deserving of a national solution.<sup>104/</sup>

\* \* \*

In summary, materials contained in low-level radioactive wastes are some of the most toxic known to man. Present scientific understanding of the potential pathways for release of that material if it is buried in shallow earthen trenches is still extremely limited, and provides no assurance that radioactive wastes buried now will remain isolated from man for the necessary period of time until the wastes decay to innocuous levels. Moreover, available evidence indicates that migration has already occurred at several disposal sites; and

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<sup>102/</sup> Id., at 17.

<sup>103/</sup> Id., at 14.

<sup>104/</sup> Id.

that the evaluations of all disposal sites has to date been severely inadequate.

Based on this information, there exists widespread agreement among government investigators that the current program is inadequate, and consensus that further studies and analyses are urgently needed. Further, it is clear that the existing regulatory apparatus has serious shortcomings that have contributed to present problems with the disposal program. No overall assessment of the environmental impact or safety of the disposal of low-level waste by shallow burial has ever been made on a systematic basis. No environmental impact statement pursuant to the National Environmental Policy Act has ever been undertaken to analyze the adequacy of the low-level waste disposal program in light of all reasonable alternatives and the environmental impact of each. And certainly no overall evaluation of the program has been made in light of the problems described above.

Plainly, the Commission should undertake a complete reevaluation of its program for disposing of low-level wastes. The logical format for such a reevaluation is a comprehensive environmental impact statement investigating the current program and all reasonable alternatives to that program. Such an investigation would enable the Commission to confront all of the problems that have been identified in the low-level waste program to date, and to reach informed conclusions about the action needed to solve each individual problem in the context of developing a comprehensive plan for safe disposal



of these wastes. In any event, NRDC believes that the National Environmental Policy Act requires precisely such a comprehensive evaluation.

III. NEPA REQUIRES THAT THE NRC PREPARE A PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON ITS LOW-LEVEL RADIOACTIVE WASTE DISPOSAL PROGRAM

A. The Low-Level Waste Disposal Program Is A Major Federal Action Significantly Affecting The Environment

Section 102(2)(C) of the National Environmental Policy Act (NEPA) directs all Federal Agencies to prepare environmental impact statements (EIS) for all "major federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332 (1972)..

In view of the facts set out above, NRC's national program to dispose of low-level wastes by shallow land burial plainly represents a "major federal action" that "significantly affects the human environment." NRC regulations themselves acknowledge that actions involving single low-level burial facilities require NEPA statements. Specifically, 10 C.F.R. § 51.5 requires the preparation of an EIS before NRC issues or amends the license of a commercial burial ground.<sup>105/</sup>

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<sup>105/</sup> See 10 C.F.R. § 51.5(a)(6):

"An environmental impact statement will be prepared and circulated prior to taking any of the following types of actions:

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(6) Issuance of a license authorizing radioactive waste disposal by land burial pursuant to Part 30, 40 and/or 70 of this chapter."

Ironically, however, not even one site-specific EIS has ever been written on a low-level waste disposal site. All existing sites were licensed prior to NEPA's effective date. And despite the plain case law obligation to write EIS's on continuing activities, see pages 56 to 57, infra, no NEPA EIS has ever been prepared on any low-level burial ground whether operated under license from an Agreement State or from NRC.

In any event, single statements on individual facilities would not satisfy NRC's legal obligation under NEPA. In order to disclose fully to the public and to governmental decision makers the environmental effects of proposed actions and all reasonable alternatives to such actions, environmental impact statements must consider comprehensively the cumulative impacts of related actions. Indeed, the need for such consideration of major federal actions provided the impetus to establish a strong national policy on the environment. Thus, the Senate Committee Report on NEPA stated:

"[NEPA] is also designed to deal with the long-range implications of many of the critical environmental problems which have caused great public concern in recent years. . . ." 105/

In interpreting NEPA's requirements, the President's Council on Environmental Quality (CEQ) has emphasized the

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105/ S. Rep. No. 91-246, 91st Cong., 1st Sess., at 3 (1969). It is also worth noting that radiation hazards were a special problem emphasized in NEPA's legislative history. Id. at 4.

importance of programmatic statements:

"The program 102 statement affords an occasion for a more comprehensive consideration of effects and alternatives than is practicable in a statement on an individual action. It tends to ensure that cumulative impacts likely to be slighted in a case-by-case analysis are considered. And it avoids duplicative discussion of basic policy questions. A program statement can be supplemented or updated as necessary to account for changes in circumstances or public policy and to measure cumulative impacts over time."<sup>107/</sup>

More recently, the CEQ has reemphasized the need for programmatic statements to improve decision making that affects the environment:

"The [new, revised] guidelines encourage the use of program or generic statements to cover a number of related individual actions when comprehensive analysis is more useful and efficient than separate analyses of several related projects. If sufficiently comprehensive and informative, such program statements eliminate or reduce the need for further individual project statements. Program statements cut redundancy and unnecessary paperwork and make the environmental analysis more meaningful."<sup>108/</sup>

Programmatic statements must not be vague discussions of environmental impacts. The consideration of adverse effects of the program must be detailed and comprehensive. To the extent

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<sup>107/</sup> Council on Environmental Quality, Third Annual Report, at 233 (August 1972).

<sup>108/</sup> Council on Environmental Quality, Fourth Annual Report, at 235 (September 1973).

that it is impossible or unwieldy to be specific in assessing potential adverse impacts, then subsequent environmental statements should be prepared on more narrow "actions." The CEQ has specifically addressed this issue as follows:

"[A] program statement would not satisfy section 102(2)(C) if it were superficial or limited to generalities. The very rationale for a program statement requires that environmental considerations be analyzed fully. When all significant issues cannot be treated adequately in connection with the program as a whole, statements of a more limited scope will be necessary on some or all individual actions to complete the analysis."<sup>109/</sup>

The case law supports the CEQ view of NEPA that statements on individual actions are not sufficient to assess the environmental effects of broad agency programs. In the leading case of Scientists' Institute for Public Information v. AEC, 481 F.2d 1079 (D.C. Cir. 1973), the Court of Appeals ordered the AEC to prepare a comprehensive environmental impact statement on its program to develop the Liquid Metal Fast Breeder Reactor (LMFBR), even though an individual statement had been prepared for the one existing demonstration plant and even though the Commission planned to issue an EIS for each future plant:

"The Commission takes an unnecessarily crabbed approach to NEPA in assuming that the impact statement process was designed only for particular facilities rather than for analysis of the overall effects of broad agency programs. Indeed, quite the contrary is true."  
481 F.2d at 1086-87.

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<sup>109/</sup> Council on Environmental Quality, Third Annual Report, at 234 (August 1972). See also 40 C.F.R. § 1500.6(b)(1) (1975).

