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NONPROLIFERATION IMPACTS ASSESSMENTS: ENHANCING PUBLIC PARTICIPATION IN SPENT FUEL MANAGEMENT DECISION-MAKING

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ABSTRACT

Nonproliferation Impacts Assessments (NIA) are a useful tool to allow more complete public participation in spent fuel management decision-making. The public participation process under the National Environmental Policy Act, which involves preparation of environmental impact statements, focuses primarily on environmental and public health issues, but is silent on consideration of other public policy issues such as controlling worldwide proliferation of nuclear weapons. Certain spent fuel management decisions can have wide ranging effects on international nonproliferation. The Department of Energy recently prepared two nonproliferation impact assessments to evaluate pertinent nonproliferation issues associated with spent fuel management decisions at the Savannah River Site and the Argonne National Laboratory-West. These NIAs were prepared by the Department concurrently with the preparation of EISs addressing the same spent fuel management decisions. This paper discusses the purpose of NIAs in the context of public involvement, the approach used in preparing them, and the structure and general content of the final documents.

INTRODUCTION

Nonproliferation Impacts Assessments (NIA) are an effective tool to allow more complete public participation in spent fuel management decision-making. Under the National Environmental Policy Act (NEPA), the public participation process, which involves preparation of environmental impact statements (EISs), focuses primarily on environmental and public health issues, but is silent on consideration of other public policy issues, in particular, controlling worldwide proliferation of nuclear weapons. Certain spent fuel management decisions may have significant effects on international nonproliferation efforts. The Department of Energy (DOE) recently prepared two nonproliferation impact assessments as part of the public participation process to evaluate pertinent nonproliferation issues associated with spent fuel management decisions at the Savannah River Site and the Argonne National Laboratory-West.[1 2] These NIAs were prepared by the Department concurrently with the preparation of EISs addressing the same spent fuel management decisions. This paper describes the purpose of the NIA, its function as a tool to enhance public participation, and the structure and content of the document.

The *Nonproliferation Impacts Assessment for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel* marks the most recent instance of the Department of Energy preparing an NIA following initial public comments. Proliferation concerns appeared prominent among the 228 comments received during the public scoping period for the *Draft Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*. The Draft EIS noted the following concerns:

> *Other commentors stated that the public should have an opportunity to comment on the nonproliferation assessment report in the same time frame as the Draft EIS, or that [the] EIS should be delayed until the nonproliferation assessment becomes publicly available. Some suggested that the nonproliferation assessment be included in the EIS. A few commentors expressed the opinion that electrometallurgical treatment of present nuclear fuel is a proliferation-prone technology.*[3]

With issues of proliferation risk important to the public, the Department prepared an NIA to accompany the Draft EIS as part of the decision-making process, despite the absence of statutory or regulatory drivers requiring an NIA. Both the NIA and the Draft EIS can be viewed on the internet as well as in public reading rooms and through public distribution.

WHAT IS A NONPROLIFERATION IMPACTS ASSESSMENT?

An NIA is an analysis of the proliferation risks that may result from a specific proposed or ongoing activity. NIAs can also be adapted to evaluate entire programs. Proliferation risks can occur as a result of several factors. In general, activities involving nuclear materials production, management, and disposition and nuclear materials technology can result in proliferation risks. Because such activities have the potential to either reduce or increase proliferation risk or, in some cases, both, an analysis is required to determine the net result from an activity.

Proliferation risks historically have not been considered in EISs, environmental assessments, or other studies performed under the NEPA. NEPA studies address a broad range of effects that may result from an activity. However, these effects are generally confined to environmental, safety, and health concerns. Other concerns, such as nonproliferation and other public policy issues are among those topics that generally fall outside the scope of a NEPA analysis and are not intended to be captured within a NEPA assessment. In fact, NIAs and NEPA studies are different analyses performed for different reasons. From a practical standpoint, only a small minority of federal actions requiring NEPA assessments have proliferation concerns (e.g., a subset of those involving nuclear materials and technologies). Nevertheless, factors such as nonproliferation, where relevant, should be considered by decision-makers. To address proliferation concerns, the NIA is the tool that performs the analysis and provides the decision-maker an appropriate perspective. Table 1 contrasts some of the differences between NIAs and EISs.

