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Amarillo National Resource Center for Plutonium

A Higher Education Consortium of The Texas A&M University System, Texas Tech University, and The University of Texas System

June 6, 1996

Department of Energy
Office of Fissile Materials Disposition
PO Box 23786
Washington, DC 20026-3786

The Amarillo National Resource Center for Plutonium's Senior Technical Review Group has reviewed portions of the Storage and Disposition of Weapons-Useable Fissile Materials Draft Programmatic Environmental Impact Statement. After careful and deliberate discussion, the Group agreed upon the enclosed comments, and we hereby formally submit them as part of the formal public comment period for the draft PEIS, which ends June 7, 1996.

We very much appreciate the opportunity for our Review Group to comment, and look forward to the Department's response.

Sincerely,

Dale E. Klein
Governing Board Chairman

Enclosure

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Amarillo National Resource Center for Plutonium

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Comments and Recommendations
Based on the PEIS Briefings
and
Reactor-Based Plutonium Disposition Options

Submitted By

Senior Technical Review Group
Amarillo National Resource Center for Plutonium

March 1996

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A Report of the
Senior Technical Review Group
March 1996

The Senior Technical Review group met on March 11 and 12, 1996, to review the Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement, and to review the reactor-based plutonium disposition options.

The Group once again emphasized the urgency of both the U.S. and Russia moving forward with selecting and implementing plutonium disposition options.

Comments and recommendations based on the PEIS briefing:

The DOE representatives gave a reasonably detailed presentation on the draft PEIS on "Storage and Disposition of Weapons-Usable Fissile Materials." Based on this presentation and an examination of several parts of the Summary document, the Review Group has several concerns, indicated in the following comments.

The absence of significant discussion on safeguards and security in the presentation was striking. We understand this is a result of limitations on what is to be included in a PEIS. We further understand that the PEIS is only one of three "pathways" to the decision on storage and disposition of weapons materials, the other two being costs and proliferation issues. (This is clearly described on page S-1.) However we believe any public discussion of the PEIS should explicitly describe these three factors because the fundamental concerns relate to the safeguards and security aspects. 1/01.06.00

We are skeptical about the feasibility of the deep borehole concept, which has been included as a "reasonable" disposition option. Obtaining approval for a site will be difficult. Licensing the site for an approach never examined by EPA or NRC will be extremely time consuming. We realize that the deep borehole concept has some potential advantages, but we remain skeptical about being able to achieve these on a competitive timescale. Proceeding with this option is inconsistent with our previous recommendation to proceed with plutonium disposition on an urgent basis. In our judgement, this option should not be described as "reasonable" but, rather, as "not necessarily unreasonable". 2/04.04.00

We were surprised to find that electrometallurgical treatment continues as a "reasonable" option for immobilization. Previous presentations to the Review Group had indicated this approach was being dropped. We believe it should have been. 3/01.04.00

Some of the Review group believe that elimination from the PEIS of the European MOX fabrication/irradiation option is inappropriate and decidedly premature. Under NEPA, exclusion of this option from the PEIS will preclude further consideration. However, environmental impacts of this option are almost exclusively overseas and are therefore excluded from NEPA coverage. Thus, there is no environmental impact basis for excluding the option. The reason cited for elimination of this option is that European fabricators have expressed an unwillingness to fabricate U.S. plutonium for irradiation in European reactors primarily because of the fabricators' concern that this would have an adverse impact upon the market for reprocessing services, which they also offer. This objection, however, would not necessarily apply to a limited program of irradiating a few assemblies or even a few reloads. Moreover, commercial objections might be subject to reversal for policy reasons and because of future changes in the market. Indeed reactor grade MOX fabrication and irradiation already are licensed and commercially proven activities in Europe. NRC licensing of MOX might be achieved quickly, but there is no guarantee of this. This existing capability provides the potential for acceleration of the disposition process if the political and commercial problems, as well as transportation issues, can be resolved. Therefore some members 4/06.01.08

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01 06 00 Comment Number 1

The purpose of the Proposed Action is, in part, to establish the technical and program infrastructure that will enable the United States to take unilateral action or negotiate reciprocal actions with other nations for the disposition of surplus weapons-usable Pu. This PEIS addresses the environmental impacts of the reasonable alternatives for DOE's Proposed Action. Analyses of the cost, schedule, technical, and Nonproliferation Policy impacts are described in separate documents to support DOE's ROD. The technical, cost, and schedule documents were made available for public review beginning in July 1996. The nonproliferation analysis was made available to public beginning in October 1996. DOE also conducted a series of public meetings, prior to the issuance of the Final PEIS, to discuss the analysis of the Nonproliferation Policy as it relates to the PEIS alternatives.