See Jones v. Lynn, 477 F.2d 885 (1st Cir. 1973) ("It would not seem sensible to adopt the piecemeal approach which HUD seeks to adopt, whereby it will prepare a modified impact statement separately [on each project] . . . , an approach akin to equating an appraisal of each tree to one of the forest." See also NRDC v. Morton, 458 F.2d 827 (D.C. Cir. 1972).

The national program to dispose of increasing quantities of low-level wastes by shallow land burial represents a programmatic decision that must be examined in an appropriately broad programmatic environmental impact statement. Particularly in view of recent reports that cast doubt on the adequacy of current practices,<sup>110/</sup> a programmatic analysis appears to be both appropriate and necessary. Separate statements on the individual sites would have difficulty considering the generic questions involved since the present need is to establish criteria for adequate disposal practices, for acceptable sites, and for the type of material such sites can properly handle.

The decision to rely on shallow land burial for disposal of low-level radioactive wastes is precisely analogous, for instance, to the decision to permit plutonium recycle, the decision to develop the LMFBR, and the determination of the best method for disposal of high-level wastes. All involve programmatic and generic issues of national environmental impact, and all require programmatic analyses of the environmental consequences of broad agency actions.

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<sup>110/</sup> See pages 32 - 45, supra.

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B. The Fact That Commercial Burial Of  
Low-Level Wastes Began Before NEPA  
Does Not Affect The Requirement  
That A Statement Be Prepared

Low-level radioactive waste disposal in commercial sites began in 1962. The applicability of NEPA to actions that began before NEPA was enacted has often been determined by an analysis of dates of so-called "critical decisions" or points at which alteration of the project would be impossible.<sup>111/</sup> In this case, however, while the actual burial of some wastes occurred before NEPA was enacted, the disposal program not only continues but is expected to expand substantially in the future. The courts have agreed that Congress did not intend to exempt from NEPA those projects which threaten endlessly repeated environmental injury. For example, in Lee v. Resor, 348 F. Supp. 389 (M.D. Fla. 1972), the court held that NEPA applied to a 20-year old continuing program of herbicide spraying. See also Sierra Club v. Morton, 351 F. Supp. 319 (D. Conn. 1972), 3 E.L.R. 20321 (D. Conn. 1973), New York v. Dept. of the Army, 2 E.L.R. (S.D. N.Y. 1972).

The Council on Environmental Quality has issued guidelines explicitly adopting the view that NEPA applies to continuing

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<sup>111/</sup> See Anderson, The National Environmental Policy Act, in Federal Environmental Law, at 396-410 and cases cited therein (E. Dolgin and T. Guilbert eds., 1974).

projects.<sup>112/</sup> NRC's regulatory program for disposal of low-level wastes is pre-eminently the type of continuing program to which NEPA has been held to apply and should apply. Given the extreme toxicity of radioactive materials and the fact that the disposal program will continue at an accelerating pace for the next 20-50 years or longer, an EIS considering the environmental impact of this continuing program is plainly required under NEPA.

C. NRC's Program Statement Must Include Analysis Of The Adequacy Of Disposal Practices Under The Agreement State Program

The programmatic EIS must, of course, cover the waste disposal program administered by the Agreement States. Five of the six existing commercial burial sites are licensed by states under this program. But, while the states directly regulate the burial sites, the provisions of the Atomic Energy Act establish that NRC bears (1) supervisory authority over the states' programs, and (2) the ultimate responsibility for ensuring that waste disposal practices are adequate to protect the public health and safety.

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<sup>112/</sup> See 40 C.F.R. § 1500.5(a):

"'Actions' include but are not limited to:

\* \* \*

- (2) new and continuing projects and program activities: . . . involving a Federal lease, permit, license certificate or other entitlement for use." (1973).



Pursuant to section 274 of the Atomic Energy Act, 42 U.S.C. § 2021 (1970), which authorizes the Agreement State program, the NRC must make two continuing determinations in order to permit states to regulate low-level waste burial grounds. First, the Commission is given continuing authority to terminate the entire agreement under which NRC delegates regulatory authority to the state if necessary to protect the public health and safety. 42 U.S.C. § 2021(j). Thus, the Commission's duty to determine that the states' practices regulating disposal sites are safe and adequate is plainly a continuing one. If state regulation allows hazards to develop, NRC must terminate the state agreement.

Second, a special obligation is placed on the Commission to assess the adequacy of state licensing of disposal practices. The Act specifically prohibits the delegation of licensing authority over disposal practices if the Commission determines that potential hazards require federal regulation. 42 U.S.C. § 2021(c)(4). Regulation of waste disposal by the states is therefore necessarily based on a continuing decision by NRC that the state programs are adequate to protect public health and safety.

The AEC in September 1974 explicitly recognized this authority and responsibility to assess low-level waste disposal practices when it proposed a rule prohibiting the burial of transuranic waste at commercial burial grounds. 34 Fed. Reg. 32421 (1974). This proposed regulation makes clear that the

Agreement State program is simply a mechanism utilized by NRC. Existence of the program in no way dilutes NRC's own obligation under the Atomic Energy Act, as amended, and as incorporated by the Energy Reorganization Act of 1974, to assess and ensure the adequacy and safety of waste disposal practices.

NRC cannot ignore its continuing authority over the disposal of all radioactive wastes. NRC must determine the extent of the hazards the wastes pose and, given these hazards, decide whether or not direct federal regulation is required. The decision to rely on the Agreement States' program amounts to approval of the States' regulations, burial methods, commercial operators and disposal sites. This decision, its environmental consequences, and the alternatives to it must be considered in NRC's programmatic impact statement.

The case law has imposed such an obligation on federal agencies when their involvement has been far less than NRC's direct supervisory obligations over low-level waste disposal under the Atomic Energy Act. For example, in Davis v. Morton, 469 F.2d 593 (10th Cir. 1972) the court held that NEPA applied to the approval by the Secretary of the Interior of a 99-year lease entered into by an Indian Tribe. The government argued in vain that there was no major federal action:

"The United States did not initiate the lease, was not a party, possessed no interest in either the lease or the development, did not participate financially or benefit from the lease in any way." 469 F.2d at 595.

The NRC's involvement with and responsibility for the adequacy of the low-level waste disposal program far exceeds that of the Interior Department in Davis. Unlike Davis, which involved only a one-time approval by the government, the NRC, as noted above, periodically reviews each state's program regulating low-level waste disposal for adequacy and compatibility. Moreover, NRC specifically bears ultimate responsibility under section 202(c)(4) to ensure that safe disposal practices are followed and to institute federal regulation if necessary to ensure safe disposal. Thus, NRC's obligation under NEPA extends to an analysis of the whole low-level waste disposal program, including an analysis of the proper role of Agreement States within that program.

