December 5, 1997

Mr. Howard Canter
Acting Director
Office of Fissile Materials Disposition
U.S. Department of Energy
1000 Independence Ave. SW
Washington, DC 20585

Comments on the Department of Energy's
Draft Request for Proposals
For MOX Fuel Fabrication
And Reactor Irradiation Services

Dear Mr. Canter:

We are writing to convey the comments of the Nuclear Control Institute ("NCI") on the Department's Draft Request for Proposals for MOX Fuel Fabrication and Reactor Irradiation Services ("draft RFP").

Before addressing specific elements of the draft RFP below, we wish to underscore that proceeding with the RFP process for MOX disposition of military plutonium in the absence of an overall agreement with Russia is both untimely and imprudent. There are substantial safety, proliferation and security risks associated with use of MOX fuel in commercial nuclear power plants, and these should not be undertaken unless and until it can be shown that there are overriding national security benefits to be derived from an agreement with Russia to rapidly dispose of excess military plutonium in the United States and Russia in a manner that eliminates asymmetries and achieves parity with respect to the amount of weapons plutonium remaining on each side. No such agreement is in sight, and therefore no process should be begun that could give impetus to establishment of a MOX fuel industry in the United States.

1. Base Contract and Contract "Options"

The draft RFP outlines a contract structure that calls for competitive bidding for a cost-plus- fixed-fee "base contract," which would cover "design, license applications and fuel qualification activities" [Executive Summary Letter, p. 1]. However, the vast majority of MOX disposition work (and expenditure of federal funds) would be conducted subsequent to these initial activities under the terms of three "option" contracts. For each of these options, the "cost for performance of the work described in the option, including fee and any incentive arrangement" would be established by means of "good faith negotiations" between the contractor and the government.

This structure appears to close off from competitive bidding the majority of disposition work and expenditures (ultimately totaling billions of dollars), making them the subject of proprietary negotiations. The potential for abuse is apparent: A contractor could "low ball" the initial bid and win the base contract, thereby acquiring exclusive rights to the subsequent option contracts, for which it would face no competition. The contractor would then be in a position to negotiate exorbitant costs and fees, without effective public scrutiny.

It is essential, therefore, that each of the three options, as well as the base contract, be open to competitive bidding. NCI recommends that DOE abandon its present "consortium" approach and thereby open each of the three subsequent option contracts, in addition to the base contract, to

competitive bidding at each phase. If DOE proceeds with the consortium approach, there will be no incentive for members of the selected consortium to keep costs down in the absence of competitive bidding and therefore no alternative but for DOE to accept the higher costs. The present scheme seems ripe for adding many tens to hundreds of millions of dollars to the costs of the project.

2. Evaluation Criteria for Bids

Section M of the draft RFP establishes "Evaluation Factors for Award," including a requirement that reactor safety and performance information be included in bids (p. M-6). However, the draft RFP does not specify minimum acceptable safety or performance records for utilities interested in using MOX fuel. Indeed, the "Evaluation Criteria" treat safety and performance as variables to be weighed against many other factors in determining to whom the MOX disposition contract(s) should be awarded.

This evaluation approach is unacceptable. Use of warhead-plutonium MOX fuel in commercial nuclear power reactors will increase the complexity of reactor operations, and may result in an unavoidable degradation of key safety margins (such as the excess shutdown margin). Consequently, utilities that choose to take on the additional challenge of using MOX fuel will need to increase substantially the attention and resources devoted to safety matters. These utilities should have a demonstrated ability to cope efficiently with major changes to the design basis, and to respond effectively to unusual operating events.

Thus, a utility with as poor a safety record as Commonwealth Edison, with half of its 12 reactors on NRC's "Watch List," is free to bid for MOX work without penalty for poor performance. NCI and 54 other public-interest groups wrote to Energy Secretary Pe¤a and NRC Chairman Jackson in May 1997, urging that Commonwealth Edison be removed from consideration for MOX disposition contracts because of its poor safety record. Both Secretary Pe¤a and Chairman Jackson responded that it would be "premature" to disqualify specific utilities at such an early stage in the process. DOE and NRC should now be prepared to posit minimum safety and performance criteria for utilities, and the final RFP should establish a clear framework for the design and implementation of those criteria. The RFP process should in no way encourage bids from utilities with poor safety records and weak management histories. They should be weeded out so as not to burden the selection and licensing process in the years ahead.