04 04 00 Comment Number 2

Comment noted.

01 04 00 Comment Number 3

The *National Environmental Policy Act* requires consideration of all reasonable alternatives. Although the Electrometallurgical Treatment Alternative for disposition of weapons-usable Pu is not as technically mature as other alternatives considered in the PEIS, it was considered to have sufficient maturity to be retained as an alternative in the Final PEIS. Further, the National Academy of Sciences (NAS) recognized this alternative, dependant upon successful demonstration. Section 2.4.4.3 of the Final PEIS has been modified to note recent conclusions from the National Research Council.

06 01 08 Comment Number 4

Comment noted. The basis for exclusion of the European MOX Fabrication/ Irradiation Option is included in the Screening Report. Section 2.1.4 of the PEIS provides further explanation on the exclusion of this alternative, due to a lack of capacity to complete the disposition mission, the institutional complexities such as transportation, security, and other geopolitical factors.

of the Review Group believe that the European pathway to early implementation, particularly through initial demonstrations of the disposition process, should not be foreclosed at this time. | 4/06.01.08 cont.

The Summary (page S-15) indicates the possibility of using LWRs both for the disposition of plutonium and for the production of tritium. We consider that, both from a policy and public perspective, these two requirements should be kept separate, and should not be accomplished in the same reactor or reactors. The Office of Fissile Material Disposition should be involved only in the various aspects of storage and disposition of plutonium and HEU, and not in the production of new weapons material. | 5/11.00.08

Finally, the Review Group strongly objects to misleading presentations in the Summary, for example, of what are purportedly calculations of latent cancer fatalities in the public and the work force for various disposition options. While we have not reviewed the entire draft PEIS, the following comments, based upon review of the Summary, indicate our concerns: | 6/16.00.00

(1) We were informed that it was assumed that new nuclear plants would not displace any existing operating units of any kind. This is an insupportable assumption. | 7/06.04.08

(2) Figures S-14 through S-18, S-23, S-25, S-27 through S-31, and S-39 through S-44 are unclear in their comparison among existing LWRs, partially completed LWRs, and evolutionary LWRs. A reader easily could conclude that evolutionary LWRs will cause more latent cancer fatalities, emit more radiation and produce more radioactive waste than existing LWRs. Yet they have been designed to reduce both radioactive emissions and radioactive waste. We were informed that these descriptions were based on two requirements: (a) actual data were used for existing plants, but maximum allowable limits were used for unfinished or evolutionary plants; (b) no error bars or uncertainty limits were allowed to be used, leading the reader to conclude the graphs are accurate. Both requirements lead to highly misleading presentations, which are accentuated by not having an explanation in appendices A and B to put the calculations into perspective. We understand that the DOE Office of General Counsel ordered that no error bars be shown. The General Counsel should be asked to reconsider this order since it affects the determination of technical issues.

(3) The figures used to describe the impact of the proposed operations are misleading as they lack the perspective of existing baseline values and, in some instances, a time-frame. Also the scales on which the data are displayed exaggerate very small effects. For example: | 8/01.00.00

a) Figures S-17 and S-18 are for the life of operation. They indicate that during this period the operation's radiological impact on cancer fatalities would be less than 3.5 or less than 6 additional cancer deaths among the resident and worker populations, respectively. However, they do not reflect the several million "spontaneous" (non-radiation related) cancer deaths that would be expected to occur among these populations during the same period. Nor do they indicate the bounds of the uncertainties around these estimates, thus the reader could conclude that the estimates are precise. However, both BEIR and NCRP have indicated that, at very low doses, zero effect is within the range of likelihood. Specifically the National Committee for Radiation Protection, in Report #121, 'Principles and Application of Collective Dose in Radiation Protection', recommends "When the collective dose is smaller than the reciprocal of the relevant risk coefficient, the risk assessment should note that the most likely number of excess cancer deaths is zero. This recommendation applies in this case, which the reader can only discover by reading the Appendices carefully."