In the Appendix to this Memorandum, NRDC sets out at length the nature of the analysis that the EIS must contain.

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IV. THE NEED FOR INTERIM REGULATIONS PENDING  
COMPLETION OF THE IMPACT STATEMENT

In light of the magnitude of the problem outlined above, the time which will be required for the preparation of the programmatic EIS, and the potentially irreversible adverse effects of present activities, immediate action is necessary to protect against potentially severe threats to public health and safety. Therefore, NRDC has petitioned NRC to adopt several interim regulations immediately. Each of the proposed interim regulations is offered as a needed immediate response to a specific problem. The legal obligations imposed on NRC by the Atomic Energy Act and the Energy Reorganization Act require the prompt adoption of the proposed regulations.

A. NRC's Legal Obligations

Pursuant to § 201(f) of the Energy Reorganization Act of 1974, 42 U.S.C. § 5481(f), the Nuclear Regulatory Commission carries out its licensing and related regulatory functions under the provisions of the Atomic Energy Act, 42 U.S.C. §§ 2011 et seq. ("AEA"). The provisions of the AEA direct NRC to protect the health and safety of the public through its licensing authority. Congress specifically found that the "processing and utilization" of nuclear materials "must be regulated. . . to protect health and safety of the public." 42 U.S.C. 2013(b) (1972).

The AEA contains the further finding of Congress that "regulation by the United States of the production and utilization of atomic energy and of the facilities used in connection therewith is necessary . . . to protect the health and safety of the public." 42 U.S.C. § 2012(e) (1972). And in articulating the purposes of the AEA, Congress declared its intention to provide for a "program to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes to the maximum extent consistent with . . . the health and safety of the public." 42 U.S.C. § 2013(d) (1972).

Furthermore, in creating the Nuclear Regulatory Commission, Congress specifically declared its intention in the Energy Reorganization Act ("ERA") "to advance the goals of restoring, protecting, and enhancing environmental quality, and to assure public health and safety." 42 U.S.C. § 5801(a). The Senate committee that was primarily responsible for drafting the ERA emphasized that the NRC was to "upgrade the regulation of nuclear power" and stated that the provisions of the ERA were "to guarantee that the new Commission will have the strength and autonomy to carry out its awesome safety, health and environmental responsibilities." Sen. Report No. 93-980, 93rd Cong., 2d Sess., at 3, 21 (1974).

These general duties to protect the health and safety of the public are made specific in the Act's licensing provisions. In issuing licenses for the disposal of radioactive materials

through burial, the Commission must take any steps necessary to protect the public health and safety. See 42 U.S.C. §§ 2073e(7), 2093b, 2111. The Supreme Court has recognized the safety requirements of these provisions of the Atomic Energy Act. The Court has noted that the Act "clearly contemplates that the Commission shall by regulations, set forth what the public safety requires as a prerequisite to any license or permit under the Act." Power Reactor Development Company v. International Union, 367 U.S. 396, 404 (1961). Accord, Citizens for Safe Power v. NRC, 524 F.2d 1291, 8 ERC 1598, 1604 (D.C. Cir. 1975). See also New Hampshire v. Atomic Energy Commission, 406 F.2d 170 (1st Cir. 1969), cert. denied 395 U.S. 962 (1970).

The Commission's duty to protect the public health and safety is plainly a continuing one. Section 187 of the Atomic Energy Act, 42 U.S.C. § 2237, makes all licenses issued under the Act subject to subsequently issued rules and regulations. Given the constantly evolving state of knowledge regarding nuclear technology and its associated hazards, the Commission's obligation to protect public health and safety requires continued review and revision of its regulations to respond to newly identified problems and hazards affecting public health and safety. Indeed, the Commission's own regulations recognize this obligation. The terms and conditions of all licenses explicitly permit the Commission to incorporate additional requirements and conditions if necessary to "protect health or to mini-

mize danger to life or property." 10 C.F.R. §§ 30.35(e)(2), 40.41(e)(2), 70.32(b)(2) (1975).

Finally, in connection with the State Agreement program, the Atomic Energy Act places a special obligation on the Commission to examine the safety of disposal methods for licensed radioactive materials. Specifically, the Act forbids the Commission from delegating regulatory authority to the states over the disposal of radioactive materials if those materials pose hazards that require direct NRC regulation. See 42 U.S.C. § 2021(c)(4) (1972).

Taken together, these statutory provisions and regulations create a continuing duty in the NRC to ensure that its regulations governing shallow land disposal of radioactive wastes adequately protect the public health and safety and safeguard the environment. As set out below, the interim regulations proposed are aimed at preventing known and specific threats to public health and safety and environmental quality. Under these circumstances, NRC has a legal duty to adopt these interim regulations immediately.

B. Each Of The Proposed Regulations Responds To An Identified Problem

1. Interim Ban On Burial Of Transuranic-Contaminated Wastes

Based on the evidence set out at length in Part II of this Memorandum, continued shallow land burial of long-lived transuranic wastes poses potentially severe threats to public

health and safety. Based on these increasingly clear hazards, the U.S. Environmental Protection Agency has stated flatly that shallow land burial of long-lived transuranic wastes cannot be permitted.<sup>113/</sup> A study by Battelle Pacific Northwest Laboratories (an ERDA contractor) came to the same conclusion.<sup>114/</sup> The task force on radioactive waste management of the 5th Annual National Conference on Radiation Control, a joint federal and state undertaking, recommended similar restrictions on burial of transuranic waste.<sup>115/</sup> The U.S. Energy Research and Development Administration acted several years ago to ban such burial at government facilities.<sup>116/</sup> The AEC proposed to take a similar step with regard to commercial wastes.<sup>117/</sup>

Failure by NRC at this time to ban continuing shallow land burial of transuranic-contaminated wastes would represent a clear violation of its duty to protect the public health and safety. The proposed regulations would place such a ban in effect through a two-step process. First, the regulations

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<sup>113/</sup> Statement of Roger Strelow, Assistant Administrator for Air and Waste Management, Environmental Protection Agency, before the Joint Committee on Atomic Energy, at 6 (November 19, 1975).

<sup>114/</sup> Battelle Pacific Northwest Laboratories, Program for the Management of Hazardous Wastes, Final Report, at 229 (July 1973).

<sup>115/</sup> Fifth Annual National Conference on Radiation Control, Planning for Protection, at 132 (October 1973).

<sup>116/</sup> U.S. Energy Research and Development Administration, Manual § 0511-04d(4) (1973) [hereinafter cited as ERDA Manual].