Unlike EISs, which are authorized under NEPA and for which specific criteria have been codified in federal-agency-specific regulations and guidance, there are no statutory or regulatory drivers requiring an NIA. Nevertheless, proliferation risks have been long recognized as a legitimate concern by decision-makers. As a result, organizations within several federal agencies have been established to address nuclear proliferation risks. Within the Department of Energy, the Office of Nonproliferation and National Security, Office of Arms Control and Nonproliferation, is responsible for addressing many of the issues associated with NIAs. The decision to perform an NIA has often been linked to the NEPA process. However, NIAs also have been prepared as a result of requests from Congress or other reasons.

While several NIAs prepared since the mid-1990s have been coupled to studies performed under the NEPA process, NIAs have also been performed independently. During the 1980s (and before) NIAs were performed in evaluating federal activities involving nuclear power technology and related activities. These studies, which were sometimes handled with little public attention, were often left out of the public participation aspect of decisions.

NIAs can also be compared to EISs in terms of the analysis approach. EIS analyses have evolved into a highly structured, requirements-driven process accompanied by a considerable amount of guidance. In contrast, formal guidance for preparation of NIAs is limited. The analysis approach for each NIA is often tailored to meet the specific circumstances of the assessment (e.g., the reason for preparation, the scope, the assessment sponsor).

The analysis for an NIA is conducted at a much higher level than that for an EIS. In the case of an EIS, the alternatives are fairly well defined, allowing quantitative risk values to be estimated. In contrast, NIA analyses are based on high-level information. For this reason, much of the analysis is qualitative in nature and is based on a small number of intrinsic characteristics of an activity rather than quantitative measurements. For example, the relative radiation levels and fissile material retrievability from different final forms can be compared, with the nonproliferation advantage going to the form offering the higher long-term radiation barrier and more stable chemistry. The qualitative nature of the NIA analysis is most apparent in the consideration of policy factors (described below). For example, activities involving the production of fissile material for the domestic weapons program would exhibit a higher proliferation risk than activities not producing fissile material since other countries could reasonably view U.S. production of weapons material as a justification for beginning or accelerating their own weapons programs. Such policy analyses cannot be readily converted into quantitative values.

Table 1
Comparison of EISs and NIAs

Factor	EIS	NIA
Legal Driver	NEPA	Not specifically required under law or regulation
Scope	Environmental, safety, and health	Nonproliferation
Document Organization	Detailed Structure -Introduction -Alternatives -Affected Environment (air, noise, waste, socioeconomics, geology, water, ecology, culture and paleontology, land use, infrastruture) -Environmental Impacts -Cumulative Impacts -Regulations and Permits	Not specified However, analyses generally consider a combination of technical and policy factors
Guidance	Considerable	Limited
Level of Analysis	Detailed	High-level.
Analysis Process	Rigorous quantitative risk assessment process	Flexible approach, generally qualitative assessment
Distribution	Broad distribution Full public access	Depending on circumstances, either limited or broad distribution

The flexible approach currently used to prepare NIAs has evolved over time and is still changing. Early analyses that were not necessarily performed as part of a public participation process. The language and structure of documents were developed with public disclosure as their primary function, and these documents were given a more limited distribution. In contrast to more recent analyses that compare a series of several alternatives comprised of various combinations of technologies and activities, the earlier studies often reviewed only a single activity. However, they provided a model for preparation of future NIAs that would be used in public participation processes.

The most recent NIAs were modeled primarily after the Department's *Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives* (Plutonium Disposition NIA, DOE/NN-0007), published in January 1997. This study analyzed the nonproliferation aspects of one of the most significant nuclear material management decisions of the United States—the disposition of 50 metric tons of surplus plutonium from U.S. defense programs.

ASSESSMENT FACTORS

Recent NIAs have generally organized the assessment into two areas, a technical assessment and a policy assessment. Depending on the structure of the assessment, specific assessment factors can be used in each area. The assessment factors discussed below are representative of those used in two recent NIAs, but additional factors are often appropriate depending on the nature of the study. In addition, individual factors can be combined or subdivided in order to facilitate the analysis.

In assessing proliferation risk under a given factor, mitigating conditions should be considered. Often the proliferation risk can be effectively mitigated by taking certain actions. For example, theft risk for different alternatives (e.g., at different facilities) can be partially mitigated by considering the benefits resulting from application of physical protection and security provisions. When such provisions are applied using a graded approach, some of the risk associated with material theft can be mitigated. Under this approach, facilities using material forms or processes exhibiting higher intrinsic proliferation risks are equipped with higher security, while those using lower risk materials and processes are equipped with lower security measures.