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However the option is retained for the utilization of European MOX fabrication to fulfill short term MOX fuel needs as explained in Section 2.4.5.1 of the PEIS.

11 00 08 **Comment Number 5**

Comment noted.

16 00 00 **Comment Number 6**

Based on comments received, the Summary for the Draft PEIS was revised. Revisions made in the Final PEIS are reflected in the Summary.

06 04 08 **Comment Number 7**

If a new reactor was built, it would operate to provide electricity to a competitive marketplace. No displacement of existing capacity per se is envisioned but the market would be the arbiter of any displacement.

01 00 00 **Comment Number 8**

Based on public comments, the Summary of the Draft PEIS was revised. The Comparison of Alternatives charts (figures) were removed, and the text was expanded and revised. Chapter 4 of the PEIS has been revised to include an explanation of low doses. Chapter 4 has also been revised to reflect "total" impacts and wastes from operating existing LWRs using MOX fuel, as well as the "net" incremental impacts (that is, the difference in spent fuel between uranium-fueled and MOX-fueled operations).

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b) Figure S-22 is another example of deceptive graphics in which the graphics developed to describe risks misrepresent the impact of the proposed operations in that they do not include baseline values (levels). The reader will not realize that the chart shows additional low level waste generated by the alternatives. The several thousand times greater volume generated by evolutionary LWRs compared to existing LWRs is because the large volume generated by the existing LWRs is not included in the chart. Also, Figures S-4 through S-13 give no indication whether they represent total or additions to existing quantities or, for that matter, whether the numbers shown for different options have been calculated on the same basis. 8/01.00.00 cont.

We recommend that the figures be revised where applicable to reflect existing operations and the cancer death rate among the general, non-exposed population.

(4) In several parts of the text, it is stated that "the dose to the population living within 80 km (50 mi) of the site would be within 100 person-rem per year". However, the reader is not told whether this is acceptable or how it compares with other population doses, including those received from natural sources. 9/09.09.08

In summary, the Review Group is skeptical about some of the retained alternatives, disturbed about the misleading character of the Summary, and concerned about the lack of discussion of the major reason for the program, i.e., the safeguards and security (or proliferation) issue.

Comments on Reactor Disposition Options

The DOE Team presented the status of the efforts to evaluate the disposition option that would utilize LWRs or CANDUs. The STRG's comments on the review are as follows:

LWR OPTIONS

The team reported that the major technical focus in utilizing LWRs has been on full core loading of mixed U-Pu oxide (full MOX core), revealing some developmental issues primarily associated with relatively new applications of burnable absorbers. To avoid potential delays in resolving these technical issues and in licensing a newer technology, DOE has shifted its emphasis to evaluating partial (1/3) core loading of MOX fuel. 10/08.03.01

While disappointed that the DOE did not begin by focusing on the 1/3rd core option, the STRG endorses this shift and a strategy that would apply the partial MOX core in the initial stages of a disposition campaign, followed by full MOX core applications when the developmental problems are resolved. The STRG recommends that this strategy, including development work, be defined in detail, along with an implementation plan that reflects the urgency of starting a disposition option. The strategy and implementation plan should include the following characteristics: 11/07.00.00

(1) Proven technology for the initial applications:

-MOX fuel and reactor designs should be patterned on existing commercial MOX experience; European design and operational experience should be utilized fully. DOE should consider obtaining all such pertinent experience from the Europeans and make it available to U.S. utilities that have shown strong interest in the MOX disposition option. 12/06.02.08

-Changes in the number of control rods or the configuration of the reactor vessel head or internals should be barred from consideration for partial core loading.

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09 09 08 Comment Number 9

Proposed 10 CFR part 834 (see 58 FR 16268) would require an as low as reasonably achievable (ALARA) program and would generally limit the potential annual population dose to 100 person-roentgen equivalent man (rem)/year (yr) from all pathways combined for DOE activities. The radiation exposure to the public is limited by the maximum individual dose of 100 millirem (mrem)/yr. To compare the population dose from the Proposed Alternatives to the natural background radiation, the PEIS presented the percentage of the population dose for each alternative relative to the natural background radiation.

08 03 01 Comment Number 10

The Department of Energy acknowledges the commentor's support for Pu disposition in reactors. Decisions on disposition will be made based upon environmental analyses, technical and economic studies, national policy considerations, and public input. The environmental analyses included in the PEIS and the technical cost and schedule analyses included in the Technical Summary Report addresses both full and partial MOX cores.