<sup>117/</sup> See 39 F.R. 32921 (1974).



place complete authority for regulation of the disposal of transuranic elements on land in the hands of NRC. Utilizing this authority, the regulations then prohibit further non-retrievable disposal of these wastes by shallow land burial. The language of the proposed regulations is taken almost verbatim from the regulations which the AEC proposed in September, 1974.<sup>118/</sup>

The proposed regulations define transuranic-contaminated wastes, in a manner similar to the AEC's September 1974 proposal, as those wastes contaminated to a concentration greater than 10 nanocuries per gram (10 microcuries per kilogram). (The value of 10nCi/g is derived from the naturally occurring concentration of radium-226 in the earth's crust.) This level of contamination has been selected by ERDA as the cut-off point for segregating transuranic wastes generated by the government.<sup>119/</sup>

NRDC recognizes that at the present time it is difficult to measure directly for the presence of alpha-emitting radionuclides at this concentration. ERDA has, however, found this to be a workable criterion, and the regulations reflect ERDA's formulation of acceptable "indirect" measurements. Reliance is permitted, if necessary, on indirect measurements or estimates and on administrative controls instead of direct external

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<sup>118/</sup> Id.

<sup>119/</sup> ERDA Manual, supra note 116, at § 0511 Appendix B (23) (1973).

measurements of waste containers.

To police this estimation procedure, the regulations propose that licensees formulate the estimating procedures on which they will rely and submit them to NRC for approval. The regulations further require NRC to establish an inspection system to assure both that the estimated procedures are utilized in the field and to verify that the approved procedures result in the accurate identification of transuranic wastes. To be effective, this inspection procedure must rely on NRC-employed inspectors and on unannounced inspections examining randomly selected portions of the waste stream.

A prohibition on land burial of transuranic waste, however, requires that the Commission make provision for an alternative method of handling these wastes. The proposed regulations would allow NRC to license retrievable storage only if specific conditions were met. The regulations focus on two critical elements in the retrievable storage program. First, if retrievable storage is permitted, it is vital to ensure that funds will be available to dispose properly of the wastes at some future time. Second, it is equally vital that the wastes be packaged and stored in a manner that will permit safe future disposal. The proposed regulations, therefore, require that persons shipping transuranic-contaminated wastes to a disposal site pay a fee that will cover all foreseeable future costs of permanent disposal, including the cost of storage and retrieval, the cost of packaging and shipping the wastes to a final repository,

a pro rata share of the projected cost of constructing and operating a final repository,<sup>120/</sup> and an allowance for future extraordinary costs that may be necessitated by future safety considerations. The proposed regulations provide that this fee be set initially at \$50 per cubic foot of transuranic waste delivered for burial, and require the Commission to undertake a study to set a more definitive level for this fee. The \$50 fee is based on preliminary studies by the AEC, which estimated that costs of storing and disposing of transuranic wastes would approximate \$28-57 per cubic foot of such wastes.<sup>121/</sup> Other studies of the question have yielded similar figures.<sup>122/</sup>

Since safe disposal of these wastes obviously depends on the availability of adequate funds to finance it, NRC must place such a funding mechanism in effect as rapidly as possible. The \$50 figure represents the AEC's best first estimate of the costs, and NRC should require that such a fee be collected

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<sup>120/</sup> The AEC stated that permanent disposal of its transuranic-contaminated wastes required deep geologic burial. See Atomic Energy Commission, Draft Environmental Statement, Management of Commercial High-Level and Transuranium-Contaminated Radioactive Wastes, September 1974, at 1.5-7 (WASH-1539). NRDC believes it likely that responsible study of commercially-generated transuranic-contaminated wastes will conclude that geologic burial is also required for such wastes.

<sup>121/</sup> Ramsey, Daly, Blasewitz, Cooley, and Richardson, "Overview of Management Programs for Plutonium-Contaminated Solid Waste in the U.S.A.," in Management of Plutonium-Contaminated Solid Wastes, at 76 (OECD Nuclear Energy Agency, 1974).

<sup>122/</sup> Battelle Pacific Northwest Laboratories, Management of Hazardous Wastes, at 229-247 and Appendix U (1973); AEC, Draft Environmental Statement, WASH-1539, supra note 120, at 1.9-7 [\$30 per cubic foot].

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immediately. If necessary, provisions can be made for refunds if subsequent study of the question establishes that a lesser fee is adequate.

It is not sufficient, however, merely to assure that adequate fees are paid by the persons who generate the waste. Steps must be taken to assure that the funds collected will actually be available to finance permanent disposal. If these funds simply flow into the general treasury of a state or national government, their availability becomes subject to the vagaries of future governmental budget decisions.

This problem has been graphically demonstrated in the case of uranium mill tailings and high-level radioactive wastes. The government's response to the admitted health hazards posed by the use of uranium mill tailings as fill under residences in Grand Junction, Colorado, was substantially delayed by difficulties in deciding who should pay for needed corrective action.<sup>123/</sup> Similar uncertainties exist in responding to the threat posed by the abandoned Vitro tailings pile in downtown Salt Lake City.<sup>124/</sup> Decisions concerning safe permanent disposal of the high-level radioactive wastes generated at the Nuclear Fuel Services Plant in West Valley New York are made significantly

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<sup>123/</sup> See, e.g., Hearings on the Use of Uranium Mill Tailings for Construction Purposes Before the Subcom. on Raw Materials of the Jt. Comm. on Atomic Energy, 92nd Cong., 1st Sess., at 514-15 (1971).

<sup>124/</sup> See, e.g., Hearings on ERDA Authorizing Legislation FY 1976 Before the Subcom. on Legislation of the Jt. Comm. on Atomic Energy, 94th Cong., 1st Sess., at 1373-76 (1975) (Statement of Utah Gov. Rampton).

more complex by the fact that no funds have been set aside to meet the extremely large estimated cost of disposal.

Even more pertinent, needed studies of the Maxey Flats, Kentucky disposal site have had great difficulty finding financial support. Both NRC and ERDA declined to provide financial assistance, and the state found the \$1 million price tag almost beyond its reach.<sup>125/</sup> The dangers posed by substantial accumulated amounts of transuranic wastes do not allow NRC to ignore the importance of providing for adequate financing of safe permanent disposal. Therefore, the proposed regulations specify that the fees collected must be placed in a special trust account dedicated solely to the purpose of financing permanent disposal of the transuranic-contaminated wastes.

As a further condition to licensing retrievable storage of transuranic wastes, NRC must assure that the wastes are well packaged and that adequate records are maintained. To facilitate safe permanent disposal, therefore, the proposed regulations require that transuranic wastes be packaged in containers that meet specified requirements.