TECHNICAL FACTORS

Within the technical assessment, technical factors focus on assuring that nuclear material is not stolen by unauthorized parties or diverted to weapons used by the host state, both during and after disposition. These factors account for physical protection measures that would be used to discourage or prevent overt or covert theft of material or technology. They also account for material accountability measures that would help assure that the quantity of fissile material entering and leaving the process is demonstrated and documented. Table 2 lists some of the considerations in this category. This list is not exhaustive. Depending on the nature of the assessment, it may be appropriate to either include additional factors or exclude some of those listed.

Table 2
Technical Assessment Factors

Assuring Against Theft or Diversion
• Type, concentration, and total amount of fissile material
• Concealability and transportability of discrete items containing fissile material
• Physical security and remoteness of material and facilities
• Ease of material accountability
• Radiation barriers of material forms
• Material handling, transfers, and transport
Cost-Effective International Monitoring
• Facility residual contamination and radiation levels
• Facility design
• Material holdup in facilities
• Security restrictions
Final Forms
• Near- and long-term radiation barriers
• Chemical/physical form

ASSURING AGAINST THEFT OR DIVERSION

Nearly any fissile material management activity includes some risk of overt or covert theft, even if the risk is considered impractical. Theft risk is also difficult to measure quantitatively. Therefore, it is more appropriate to assess technical factors relative to one another rather than on an absolute scale.

Diversion is distinct from theft. Diversion is an act conducted by the host government. Theft of material by employees of the government, subnational groups, or individuals acting alone or in collaboration with other organizations are not considered diversion. The concept of diversion is best understood and most appropriately applied in other countries that do not have established nuclear weapons programs—known as non-nuclear weapons states (NNWS) under the Treaty on the Nonproliferation of Nuclear Weapons (1968). In the case of an established nuclear weapons state (NWS) such as the United States, the incentive for diversion is either more limited or nonexistent, especially in the context of recent disarmament progress and the resulting stockpiles of nuclear material identified as surplus to defense needs. In considering diversion in an NIA, it is not meaningful to consider that the host government could actually declare diversion is being prevented since it is the government itself that would actually perform the diversion. Instead, in the context of an NIA, it is the assurance against diversion, rather that the actual prevention of diversion, that is relevant. This assurance involves a demonstration of transparency under which nuclear facilities and materials are made available for safeguarding by the International Atomic Energy Agency (IAEA), the organization charged with implementing the international safeguards program, or some other form of bilateral or multilateral international monitoring.

Type, Concentration, and Total Amount of Fissile Material. This factor considers the attractiveness of the fissile material to would-be proliferants based on how easy it would be to convert the material into usable weapon components. There are only a small number of fissile isotopes, which can be used in the primary explosive component of a nuclear weapon. From a practical standpoint, uranium-235 and plutonium-239 are the best fissile isotopes for nuclear weapons, but it is possible to produce a nuclear explosion using other isotopes.[4] Attractiveness of these fissile materials depends in part on how easily they may be converted into the usable forms found in weapons. This includes whether the material is in a low concentration that must be processed through several chemical and physical processing steps and, for uranium, whether the material is isotopically dilute. In stabilizing nuclear materials, some technologies produce interim forms of relatively pure fissile material that are subsequently further processed into more proliferation-resistant forms. In other cases, proliferation-resistance gradually increases during each processing step until a final form is produced.

Activities involving the temporary or permanent production or purification of fissile material pose a greater proliferation risk than those involving only mixtures of chemically or isotopically dilute fissile material. The total amount of fissile material is also a consideration. All other factors considered equal, activities involving larger quantities of fissile material, or larger quantities of separated fissile material, pose greater risks than those involving smaller quantities and should be given greater scrutiny.