07 00 00 Comment Number 11

Generally, the goal is to complete disposition within 25 years after the ROD. The storage decision will be for long-term storage, up to 50 years. Schedule data, along with technical and cost data, were provided in Technical Summary Reports of both storage and disposition in late July 1996.

06 02 08 Comment Number 12

The reactor cores and the reactor vessel designs would be engineered when particular reactors are selected. Although significant modifications are not envisioned, precluding design and hardware changes to existing reactors need not occur. All necessary changes will be considered in costing the alternatives. In considering necessary reactor modifications all available information, including European experience as applicable, will be utilized.

-Pu metal conversion processes should be selected that will provide oxide with essentially the same characteristics as present commercially used MOX, (excepting the Pu isotopic distribution and possibly some gallium residue in the MOX fuel). | 13/03.02.08

-Existing facilities should be used wherever practical at each stage (conversion, fuel fabrication, and reactor operation). There is potential through this approach to reduce the time to start the disposition and the costs of the disposition process as well as to minimize the introduction of new facilities which will later have to be decommissioned. DOE should also take into account potential difficulties in documenting design basis and equipment qualifications for existing facilities. The STRG concurs with the DOE position to consider initially only those reactors that will not require license renewal or extension during the length of the disposition program. | 14/01.02.00

(2) Program Acceleration Planning

-The STRG is concerned that there is an insufficient sense of urgency in pursuing the disposition options. The new formulation of strategy and planning should place first priority on timeliness, given that the security and health & safety requirements are met. Cost is an important factor but should not be subjugated to timeliness. | 15/07.01.00

-Emphasis should be given to narrowing down the reactor burning options to permit greater focus. Seventeen sub options in this category were identified as still under evaluation.

-In-depth review of licensing issues should be sought with NRC on the several vendor partial MOX core designs, including the impact of the weapons Pu isotopic distribution.

-The STRG considers it important to demonstrate as soon as possible the adequacy of full scale MOX fuel assemblies derived from weapons grade Pu. Specifically:

(a) Since MOX fabrication appears to be on the critical path, strategies should be defined to accelerate the fabrication of such demonstration lead assemblies. European commercial facilities should be considered as well as experimental-level facilities in the U.S. National Laboratories. | 16/06.01.08

(b) Early demonstration of lead MOX fuel assembly irradiation in commercial reactors should be sought, including European reactors that are already licensed for MOX operation. *Elimination of the Euratom MOX fabrication/reactor burning option should be reconsidered if* elimination would preclude such early demonstrations. | 17/06.01.08

-The DOE team cited many political and commercial difficulties in utilizing western European capability for the reactor disposition option. Since there is high technical potential to start the process much sooner by that route, the political and commercial issues should continue to be addressed aggressively.

(3) Necessary R&D

-An effective R&D program should be mounted to evolve as rapidly as possible to the utilization of full MOX core so as to minimize the number of reactor sites and their auxiliary facilities and associated transportation and security requirements. | 18/06.01.08

-The R&D program will need to include in the development of MOX fuel fabrication facilities the impact of using new burnable absorbers as well as reactor design and fuel reliability issues related to new burnable absorber design features. | 19/06.01.08

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03 02 08 Comment Number 13

If a Reactor Alternative is chosen as part of the ROD for Pu disposition, the MOX fuel fabrication process would meet all the appropriate reactor fuel specifications. The feed material needed to fabricate MOX fuel, produced using pit and non-pit processing technologies, would meet the specifications of the MOX process.

01 02 00 Comment Number 14

Comment noted.

07 01 00 Comment Number 15

The Department of Energy recognizes the "sense of urgency" for timely disposition of surplus Pu. Accordingly, in the ROD for this PEIS, DOE will select a technology strategy for disposition with the goal to complete disposition within 25 years thereafter. Schedule data were provided in the Technical Summary Report in late July and October 1996; this information will be considered in the ROD. Furthermore, DOE will immediately begin preparation of tiered NEPA reviews to analyze specific locations and technology variants for disposition activities, and will begin disposition immediately following the tiered, location-specific decisions.

06 01 08 Comment Number 16

Fabrication and use of MOX fuel using reactor-grade Pu is a mature, industrial scale technology in Europe with at least three vendors actively fabricating MOX fuel. There are some differences introduced by the use of weapons-grade Pu, which DOE is addressing as part of an ongoing weapons-grade MOX fuel research and testing program.