The GAO in its report took special note of the problems caused by improper labeling and inadequate record-keeping in

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<sup>125/</sup> An ERDA study of the problem due to be completed in June 1975 has yet to be issued. Letter from James R. Miller, Chief, NRC Fuel Cycle Licensing Branch, Division of Fuel Cycle and Material Safety, to Dr. Terry R. Lash, dated November 10, 1975.

the management of low-level waste burial grounds.<sup>126/</sup> To avoid similar difficulties with transuranic-contaminated wastes, the proposed regulations require the maintenance of permanent records (probably on computers) which contain extensive information concerning the nature of the wastes buried, including the total transuranic and radioactive content, the concentration and chemical form of the transuranic and other significant radionuclides present in each container in the greatest concentrations, the combustibility and compactibility of the wastes, the container weight, and the storage location. In addition, the regulations would require that much of this information also appear on the waste container itself. This second requirement would serve to double check the permanent records and would also provide a source of information in the event the permanent records were destroyed.

2. Moratorium On The Issuance Of Additional Burial Sites And Floor On Payments To Cover Perpetual Care Of Existing Sites

In its report examining practices at low-level radioactive waste burial sites, the Congressional General Accounting Office emphasized four major deficiencies in the current program for disposing of low-level radioactive wastes by shallow burial. First, no site selection criteria exist for determining which sites offer the greatest long-term assurance that radioactivity, once buried, will not migrate. The GAO pointed out:

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<sup>126/</sup> GAO Report, supra note 6, at 30-31.

"The need for site selection criteria is recognized by ERDA, NRC, EPA and the U.S. Geological Survey (USGS). In July 1973, Battelle Pacific Northwest Laboratories issued a report to EPA which pointed out that disposal site standards had not been established and recommended standards be developed and used for selecting and licensing disposal sites." 127/

Second, the GAO report noted that the environmental monitoring systems at various disposal sites were inadequate and recommended to ERDA and NRC that the effectiveness of monitoring programs at existing disposal sites be improved. NRC acknowledged, in response to the GAO recommendations, that "environmental monitoring programs at certain burial sites needed improvement." 128/ Further, an NRC review group recently evaluated the Sheffield, Illinois disposal site and identified numerous shortcomings in its monitoring program. 129/

Third, the GAO pointed out that standards have not been developed for determining what levels of migration of radioactivity at disposal sites are unacceptable and require corrective action. In the absence of radioactive release standards setting maximum permissible migration rates, regulation of radioactive waste disposal sites and responses to findings of migration must be handled on an ad hoc basis. Evaluation of the migration experienced at both the New York and Kentucky

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127/ Id., at 10.

128/ Id., at 26.

129/ Id., at 24, 28.

disposal sites has foundered to some extent on an absence of relevant standards. NRC explicitly responded to an inquiry from Kentucky officials that none of NRC's existing standards were appropriate for assessing migration from disposal sites:

"\* \* \* the MPC values should not be used as detection levels or action levels in determining whether migrating radioactivity is acceptable or unacceptable, or whether or not corrective action should be instituted. The MPC values are only useful in assessing the radiation safety and public health aspects of the released radioactivity, and thus the urgency in taking corrective action. Also we do not believe the [as low as practicable] concept is applicable here either. What appears to be needed is the establishment of action levels, which if exceeded would result in specified measures being taken, e.g. more intensified monitoring, corrective action, etc. However, once it has been determined that radioactive material is migrating from a burial site, we believe a benefit-risk concept should be applied in evaluating the various alternative corrective actions that might be taken to minimize such migration."<sup>130/</sup>

Further, the general environmental radiation protection standards proposed by the Environmental Protection Agency are based on the assumption that little radioactivity will be released to the environment from waste disposal sites.<sup>131/</sup> If EPA's standards are to provide adequate protection, strict limits must be set on acceptable migration rates. The need to

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<sup>130/</sup> Id., at 21.

<sup>131/</sup> U.S. Environmental Protection Agency, Draft Environmental Statement, Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle (May 1975).



set such limits appears particularly crucial as one NRC official has now acknowledged:

"It is our opinion that 100 percent retention [of radioactivity at low-level waste disposal sites] is not a realistic goal. It is doubtful that a site could be found that would not permit some releases albeit small. . . . We agree that criteria for evaluating the release of radioactivity from commercial burial grounds should be defined to assist in determining the acceptability of existing and future disposal sites and practices." 132/

The GAO specifically recommended that radioactive release standards be established by both NRC and ERDA as a necessary ingredient in an effective monitoring program. 133/

Fourth, the GAO report noted that "NRC and several Agreement States have not established long-term-care requirements for commercial disposal sites and determined the adequacy of long-term-care funds to meet such requirements." 134/ In the absence of such regulations, the GAO found that existing provisions for long-term-care of the disposal sites and funding arrangements for such care were significantly inadequate in many cases. Since the fundamental issue posed by radioactive waste disposal is long-term care, the absence of such standards

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132/ Letter from Richard E. Cunningham, acting Director, Division of Fuel Cycle and Materials Safety, Nuclear Regulatory Commission, to David S. Smith, Director, Technology Assessment Division, U.S. Environmental Protection Agency, dated January 30, 1976.

133/ GAO Report, supra note 6, at 21.

134/ Id., at 34.

appears to be a major omission in a regulatory program designed to safeguard the public health and safety. The GAO specifically recommended to NRC that long-term-care requirements for commercial disposal sites be established and that the funding to support such requirements be established. <sup>135/</sup>

NRDC believes that licensing of additional sites without establishing these four sets of standards would be inconsistent with NRC's obligations under the AEA. No program to license new disposal sites can claim to protect the public health and safety unless standards are established for selecting sites, for monitoring radioactivity at those sites, for setting acceptable limits on the migration of radioactivity, and for establishing needed long-term-care requirements. The proposed regulations provide for a moratorium on the licensing of additional waste disposal sites until the critical sets of standards listed above have been promulgated.

In addition, the proposed regulations seek to end the practice of burying wastes without making adequate provisions for future care. Today radioactive wastes are being buried at the Sheffield, Illinois, site regulated by NRC (and at other sites regulated by the states) without benefit of adequate financial arrangements for safe, permanent care of the site. The absence of financial resources to cover safe permanent care raises the clear spectre that inadequate care and monitoring of the site in the future could allow a threat to public health

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<sup>135/</sup> Id., at 38.

and safety to develop. It is, therefore, critical for the Commission to act promptly to assure that adequate sums of money are accumulated beginning immediately to finance long-term care.