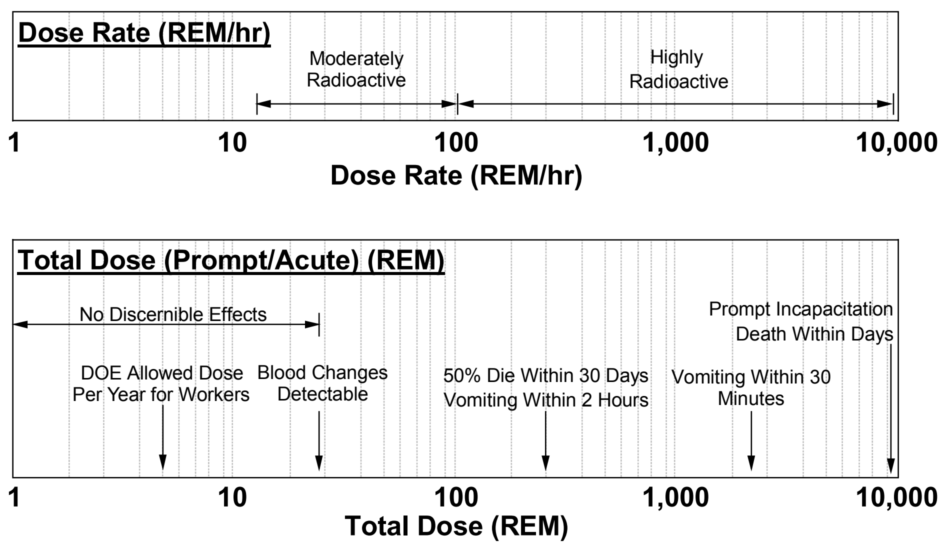
Concealability and Transportability of Discrete Items Containing Fissile Material. This factor considers the attractiveness of the fissile material to would-be proliferants based on how easy it would be for fissile material to be stolen. Items or containers of material that are dimensionally small are more easily concealed and can be transported without detection more easily. For example, items that can be concealed in a pocket pose a greater theft risk than large pieces of equipment or items that must be carried in heavy shielded containers.

Physical Security and Remoteness of Material and Facilities. Facilities with more stringent physical security—the "3G's", gates, guards, and guns—are better protected against theft. Similarly, facilities that are remotely located or accessed by a small number of persons are lower theft risks than others.

Ease of Material Accountability. This factor considers how easily theft could be detected by accounting for fissile material. Fissile material configured as a small number of discrete items, for example, individual ingots or containers, are easier to track than bulk material. Discrete items may be individually and uniquely identified and counted to verify their presence, in comparison to bulk material, which must be measured (e.g., by weight or volume) and analyzed to verify the amount of material present. The measuring process can be only so precise, introducing another element of uncertainty into the amount of material present. This uncertainty increases when material is processed in bulk form since each processing step generally involves a small amount of material processing losses (e.g., deposits on ventilation filters or residues left in equipment or containers) that become increasingly difficult to account for as the number of processing steps increases.

Radiation Barriers of Material Forms. The immediate health consequences of high doses of whole-body radiation represent a significant barrier to theft of highly radioactive materials, and this characteristic is one of the major considerations of the Spent Fuel Standard, a concept developed by the National Academy of Sciences to evaluate the potential proliferation concerns of nuclear materials. Operations involving such materials require heavy shielding and remote handling equipment. The IAEA considers all materials above 100 rem/hour at one meter to be "highly radioactive" and "self-protecting."[5] This threshold only allows a few minutes of close contact before noticeable blood changes occur (above 25 rem of acute dose, a blood test will indicate exposure). DOE considers whole body doses above 15 rem/hour at one meter to cause a significant reduction in risk of theft and 100 rem/hour at one meter to essentially rule out theft as a principal risk consideration.[6 7] Figure 1 summarizes the effects resulting from a range of radiation doses and corresponding radiation levels.

Figure 1
Effects of Radiation on Human Health[8]



Material Handling, Transfers, and Transport. The human element in material handling, transfers, and transportation involves an inherent risk of theft. A higher theft risk is generally associated with a higher number of material handling steps, involved individuals from different organizations, or material transfers between individuals and groups. Similarly, theft risk increases with time. The longer the period during which a material is handled or actively managed outside of a secure location or form, the higher the theft risk. For example, an alternative that dispositions material into a stable and secure material form within 1 year may be preferable to one that requires 5 years to reach that point.

COST-EFFECTIVE INTERNATIONAL MONITORING

This factor considers how straight-forward it is to conduct international monitoring similar to IAEA safeguards at a facility.[i] Despite the implausibility of material diversion by the United States, international monitoring is often considered essential to provide international transparency of the fissile material management activities and increase U.S. credibility within the nonproliferation community.

However, there are several technical factors that can complicate international monitoring efforts, making some alternatives less preferable.