06 01 08 Comment Number 17

The Department of Energy is moving forward with activities to test the fabrication of MOX fuel from weapons-usable Pu and its performance in LWRs and heavy water reactors.

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(4) Scope

-All criteria governing the disposition process should be included in the strategy and planning. Security and proliferation resistance should be treated explicitly, criteria that were not strongly treated during the DOE team presentations. | 14/01.02.00 cont.

-Arbitrary budget constraints, as distinct from defining a focused, cost effective plan, should not be imposed on the planning process. The appropriate full scope of the needed program should be defined, permitting a later, more intelligent application of budget restraints if necessary. | 20/07.00.00

CANDU OPTIONS

The DOE team reported that no technical difficulties had arisen in the full core MOX application, that the much shorter fuel pins could be more easily handled in the existing MOX fabrication facility (FMEF) at Hanford, and that political acceptance at this time in Canada was good although the new administration was reviewing the issue.

The small size of the CANDU assemblies raises questions as to the sufficiency of the radiation barrier to comply with the spent fuel standard. The proposed solution was to raise their proliferation resistance to the LWR spent fuel level by latching many assemblies together to increase the radiation level and make them more bulky. Effort is also underway to raise the Pu level in the design to try to achieve a fuel cost reduction of about a factor of two. | 21/06.05.08

The STRG comments on the LWR option also apply to the CANDU option where applicable. Further, the fact that CANDU reactors use on line refueling could result in some increase in proliferation risks. | 22/06.05.08

JOINT U.S./RUSSIAN STUDIES

The LWR disposition option is included in an overall study with the Russians of a broad array of disposition options. This effort is particularly important since it provides the potential for a "middle way" for Russian cooperation (quid pro quo) in the disposition process: between their present preference for the untimely and costly fast reactor disposition option and their complete rejection of weapons Pu direct disposal and immobilization options. This prospect is justification in itself for vigorous pursuit by the U.S. of the LWR disposition option. | 23/01.03.00

SPENT FUEL STANDARD

In defining the components of the spent fuel standard, isotopic denaturing should be included. Although the practical level of isotopic denaturing does not eliminate potential diversion for terrorist nuclear explosive use, it is a significant additional barrier to host nation re-use or rump nation military use. | 24/01.02.00

UTILITY COOPERATION IN THE MOX FUEL DISPOSITION PROCESS

The efforts to explore the interest of the utilities in assisting in the commercial LWR disposition option are important to achieving timely implementation of the option. There is concern, however, that the incorporation of a tritium production mission with the excess weapons Pu disposition mission will introduce complexity, delay, and increased public apprehension into the disposition mission. The STRG also expressed concern on reversing the long-standing U.S. policy of separating nuclear weapons production from nuclear electricity production. As indicated in the STRG comments on the draft PEIS, the Office of Fissile Material Disposition should be involved only in the various aspects of storage and disposition of weapons grade Pu and highly enriched U. | 25/11.01.08

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06 01 08 Comment Number 18

The Department of Energy is considering the possible use of full MOX cores for the reactor disposition of surplus Pu. Uncertainties with the use of full MOX cores are being evaluated as part of the fuel qualification program.

06 01 08 Comment Number 19

Comment noted.

07 00 00 Comment Number 20

Comment noted.

06 05 08 Comment Number 21

The Canadian proposal is to fasten 24 fuel bundles into a module to increase the size, weight, and radiation level and achieve the same resistance to theft and diversion as LWR spent fuel. The online refueling will require additional efforts to safeguard the CANDU reactor, but is achievable (see *Draft Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Materials Storage and Plutonium Disposition Alternatives*, October 1996).

06 05 08 Comment Number 22

Although CANDU reactors require more intensive actions to safeguard than LWRs, International Atomic Energy Agency (IAEA) safeguards are already in place for CANDU reactors in Canada, irrespective of the Pu disposition mission.

01 03 00 Comment Number 23

Comment noted.

01 02 00 Comment Number 24

Isotopic denaturing is not considered a proven technology for Pu disposition and would take time for it to be proven. This would not meet the schedule and cost criteria for consideration as a reasonable alternative for implementation.

11 01 08 **Comment Number 25**

Comment noted.