The regulations would immediately institute revised charges calculated to cover adequate long-term care. Specifically, the regulations would require that a minimum of \$0.15 per cubic foot of waste be paid to finance long-term care. A South Carolina study committee recommended that a total fee of \$0.14 be charged for each cubic foot of waste buried at the Barnwell, South Carolina site to cover long-term costs.<sup>136/</sup> In New York state, according to the GAO, the rate has been periodically increased over the years to the present charge of \$0.15 per cubic foot.<sup>137/</sup> The proposed \$0.15 charge per cubic foot is based on these two calculations of needed charges per cubic foot, which appear to be the most recent available. In addition, the regulations obligate the Commission to undertake a study of needed long-term care requirements and the financial implications of those requirements and to revise the fee accordingly.

The proposed regulations would also require that the owner of the land (either the state or the federal government)

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<sup>136/</sup> Grant, Hite, and Shealy, Economic Analysis of Funding Arrangements for Maintenance, Surveillance, and Contingency Costs Associated with Burial of Low-Level Radioactive Wastes in South Carolina, at 24-25 (December 1974).

<sup>137/</sup> GAO Report, supra note 6, at 36.

place the money paid for perpetual care in an escrow account dedicated solely to that purpose. If the availability of money depends completely on uncertain future political budget decisions, adequate future care is jeopardized. It is also, therefore, important for the Commission to permit waste burial only if proper arrangements are made for handling funds intended for long-term care to insulate such money -- to the greatest extent possible -- from being diverted to other purposes.

3. Ban On Liquid Shipment Of Low-Level Radioactive Wastes

At the present time, on-site solidification of radioactive wastes is allowed at three or four of the commercial burial sites. Thus, some wastes are shipped to disposal sites in liquid form. Yet shipment of liquid radioactive wastes presents a significantly higher risk of release of radioactivity in the event of an accident than shipment in solid form. Moreover, storage of liquid wastes at the disposal site itself poses significant additional hazards which have, in at least one instance, materialized. At one disposal site, the liquid content of a storage tank was released through an act of vandalism or sabotage.<sup>133/</sup> Since the waste was liquid, complete recovery was impossible.

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<sup>133/</sup> Report of the Nuclear Regulatory Commission Review Group regarding Maxey Flats, Kentucky Commercial Radioactive Waste Burial Ground, at 4 (July 7, 1975).

Both ERDA's practices and NRC's regulations pertaining to high-level radioactive wastes recognize the significantly greater danger of release to the environment posed by wastes in liquid form. <sup>139/</sup> Moreover, most of the migration of radioactive materials at the New York and Kentucky sites has been associated with the presence of water in the disposal trenches. Ideally, burial of liquid wastes should not be permitted, and this practice appears to have stopped at most commercial disposal sites. But if waste is not to be buried as a liquid, there is no need to allow liquid waste to be shipped to disposal sites. At the present time, both shipment and storage of low-level radioactive wastes pose unnecessary potential hazards to public health and environmental contamination. Therefore, the proposed regulations require that low-level radioactive wastes be solidified prior to shipment to a licensed disposal site.

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<sup>139/</sup> See, e.g., 10 C.F.R. Part 50, Appendix F, paragraph 2

CONCLUSION

For the reasons set out above, the Natural Resources Defense Council respectfully requests the Nuclear Regulatory Commission to undertake forthwith the preparation of a programmatic environmental impact statement pursuant to the National Environmental Policy Act on its program for disposal of low-level radioactive wastes. Further, the Natural Resources Defense Council requests the Commission to grant the petition for rulemaking which the Council has filed and to adopt promptly the interim regulations proposed in that petition.

Respectfully submitted,

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APPENDIX

DESCRIPTION OF GENERIC ENVIRONMENTAL

IMPACT STATEMENT

The National Environmental Policy Act requires the Nuclear Regulatory Commission to prepare a generic EIS on its regulatory program for disposal of low-level radioactive wastes. The EIS must analyze the overall, long-term environmental impact of the present program, of all reasonable alternatives to the present program, and of all reasonable alternatives to individual portions of that program. The analysis must be both comprehensive and detailed. And, most importantly, the environmental impact statement must be a satisfactory decision making document for assessing the costs, risks, and benefits of alternative regulatory programs for low-level waste disposal.

Below are a discussion of the issues that, at a minimum, must be addressed in an adequate EIS and a suggested outline for the EIS.

Questions to be Addressed in the Statement

1. Is Shallow Land Burial Ever an Adequate Means of Disposing of Nuclear Wastes?

A central issue of the EIS must be an assessment of the acceptability of shallow land burial of low-level radioactive

wastes. The statement cannot assume the validity of past decisions that were made without the benefit of an environmental impact statement or, for that matter, a thorough safety analysis. The statement must explicitly consider afresh whether any radioactive wastes should ever be disposed of by simple burial.

To evaluate the shallow land burial alternative, the statement must examine all reasonable alternative means of disposing of the wastes and set forth the relative environmental and economic costs associated with each method. In order to assess the potential environmental and health hazards, the types, quantities and toxicities of the various wastes that are produced today and that will be produced in the future should be examined. In this context, "low level" wastes must be carefully defined by an appropriate hazard index or by a set of parameters that includes consideration of (1) the radioactive half-life, (2) behavior in the environment, and (3) toxicity to humans of the radionuclides contained in the wastes.

To our knowledge no single, widely accepted hazard index now exists. Therefore, the NRC must devote substantial effort to devising a comprehensive set of parameters that will allow the unambiguous categorization of wastes for disposal purposes. Systematic use of such parameters must constitute the basis for any determination of the types and amounts of wastes that can be safely buried in shallow earthen trenches or in other types of disposal facilities. Current information strongly suggests that neither shallow land burial nor ocean dumping is an acceptable method of disposal for transuranic radionuclides. But other



potentially hazardous, long-lived wastes, such as Iodine-129, may be equally unsuited for disposal by shallow land burial or ocean dumping. In sum, the statement should carefully analyze the radionuclides in low level radioactive wastes and determine the adequacy of shallow land burial, ocean dumping, geologic disposal, or other disposal methods for each, based on an objective set of criteria.

Specifically, the statement must address the appropriate handling of transuranic-contaminated wastes, and analyze whether shallow land burial can ever be acceptable for such wastes. The statement should evaluate ERDA's current practice of storing all government-generated transuranic-contaminated wastes in retrievable form. This evaluation must, of course, consider the proposed 1974 regulations (39 Fed. Reg. 32921) that would have applied ERDA's practice to the private sector and set a ten nanocurie per gram limit on the transuranic content of waste that could be buried in commercial low-level waste disposal sites. (The proposed regulations required any waste exceeding that limit to be transferred to the federal government for long-term management and included a provision requiring the producer of the waste to pay a fee sufficient to cover subsequent management of the waste.) The statement must examine the possible impact and costs of separating and temporarily storing transuranic-contaminated commercially-produced wastes and the likelihood and time frame of eventual disposal of such wastes. The statement must also examine alternative ways of defining

transuranic wastes if it concludes that such wastes should be transferred to the federal government for management and disposal.