Facility Residual Contamination and Radiation Levels. Facility contamination and radiation levels limit access to certain areas within nuclear materials handling facilities. This limit on access can prevent international monitors from effectively performing a design verification of the facility. Without a complete design verification, international monitoring of the processes, equipment, and materials is more difficult to perform. Because of this, facilities that are new, clean, or have been decontaminated to safe levels are preferable to those that are heavily contaminated.

Facility Design. Recently constructed nuclear facilities are often designed with international monitoring in mind. The designs include provisions to install and operate monitoring and verification systems once the facility is operational. In contrast, the earliest nuclear facilities were designed and built before safeguarding systems and practices had been developed. These early facilities can be more difficult to equip for a monitoring program.

Material Holdup in Facilities. To assure transparency, mass balances within processing facilities are needed. A reasonably precise mass balance is not possible when unknown amounts of material are held up in the facility before and after processing.

Security Restrictions. Facilities that are or have been actively used in domestic defense programs are subject to stringent security standards. Arranging for international monitoring of such facilities in a manner that does not compromise U.S. defense and national security interests may be difficult. In some cases, international monitoring can not be performed. In comparison, arranging inspections of nondefense facilities would usually not involve such complications.

FINAL FORMS

Final forms containing fissile material can pose a broad range of proliferation risks. These risks reflect the degree of ease for which fissile material could be extracted from the form and converted into a weapon component. This factor recognizes that pure metal is the least desirable form for weapons usable fissile material from a nonproliferation perspective. Attempts by a potential proliferant to convert a final form into pure fissile metal often can be complicated by the radiation barrier and chemical/physical characteristics exhibited by the form. Radiation barriers and chemical/physical form are discussed above in relation to the assessment of material attractiveness with respect to theft. However, these factors are also important in guaranteeing that there will be strong economic and technical disincentives toward future attempts to retrieve fissile material for weapons purposes, and in demonstrating this internationally.

The assessment of the final form also needs to consider how long the form will be managed before it is subsequently processed further. For example, an NIA may address a nuclear material processing decision that results in final forms that will be further dispositioned in the future. If the nature and timing of the future dispositioning activity is already known (e.g., the material will be repackaged and sent to a geologic repository when one is ready, or the material will be stockpiled and converted into reactor fuel according to an established schedule), the nature and timing of this activity can be considered in the assessment. On one hand, final forms intended to endure indefinitely require more enduring nonproliferation characteristics. On the other hand, for final forms that are expected to be processed further, the likelihood that the future processing plans will actually be implemented also needs to be considered.

Near- and Long-Term Radiation Barriers. As previously discussed, the radiation barrier associated with a form containing fissile material, in particular a final material form, is an important factor in evaluating proliferation risk. In general, the higher the radiation barrier, the lower the corresponding theft risk. Also of interest is the longevity of the radiation barrier. A final form containing a high radioactivity level that quickly decays is less preferable that one with a slightly lower initial radioactivity level that decreases more slowly. A high radiation level requires any fissile material recovery processing to be conducted remotely, complicating the effort and increasing the time and cost of the processing.

Chemical/Physical Form. Some final forms are much more resistant than others to fissile material recovery efforts. Again, pure metal forms are considered weapons-useable, and many chemical forms can be readily processed to recover metals (such as oxides, chlorides, fluorides, nitrates, and certain other forms). In comparison, it is generally more difficult to extract fissile material from ceramic and vitrified forms or certain mixtures that contain materials that complicate chemical recovery. Similarly, massive and bulky ingots are more difficult to process than finely divided or small forms such as pellets or rods.

POLICY FACTORS

Policy factors focus on the ability of the Unites States to maintain and strengthen international efforts to stem the spread of nuclear weapons, including efforts to minimize the use of weapons-usable fissile material in the civilian fuel cycle. Policy factors consider the potential responses by the international community that may result from specific activities occurring in the U.S.. Because it is difficult to fully comprehend the internal political workings in other countries and identify how a U.S. action would fit in the context of other international activities to motivate a country to act in a certain way, some policy factors are difficult to assess. In international politics, nonproliferation must compete with international trade, nonnuclear defense programs, government reform, and other national and cultural issues in influencing each countries behavior. For some countries, their intentions with respect to development of a nuclear weapons program can be readily discerned by their international behavior or public declarations. In other cases, a country's intentions have not yet been established. In either case, the actions of the U.S. are closely watched, and would-be proliferant states will readily seize upon any U.S. action that can be interpreted as an expansion of the U.S. weapons program. Even countries with no apparent inclination toward nuclear weapons proliferation may be willing to use U.S. actions as rhetorical leverage to further their programs that may be less favorable to U.S. interests.