Instead, the draft RFP contains the following troubling language in Section M's treatment of a utility's "Past Performance" with regard to such matters as NRC licensing violations and safety issues [p. M-7]:

> If the Offeror does not have past performance information, the Offeror will be given a neutral rating and will not be evaluated favorably or unfavorably for this factor. It should be noted that if the Government's attempts at gathering and verifying the offeror's past performance information fails, and the Offeror has been notified and not been able to correct this problem, the Offeror will be given a neutral rating and will not be evaluated favorably or unfavorably for this factor.

It appears from this statement that Offerors will not be evaluated negatively for failing to provide past performance information, or for providing past performance information that cannot be confirmed by the Government. If so, the proposed process is unacceptable. Past performance information should be required and confirmed.

3. Public Availability of Contractor Work Plans

The draft RFP requires the contractor to prepare, and submit to DOE for approval, a number of work plans specifying how various aspects of contract work will be carried out. For example, the Contractor must prepare a "MOX Fuel Safeguards Plan" and a "MOX Fuel Security Plan" within 13 months of contract award [Section J, pp. 14-15]. These work plans will establish courses of action under the contract that have major implications for public safety (fuel qualification, reactor safety, SNM transportation, security and safeguards, etc.). Therefore, the plans should be made publicly available for comment when the Contractor submits them to DOE and not afforded the confidentiality of "proprietary information." In the post-award phase, there is no need to treat such

information as proprietary, and this should be duly noted in the final RFP. To do otherwise would shut the public out of decision-making about the course of the MOX program that could significantly affect public health and safety.

4. MOX Fuel Qualification Plan

The draft RFP apparently allows the contractor to decide whether the irradiation of test/demonstration MOX fuel elements would be required for fuel qualification [Section J, p. 19]. Given the major unresolved safety questions about the use of weapons-grade plutonium MOX fuel in light-water reactors, there should be no contractor discretion on this point. If a MOX disposition program proceeds, irradiation and evaluation of lead test assemblies should be mandatory.

The plutonium used in lead test assemblies should be representative of the plutonium that would be used to fabricate MOX throughout the entire disposition exercise. Representative lead test assemblies are necessary because use of weapons-grade plutonium MOX fuel affects both the probability and impact of certain reactor accident scenarios, and these effects would be significantly different from those of either low-enriched uranium fuel or reactor-grade plutonium MOX fuel.1 Nor has it been established that the weapons-grade plutonium can be made substantially gallium-free. Yet, the draft RFP specifies that plutonium available from DOE before 2001 for test elements will be "substantially gallium-free existing oxides (mostly non-weapons grade)" [Section J, p. 16].

5. Generic vs. Site-Specific Licensing Decisions

Under the proposed "Fuel Qualification Plan," the contractor would seek generic qualification of one or two MOX "fuel types" by NRC. NCI does not disagree in principle with this approach, but if this path is followed, two central questions must be addressed.

First, in light of the fact that "MOX fuel shows a higher failure potential than UO2 at comparable burnup," as revealed by a recent MOX fuel experiment at the Cabri test reactor in France,2 significant consideration should be given to limiting average burnup of MOX fuel to the regulatory ceiling of 36,000 MW-D/MTHM now imposed in France.3 This is the only way to avoid with assurance the risks associated with the propensity of high-burnup MOX fuel to catastrophically rupture in the event of reactivity transients or loss-of-coolant accidents (LOCAs). This problem may be more severe for weapons-grade MOX because the phenomenon believed to be responsible for the inferior behavior of MOX fuel (locally high burnups and fission gas release because of the inhomogeneous distribution of plutonium in MOX fuel) would be exacerbated by the higher fission rates that occur in weapons-grade plutonium.