2. How Should Waste be Buried?

Assuming certain types of waste can be safely disposed of by shallow land burial, the acceptability of different land burial techniques and their relative degrees of protection should be considered. What depth of burial is necessary? What quantity of waste can be allowed in a single pit or trench? How should the trench be lined and covered? What steps must be taken to prevent water from coming into contact with waste material? Should all wastes be solidified before burial and, if so, what should be the characteristics of the solids accepted for burial? Currently no reliance is placed on the burial containers to prevent migration of radionuclides into the environment. The statement must consider if this policy should be continued and whether man-made protective barriers should be used.

A comprehensive set of burial alternatives must be examined in an extended scenario considering various depths, containers, types of dumping and trench configurations. The potential for radionuclide migration and other environmental and health hazards from each scenario should be projected. Alternatives should be compared in a cost/risk/benefit analysis.

Based on an honest examination of the above questions the statement should be able to reach conclusions on the most

favorable means of disposal from an environmental standpoint. The single "best" alternative might involve no shallow land burial of wastes at all. In any case, a hierarchy of possible disposal methods and their potential environmental and health impacts should be matched with economic consequences to yield a detailed cost/risk/benefit analysis. The analysis should be conducted separately for wastes already buried and for future wastes.

a. What is to be Done with Future Wastes?

The costs and benefits arrived at in the statement's assessment of alternatives - and NOT past decisions - should determine the choice of future methods of disposal.

Questions, such as who should regulate waste disposal, where should disposal sites be located, and what types of wastes may be buried, should not be constrained by past events or decisions. Because no adequate environmental impact analysis has been performed on the past disposal program, the projection of the procedures to be followed in the future should be unhampered by the current program and its commercially operated low level burial sites regulated primarily under the Agreement States Program. While one option may be continuing burial at the existing sites, the statement must not be committed to such a policy before conducting a thorough analysis of all other possibilities, including all reasonable alternative disposal modes and regulatory patterns.

b. What is to be Done with Existing Wastes?

The second phase of the alternative assessment involves another set of costs and benefits: those associated with the wastes that have been buried in the past. The statement may well conclude that the disposal conditions for these wastes were not only less than ideal, but that the wastes may actually pose an unacceptable hazard. Depending on the magnitude of the difference between better disposal methods and past practices, many questions would have to be resolved.

For example, what degree of potential hazard would justify closing all sites or particular sites? What would justify closer government monitoring? What risk would necessitate digging up buried wastes to assure safer disposal? Should the operators of the existing sites be assessed for a sinking fund or be required to post a bond to cover future surveillance and safety needs? All these are cost/risk/benefit questions requiring environmental and economic considerations to be weighed and explained.

3. Where Should Wastes be Buried?

In light of the above analysis, the statement should propose detailed quantitative criteria for evaluating the acceptability of potential burial grounds. These criteria must include careful consideration of topographical, geographical, geological, hydrological, ecological, and meteorological conditions.

Since this determination is so closely related to the type of burial utilized, the potential sites should be considered in light of the burial alternatives previously examined.

Specific criteria for site selection should be set out in the context of alternative types of burial sites. Proximity to population, geologic structure, ground water location, weather variables and so on should be studied to determine a safe range of conditions under which the necessary isolation times can be assured.

The six existing commercially operated low-level sites were selected so as to "minimize the risk of unexpected or hazardous exposures."<sup>1/</sup> Yet after thirteen years of operation, movement of radionuclides away from the burial sites is known to have occurred at two of the six sites. While it is difficult to predict migration in many areas,<sup>2/</sup> the hazards of such an occurrence are potentially severe enough that extensive studies should be undertaken for the EIS, to provide some basis for predicting radionuclide migration over periods of 10-20 half-lives of various radionuclides.

In addition, the statement must consider at length the acceptability of current practices authorizing the burial of small

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<sup>1/</sup> 10 C. F. R. § 20.3.02.

<sup>2/</sup> E. P. A., "Storage of Low Level Radioactive Wastes in the Ground: Hydrogeologic and Hydrochemical Factor", EPA - 520/3 - 74 - 009 (1974), 32-33.

quantities of radioactive waste by any licensee anywhere in the country. The EIS should review in detail the types and amounts of radioactive waste for which such unsupervised burial is adequate.

4. Who Should Bury the Waste?

Experience with the Agreement State Program and with existing commercially operated burial grounds provides information on one type of operating and regulatory pattern for waste disposal. However, a full range of alternatives must be examined and a cost/risk/benefit analysis presented for each.

a. Burial by the Federal or State Government

The costs and benefits of the federal government actually conducting all disposal operations itself should be extensively analyzed. ERDA experience should be fully discussed and considered. Alternatively, the possibility of state operation of disposal operations should be considered.

What would be total federal or state cost for the burial techniques examined above? How much of that expense could be shifted to the producers of waste? What are the advantages of each technique in terms of long-term control? What are the advantages/disadvantages in terms of ensuring proper disposal?

b. Burial by Commercial Enterprise

Reliance on commercial operation of waste disposal programs must be compared with government operations. The com-

parison must also involve consideration of alternative regulatory mechanisms under which commercial disposal sites might operate.

i. Should the States or the Federal Government Regulate Commercial Burial Companies?

Past experience provides a basis to compare the effectiveness of state and federal regulation of commercial burial grounds. Specifically, the statement should compare state and federal regulation to determine which type of regulation provides the best expertise, personnel, funding, and commitment to guarantee safe operation of the sites.

ii. What Kinds of Additional Regulation are Necessary?

The statement must also examine the various possible forms and scope of regulation, standards for disposal methods, safety procedures, cost allocation, etc. The statement should specify the extent of regulation needed in each area. For example, where should government regulation place the cost of disposal? Should the producers of waste be charged for the right to dump? What should such charges cover? A recent study of Clemson University concluded that fees charged waste producers at the existing South Carolina site should be dramatically increased to cover the true costs of waste management and burial.<sup>3/</sup>

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<sup>3/</sup> Grant, C., Hite, J., and Shealey, H.G., "Economic Analysis of Funding Arrangements for Maintenance, Surveillance, and Contingency Costs Associated with Burial of Low-Level Radioactive Waste in South Carolina", AE 379, A Special Study for the South Carolina Department of Health and Environmental Control, prepared by Department of Agricultural Economics and Rural Sociology, Clemson University, (Dec. 1974).