Policy factors are fundamentally different from technical factors. While technical factors have a technical basis, assessments of policy factors tend to be more subjective and may be controversial. For technical factors, although the tone and emphasis expressed in the assessment can be subject to debate, the technical information on which the analysis is based can generally be agreed upon. This is not the case for the assessment of policy factors. Instead, many views, even those in complete opposition, can be valid, and it is not unusual for experts to disagree. To properly analyze policy factors, it is beneficial for the NIA to consider a broad spectrum of views from a range of experts, explaining the strengths and weaknesses of various positions.

Policy factors also differ from technical factors in terms of how they behave over time. Unlike technical knowledge, which generally becomes more refined and convergent over time, policy issues tend to oscillate between two or more opposing positions.

Certain nonproliferation policy factors may seem independent of the merits of an action from a waste management, environmental, or economic perspective. However, they are an integral part of an NIA, and should be of interest to waste management and environmental professionals because nonproliferation issues can drive waste management and environmental decision-making.

For NIAs involving spent fuel management and civilian nuclear material and facilities, the primary basis for the policy factors considered is the U.S. policy with respect to highly enriched uranium, plutonium, and reprocessing. Table 3 presents an excerpt from President Clinton's public policy statement on nuclear nonproliferation, which summarizes the key points of current U.S. policy in this area. Table 4 identifies the key policy factors considered in two recent NIAs addressing spent fuel management decisions. As previously stated, depending on the nature of the NIA, it may be appropriate for an NIA to consider additional policy factors or to remove, combine, or subdivide some of the factors listed below. Therefore, NIAs addressing topics not directly related to spent fuel management (e.g., development or deployment of nuclear weapons production or testing facilities, technologies, or programs) may include other policy factors.

Table 3
Elements of U.S. Policy on Nuclear Nonproliferation[10]

Fissile Material

The U.S. will undertake a comprehensive approach to the growing accumulation of fissile material from dismantled nuclear weapons and within civil nuclear programs. Under this approach, the U.S. will:

1. Seek to eliminate where possible the accumulation of stockpiles of highly-enriched uranium or plutonium, and to ensure that where these materials already exist they are subject to the highest standards of safety, security, and international accountability.

2. Propose a multilateral convention prohibiting the production of highly-enriched uranium or plutonium for nuclear explosives purposes or outside of international safeguards.

3. Encourage more restrictive regional arrangements to constrain fissile material production in regions of instability and high proliferation risk.

4. Submit U.S. fissile material no longer needed for our deterrent to inspection by the International Atomic Energy Agency.

5. Pursue the purchase of highly-enriched uranium from the former Soviet Union and other countries and its conversion to peaceful use as reactor fuel.

6. Explore means to limit the stockpiling of plutonium from civil nuclear programs, and seek to minimize the civil use of highly-enriched uranium.

7. Initiate a comprehensive review of long-term options for plutonium disposition, taking into account technical, nonproliferation, environmental, budgetary and economic considerations. Russia and other nations with relevant interests and experience will be invited to participate in this study.

The United States does not encourage the civil use of plutonium and, accordingly, does not itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes. The United States, however, will maintain its existing commitments regarding the use of plutonium in civil nuclear programs in Western Europe and Japan.

Export Controls

To be truly effective, export controls should be applied uniformly by all suppliers. The United States will harmonize domestic and multilateral controls to the greatest extent possible. At the same time, the need to lead the international community or overriding national security or foreign policy interests may justify unilateral export controls in specific cases. We will review our unilateral dual-use export controls and policies, and eliminate them unless such controls are essential to national security and foreign policy interests.

We will streamline the implementation of U.S. nonproliferation export controls. Our system must be more responsive and efficient, and not inhibit legitimate exports that play a key role in American economic strength while preventing exports that would make a material contribution to the proliferation of weapons of mass destruction and the missiles that deliver them.

Nuclear Proliferation

The U.S. will make every effort to secure the indefinite extension of the Non-Proliferation Treaty in 1995. We will seek to ensure that the International Atomic Energy Agency has the resources needed to implement its vital safeguards responsibilities, and will work to strengthen the IAEA's ability to detect clandestine nuclear activities.