Second, we believe that the generic MOX fuel qualification process must include experiments in support of a new regulatory source term specific to weapons-grade MOX fuel, and that this source term should be utilized in reactor license amendment proceedings. This is necessary for two reasons. One, irradiated MOX fuel has microstructural differences from uranium fuel that may affect the pattern of release of radionuclides. Two, existing regulatory source terms do not take into account the possibility of catastrophic rupture and dispersal of fuel pellets which, as explained above, may occur more readily in MOX fuel.

Finally, we wish to emphasize that, assuming there is a generic qualification of MOX fuel, DOE should make clear that the contractor should not expect that this would automatically result in a "no significant hazards" determination in the proceedings to amend individual plant licenses to allow MOX irradiation. There are likely to be significant hazards associated with MOX fuel apart from its mechanical and thermal characteristics (which presumably are among the issues that would be analyzed during any generic rulemaking process). Site-specific safety issues related to the use of MOX fuel include the impact of an increased source term on low population zone and emergency evacuation zone distances, and various reactor-specific characteristics (such as the condition of the pressure vessel).

These issues must be analyzed on a case-by-case basis, in the context of each individual plant's application for license amendment. NCI will strongly oppose any attempt to regulate these issues

on a generic basis. Such generic rule-making is also unlikely to prove acceptable to local public-interest groups and the population living near reactor sites.

6. European MOX Fuel Fabrication Option

The draft RFP "requires domestic fabrication of MOX test/demonstration fuel," but DOE is still considering "whether alternate proposals for European fabrication of MOX test/demonstration fuel will be accepted" [Executive Summary Letter, p. 3].

The many safety and security risks attendant upon international transportation (by sea or air) of separated plutonium and MOX fuel---which we have detailed in our comments on the Storage and Disposition PEIS---are not addressed in the draft RFP, either in terms of identifying the security measures that would be required to minimize them or of the costs of these measures and whether they are to be covered by industry or government. NCI opposes any use of European MOX fabrication capacity in the disposition program, including fabrication of lead test assemblies, because of the additional safety and security risks associated with transport, as well as the fact that European facilities are not subject to IAEA safeguards.

If any separated plutonium or MOX shipments do take place under the auspices of the disposition program, they should be subject to the same requirements that the United States imposes on Japan for sea transports of U.S.-origin plutonium from Europe---specifically, use of an armed escort vessel. Such a vessel should have sufficient military capability to repel a well-organized attack using advanced weapons systems.

7. Licensing of MOX Fuel Fabrication Plant

The draft RFP requires the contractor to prepare a "Regulatory Management Plan" for NRC licensing of the MOX fuel fabrication plant [Section J, pp. 11-12]. However, there is currently no statutory or regulatory authority for NRC to license a DOE MOX facility. NRC and DOE have recently begun discussions on such external regulation issues, and plan to begin a pilot program at a few DOE facilities to study the matter.4 There is no reason to believe that this matter will be resolved any time soon.

NCI agrees that any MOX fuel fabrication plant should be licensed and regulated by NRC. No contractor licensing plan should be accepted by DOE until a comprehensive legal structure is in place to implement NRC external regulation of DOE facilities. In fact, DOE cannot even evaluate such a plan until it knows what the NRC regulatory framework will look like.

8. Safeguards at the MOX Fuel Fabrication Plant

An important issue for DOE to assess prior to awarding any MOX contract is material control and accounting issues at MOX fuel fabrication plants. The draft RFP calls for design specifications that limit the total amount of plutonium held-up in process and scrap to 0.5 percent, or 17.5 kg (2.19 significant quantities, or SQ) of Pu for a throughput of 3.5 MT per year. However, because of acknowledged limitations in the ability to accurately assay MOX scrap and in-process holdup, this standard is inadequate.