The type and frequency of governmental inspection must also be scrutinized. What type of environmental monitoring program should be conducted and by whom? How can the separation of non-buriable wastes be most safely monitored? What should happen if the operator breaches lease conditions or operating orders in any of these regards?

The question of continuing protection must also be addressed. The South Carolina study cited above concluded that licensees should be required to post an eighteen-year declining term performance bond to protect against default until an adequate state-operated sinking fund was established.<sup>4/</sup> The statement must consider whether a similar requirement is appropriate for all burial sites. The size and duration of the bond must be carefully calculated. Should a sinking fund managed by the state or federal government be set up? How will such bonding/sinking fund requirements affect the viability of commercial burial operations?

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<sup>4/</sup> Id., 16-19, 15.



Suggested Outline of Generic EIS on the Regulatory Program  
for Low-Level Radioactive Wastes

- I. Introduction - Brief "Executive Summary" describing the present program and alternatives to it, including advantages and disadvantages of the major alternatives
- II. Purpose of the EIS
  - A. A discussion of how this EIS will aid the formulation of new policies and regulations on low-level waste
  - B. Scope of the EIS
    1. The relationship of this EIS to future EIS's prepared for individual waste storage or disposal facilities
    2. The relationship of this EIS to the EIS's related to the regulation of other radiation hazards produced by the nuclear energy program, particularly EIS's about regulatory programs pertaining to other types of radioactive wastes
    3. The relationship of this EIS to the NRC and state responsibilities in the Agreement State Program
- III. Description of the commercial low-level waste disposal industry in Agreement and non-Agreement States
  - A. Processes that result in the production of low-level wastes
    1. Nuclear fuel cycle facilities
    2. Industrial processes
    3. Medical care activities
    4. Research activities
    5. Other
  - B. Description of the burial of low-level wastes in the past, including the amount of wastes buried, location of burial sites, and experience with existing sites, including the recent discovery of radioactivity off-site

C. Present low-level waste burial operations

1. Amount of waste being produced annually
2. Location of waste producers in relation to existing burial sites
3. Description of environmental (geological, hydrological, meteorological, ecological, etc.) conditions and population near each burial site

D. Future waste production and burial

1. Amount of low-level waste to be produced under different degrees of nuclear development during the next 50 years
2. Number of new disposal sites that would be required under existing regulations
3. Lengths of time presently operating burial facilities are expected to continue in operation
4. The relationship of future locations of burial facilities to projected population centers and types of environment

IV. Analysis of hazards posed by low-level wastes and advantages/disadvantages of various disposal alternatives

A. Hazards posed

1. Radionuclides of significance in low-level wastes
2. Health hazards
3. Potential pathways of exposure
4. Rate of movement through pathways
5. Potential for concentration in environment

B. Hazard index construction - relevant parameters

1. specific toxicity
2. half-life
3. biomagnification
4. geochemical behavior
5. consideration of decay products
6. other

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- C. Alternative disposal options - analysis of relative assurance of isolation of radioactive materials
  - 1. Shallow burial
    - a. without man-made barriers
    - b. with man-made barriers
    - c. with varying disposal practices (e.g. depth of burial, compaction, etc.)
    - d. with varying disposal requirements
      - solidification
      - incineration
      - separation of particular nuclides
    - e. with various restrictions on location of burial grounds
    - f. other restrictions and requirements
  - 2. Geologic disposal
  - 3. Ocean dumping
  - 4. Other
- D. Acceptability of disposal of radionuclides with various hazard indexes by various disposal methods
- V. Description of the present regulatory program and the environmental impact of continuing it in its present form
  - A. Supervision of licensing in Agreement States - description of the periodic investigations and analysis of low-level waste disposal regulation in Agreement States and procedure followed for determining adequacy and compatibility
  - B. Description and comparative analysis of the various conditions being imposed on each active burial facility in Agreement States and non-Agreement States
  - C. Description and evaluation of present inspection and monitoring procedures to assess the possibility of exposure to radioactivity from disposal facilities

- D. Description of how the costs of perpetual monitoring, routine maintenance and correction of unusual problems of burial sites is or will be allocated between the federal government, state governments, facility operators and successors in interest to the lands having low-level wastes on them
- E. An assessment of the effectiveness of the conditions presently imposed by the NRC and various Agreement States in preventing (over an appropriate time period):
  - 1. subsurface movement of radionuclides by water contacting the wastes
  - 2. exposure and overland transport of radionuclides by normal wind and water erosional processes
  - 3. the use of radioactively contaminated materials for construction or other unauthorized uses by an unknowing person or one who purposefully ignores the potential hazards
  - 4. transport upward of radionuclides by capillary flow followed by their concentration in vegetation growing at the burial facilities and the ingestion of the radioactive vegetation by livestock or other animals grazing on the disposal site
  - 5. the intrusion of burrowing animals into the trenches and removal of wastes by them
  - 6. the ignition of fires in the trenches
  - 7. erosion due to floods or following disruption of landscape by earthquakes
- F. The environmental impacts to be expected from the exposure of humans, flora and fauna to the release of radioactive materials by each of the seven exposure routes listed in V. above

- VI. Alternatives - discussion of the alternative regulations and their environmental impacts, considered with and without the possibility of state regulation under the Agreement State Program
  - A. Removal of some or all of the "critical" radionuclides before disposing of the wastes, and then disposing of the concentrated radionuclides in the same manner as the high-level wastes

1. Require producers of waste to remove critical radionuclides before shipment to burial grounds
  2. Require waste burial operators to segregate wastes according to content of critical radionuclides
- B. Increased numbers and kinds of man-made barriers to reduce possibility of waste movement
  - C. Adoption of more stringent environmental (geological, hydrological, meteorological, ecological, etc.) conditions that must be met in order to obtain license for a burial facility
  - D. Adoption of stronger inspection, labeling, and monitoring regulations and requirement of appropriate financial securities to ensure adequacy of operators' performance
  - E. Adoption of more precise requirements defining the chemical and physical characteristics of waste that can be buried (e.g. define the nature of solidification required, ban burial of non-radioactive toxic wastes, ban burial of any wastes that might increase mobility of radionuclides through chemical or physical interaction, etc.)
  - F. Comparison of long- and short-term environmental and health impacts of the alternatives with the impacts of the present program
  - G. Comparison of costs/risks/benefits of each alternative with the present program
- VII. Additional Research and Development - discussion of what additional studies are desirable or necessary in order to promulgate adequate, comprehensive regulations pertaining to low-level waste disposal
- A. ERDA-sponsored work requested by ...
  - B. NRC confirmatory studies - detailed description of all contracts and activities
  - C. Studies conducted by other federal agencies (e.g., EPA) that are pertinent to low-level waste disposal

ENCLOSURE 2

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