Table 4
Policy Assessment Factors

1. Consistent with U.S. policy related to reprocessing and nonproliferation.
2. Avoid encouraging other countries to engage in the reprocessing of spent nuclear fuel, or undermining U.S. efforts to limit the spread of reprocessing technology and activities, particularly to regions of proliferation concern.
3. Help demonstrate clearly that the United States is not producing additional fissile material for use in nuclear weapons.
4. Support negotiation of a nondiscriminatory global Fissile Material Cutoff Treaty (FMCT).

Consistent with U.S. Policy Related to Reprocessing and Nonproliferation. This factor evaluates whether any of the activities under consideration are in conflict with the language in the presidential statement or in other policy documents. In particular, whether the proposed activity includes plutonium reprocessing for either nuclear power or nuclear explosive purposes. Where there is perceived a direct conflict between the policy the proposed activity, the activity would not be considered acceptable, notwithstanding executive guidance to the contrary. However, the language of policy statements is carefully worded, leaving room for judgment. An example is the decision based on the U.S.-Russian bilateral plutonium disposition agreement to convert about a portion of the U.S. excess defense plutonium into MOX to be used as commercial reactor fuel. In this case, the material in question does not require reprocessing in order to convert it to MOX fuel and the nonproliferation merits associated with burning it as commercial reactor fuel (and achieve the spent fuel standard) were judged to outweigh the detractions.

At the same time, the language of a policy statement is interesting from the standpoint of what it does *not* state. For example, while the nonproliferation policy statement clearly states that the United States ". . . does not itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes," it is silent about plutonium reprocessing activities conducted for other purposes (e.g., for stabilizing material forms or for health and safety or research purposes). Nor does it declare prohibitions on reprocessing to recover highly enriched uranium or on the use of previously reprocessed plutonium for any purpose. In addition, the precise meaning of the term "reprocessing" is not defined either here or in other public government policy documents, leaving open the interpretation of whether various technologies or activities that are similar to but, in some conceivably significant way, different than, conventional aqueous reprocessing are subject to the prohibition.

Avoid encouraging other countries to engage in the reprocessing of spent nuclear fuel, or undermining U.S. efforts to limit the spread of reprocessing technology and activities, particularly to regions of proliferation concern. As discussed above, some policy factors are subject to conflicting judgments, and this factor falls into that category. In considering "not encouraging the civil use of plutonium", there could be legitimate disagreement about a given action and the signal it would send to other countries with respect to civilian use of plutonium. The actions taken by the U.S. can be interpreted by other countries in many ways. In general, countries will use U.S. actions to further their own self-interest (which is often, but certainly not always, consistent with U.S. interests). However, there is rarely a clear view into the internal policy debates in other countries, so it is difficult to precisely predict how other countries will respond to U.S. actions. In the evaluation of this factor, the NIA can analyze whether the proposed activity could be used as justification by other countries to begin, continue, or accelerate civilian plutonium production programs.

Help Demonstrate Clearly that the United States is not Producing Additional Materials for Use in Nuclear Weapons. This factor reflects the need for the U.S. to continue to reinforce its commitment to nuclear nonproliferation to other countries. As noted above (see Table 3), it is the public policy of the U.S. to not produce additional plutonium for the weapons program. However, it is also important for the U.S. to demonstrate that it is in "scrupulous compliance with its publicly stated policy. In other words, that the U.S. is not saying one thing, but doing another. From a practical standpoint, the end of the Cold War nuclear arms race has resulted in enormous quantities of excess fissile material, both in the U.S. and in Russia, and the U.S. has little (or nothing) to gain and much to lose from clandestine government-sponsored attempts to produce more weapons-useable fissile material.[11] In principle, the most obvious approach to providing assurances to other countries is to allow international monitoring of plutonium production facilities. Where there are no barriers preventing or complicating international monitoring (see the discussion of Cost-Effective International Monitoring under Technical Factors), this factor does not become a deciding issue.

Support Negotiation of a Nondiscriminatory Global Fissile Material Cutoff Treaty (FMCT). The basis for this factor is also stated outright in the public U.S. policy statement. However, there are many actions that could undermine U.S. efforts to finalize an FMCT. Under an FMCT, reprocessing facilities formerly used for production of plutonium for the U.S. weapons program would be subject to some form of international monitoring. In addition, facilities with a plutonium production capability that are not part of the defense program may be subject to international monitoring. Activities that might cause the U.S. to exclude such facilities from international monitoring have the potential to undermine U.S. efforts to finalize the agreement.