Current techniques, such as neutron multiplicity counters, are subject to statistical errors of 10-50% when measuring "dirty" (e.g. moisture-contaminated) MOX scrap.5 Also, techniques for assay of glove-box holdup of plutonium are subject to uncertainties of 25-30% for gamma-ray assay and can exceed 20% for neutron coincidence counting (partly due to the statistical deviations in the Pu-240 content of the plutonium).6 Assuming a standard deviation (σ) of 30% for assay of scrap and holdup, then diversions of less than 3.3σ x 17.5 kg = 17.3 kg (2.17 SQ) could not be detected at the accepted 95% confidence level. Thus to detect a diversion of 1 SQ in one year with 95% confidence, no more than 8.1 kg of plutonium (0.23% of throughput) should end up in scrap and holdup annually.

Achieving such a standard will require significant investment in safeguards research and development on the part of the contractor, because the experience of MOX fabrication plants to date has been less than satisfactory. MOX plants typically experience considerable difficulty in

reconciling the amount of plutonium fed into the plant with the amount of plutonium that emerges in the fabricated MOX fuel product because of the tendency of plutonium oxide powder to stick to surfaces of processing equipment.7 The only reference to this problem in the draft RFP is the requirement that the MOX plant design must "minimize dust contamination" in glove-boxes [Section J, p. 5], but there is no indication as to how this could be accomplished.

The PFPF plant at Tokai in Japan, purportedly designed to deal effectively with this problem, has a severe and ongoing problem with plutonium "hold-up." Significant amounts of plutonium oxide have become stuck, or "held up," in the automated glove-boxes at PFPF. Between the plant's commissioning in 1988 and early 1994, approximately 70 kilograms of plutonium were apparently held up in process---enough for more than eight nuclear bombs.8 Japanese authorities conducted a clean-out inspection at the request of the IAEA at considerable cost,9 but were still not able to account for about 10 kilograms (more than one significant quantity) of "held-up" plutonium.10

Prior to authorizing design and construction of a MOX fuel fabrication plant, DOE should prepare a report on the results of this inspection, addressing the question of whether the hold-up problem at the PFPF plant has been eliminated. This report should also survey and report safeguards results (uncertainty factor in measurement, MUF, etc.) at MOX fuel fabrication plants in Europe as well as Japan. If the companies operating these facilities (some of which are likely to be leading candidates for the MOX contract) refuse to cooperate with DOE in providing such information, it should be duly noted in the report, and raised as a major negative factor against awarding the contract to those bidders. DOE should also require the contractor to specify how it plans to avoid a hold-up safeguards problem at its MOX fabrication facility.

9. Security at MOX Reactor Sites

The draft RFP specifies that LWR sites must be able to store one reload core of MOX fuel onsite for at least 90 days [Section J, p. 20]. NCI objects to long-term on-site storage of fresh MOX fuel on security grounds. Such fresh MOX fuel lacks a radiation barrier, and if it were stolen, weapons-grade plutonium could be separated from this MOX by straightforward chemical means. By comparison, EdF, the French nuclear electric utility, does not permit fresh MOX fuel to be stored at its reactor sites for more than two weeks, and does not allow any dry storage of such fresh fuel.11

For any storage of fresh MOX fuel, at reactor sites or elsewhere, NCI urges adherence to the National Academy of Science's "stored weapon standard," that is, fresh MOX fuel must be accorded the same degree of security as would an actual nuclear warhead.12 NCI recommends, therefore, that the final RFP specify a requirement for additional guards and other enhanced security arrangements to be applied whenever such MOX fuel is delivered to a utility site on other than a "just-in-time delivery" basis.

10. Shutdown of the MOX Fuel Fabrication Plant

The draft RFP discusses decontamination and decommissioning of the MOX fuel fabrication plant [Section J, p. 13]. However, the draft RFP does not require a schedule for decommissioning, nor does it appear to require explicitly that the MOX fabrication plant be permanently shut down at the end of the disposition mission.

The final RFP, and any MOX contract, must implement the requirement in the plutonium disposition ROD that the entire MOX fuel infrastructure be restricted to the weapons-plutonium disposition exercise.13 Thus the final RFP should specify that the MOX fuel fabrication plant must be immediately and permanently decommissioned upon completion of MOX disposition.

Sincerely,

Paul Leventhal
President

Steven Dolley
Research Director

Edwin Lyman
Scientific Director

cc: Marlene Martinez, DOE-Chicago

Additional NCI Comments, January 16, 1998

End Notes

1. Edwin Lyman, "Comments on the Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement: Public and Occupational Health and Safety Impacts of Plutonium Disposition Alternatives," Nuclear Control Institute, revised October 1996. Back to document

2. F. Schmitz, Institute de Protection et de Sureté Nucléaire (ISPN), "The Status of the Cabri REP-Na Test Programme: Present Understanding and Still Pending Questions," presentation to the NRC/Industry Meeting on High-Burnup Fuel Issues, Rockville, Maryland, November 18-20, 1997. Back to document

3. Jean-Luc Provost, Electricité de France, "Plutonium Recycling and Use of MOX Fuel in PWR: EDF Operating Experience," Industry Presentation to NRC on the Use of MOX Fuel, Rockville, Maryland, February 21, 1997. Back to document

4. "DOE, NRC Sign External Regulation MOU," *NuclearFuel*, December 1, 1997, pp. 5-6. Back to document

5. H. Menlove, Los Alamos National Laboratory, "Initial and Operating Experience for MOX Scrap Measurement," Institute for Nuclear Materials Management (INMM) 38th Annual Meeting, Phoenix, Arizona, July 1997. Back to document

6. T.K. Li et al., "Evaluation and Development Plan of NRTA Measurement Methods for the Rokkasho Reprocessing Plant," INMM 36th Annual Meeting, Palm Desert, California, July 1995. Back to document

7. For a detailed discussion of these issues, see Paul Leventhal, "IAEA Safeguards and Shortcomings: A Critique," Nuclear Control Institute, September 12, 1994; Steven Dolley, "Comments on the Department of Energy's Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement: Nonproliferation and Related Issues," Nuclear Control Institute, June 8, 1996. For further technical discussion of safeguards problems at plutonium facilities, see Marvin Miller, "Are IAEA Safeguards on Plutonium Bulk-Handling Facilities Effective?," Nuclear Control Institute, August 1990. Back to document

8. This hold-up was first made public by the Nuclear Control Institute in 1994. "'Astounding' Discrepancy of 70 Kilograms of Plutonium Warrants Shutdown of Troubled Nuclear Fuel Plant in Japan," Nuclear Control Institute, May 9, 1994. Back to document

9. Mark Hibbs, "IAEA Gives Japan Till 1995 to Account for Holdup Inventory at PFPF Plant," *NuclearFuel*, October 10, 1994, pp. 12-13; Mark Hibbs, "Rebuild at PNC's PFPF Plant Will Cost Japan $100-million," *NuclearFuel*, October 9, 1995, pp. 11-12. Back to document

10. Mark Hibbs, "PFPF Holdup Pu Inventory Under 10 kg; R&D Work to Focus on Monju Fuel," *NuclearFuel*, November 4, 1996, pp. 15-16. Back to document

11. D.L. Williams Jr., "Licensing Issues Associated with the Use of Mixed-Oxide Fuel in U.S. Commercial Nuclear Reactors," Oak Ridge National Laboratory Report, ORNL/TM-13421, April 1997, p. 9. Back to document

12. Committee on International Security and Arms Control, National Academy of Sciences, *Management and Disposition of Excess Weapons Plutonium*, 1994, p. 31. Back to document

13. "The use of MOX fuel in existing reactors would be undertaken in a manner that is consistent with the United States' policy objective on the irreversibility of the nuclear disarmament process and the United States' policy discouraging the use of plutonium for civil purposes. To this end, implementing the MOX alternative would include government ownership and control of the MOX fuel fabrication facility at a DOE site, and use of the facility only for the surplus plutonium disposition program. There would be no reprocessing or subsequent reuse of spent MOX fuel. The MOX fuel would be used in a once-through fuel cycle in existing reactors, with appropriate arrangements, including contractual or licensing provisions, limiting use of MOX fuel to surplus plutonium disposition." U.S. Department of Energy, "Record of Decision for the Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement," January 14, 1997, p. 17. Back to document

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