CONCLUSION

The properly prepared NIA is an effective tool to evaluate the potential proliferation risks associated with nuclear materials and spent fuel management decisions. As an adjunct to the NEPA process, it is also an effective tool to inform the public of these risks, allowing a greater degree of public participation in the decision-making process.

The Department has not concluded final decisions for the proposed actions covered by the two NIAs used as examples in this paper. (These are *Nonproliferation Impacts Assessment for the Management of the Savannah River Site Aluminum-Based Spent Nuclear Fuel*, December 1998, and *Nonproliferation Impacts Assessment for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*, July 1999.) However, the first NIA was instrumental in clarifying the nature of plutonium production that would result from reprocessing certain spent fuel items at the Savannah River Site.

[At this time (January 2000), the public review process of the second NIA is still ongoing.] In the second NIA, the analysis concluded that all but one of the alternatives under consideration either fully met U.S. nonproliferation objectives or had the potential to raise only limited concerns. One of the alternatives, the one involving PUREX processing of the sodium-bonded blanket fuel at Savannah River Site, raised significant issues with respect to reprocessing. Of the remaining alternatives, some have marginal, but not decisive, advantages over others, but all were judged acceptable in terms of proliferation risk.

While the specific analytical conclusions of each study are of interest, there is a more significant issue with respect to these NIAs. Namely, that both documents were effective in communicating the nonproliferation issues relevant to the decision to both the public and to government decision-makers.

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DOE Facts, DOE Declassifies Location and Forms of Weapons-Grade Plutonium and Highly Enriched Uranium Inventory Excess to National Security Needs. USDOE. February 8, 1996.

FOOTNOTES

1. Nonproliferation Impacts Assessment for the Management of the Savannah River Site Aluminum-Based Spent Nuclear Fuel. USDOE. December 1998.

2. Nonproliferation Impacts Assessment for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel. USDOE. July 1999.

3. *Draft Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel* (DOE/EIS-0306D), 1999. Page 1-4.

4. Uranium-235 and plutonium-239 are more plentifully produced that other fissile isotopes and do not exhibit high rates of spontaneous fission, gamma radiation, or decay heat generation that may complicate the construction or use of a nuclear weapon.

5. International Atomic Energy Agency. *The Physical Protection of Nuclear Material*. INFCIRC/225/Rev. 3. September 1993.

6. U.S. Department of Energy. *Guide for the Implementation of DOE Order 5633.3b, Control and Accountability of Nuclear Materials*. Page 1-4.

7. Adapted from *Nonproliferation Impacts Assessment for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*. U.S. Department of Energy Office of Arms Control and Nonproliferation. July 1999.

8. Adapted from *Nonproliferation Impacts Assessment for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*. U.S. Department of Energy Office of Arms Control and Nonproliferation. July 1999.

9. Used in this context, the term *safeguards* refers to systems to detect—but not prevent—the diversion of fissile material from a civilian nuclear program to a weapons program. This usage is common within the nonproliferation circles and contrasts with the meaning of safeguards at commercial U.S. nuclear power facilities, where it refers to physical protection and security standards intended to prevent theft and maintain facility security.

10. This summary of current U.S. policy with respect to reprocessing and the civilian use of plutonium and highly enriched uranium is based on President Clinton's Nonproliferation and

Export Control Policy, as described in the September 27, 1993, White House Fact Sheet on the subject.

11. There are a total of 52.7 metric tons of plutonium and 174.3 metric tons of highly enriched uranium (for a total of 226 metric tons of fissile material) that has been declared excess to U.S. defense needs. Given that many thousands of nuclear weapons could be manufactured from the amount of material that has been declared "excess", the concept of additional production of weapons-usable fissile materials by the U.S. strains credulity. (Source: DOE Facts, DOE Declassifies Location and Forms of Weapons-Grade Plutonium and Highly Enriched Uranium Inventory Excess to National Security Needs, February 8, 1996.)

[i] Used in this context, the term *safeguards* refers to systems to detect—but not prevent—the diversion of fissile material from a civilian nuclear program to a weapons program. This usage is common within the nonproliferation circles and contrasts with the meaning of safeguards at commercial U.S. nuclear power facilities, where it refers to physical protection and security standards intended to prevent theft and maintain facility security.