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SAFEGUARDS ISSUES OF LONG-TERM WASTE MANAGEMENT AT DOE SITES

by

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ABSTRACT

Waste management at U.S. Department of Energy (DOE) sites is not often regarded as a safeguard-sensitive step in the nuclear fuel cycle because the material concerned is relatively unattractive for diversion or theft. However, the accumulation of large amounts of fissile materials in wastes over a period of time can be a safeguards concern. One estimate shows that high-level and transuranic wastes and some miscellaneous radioactive materials at DOE sites may contain as much as 15 Mt of fissile materials. In the context of present U.S. strategies for the disposal of these radioactive wastes, this study identifies safeguards issues relevant to proposed scenarios for the long-term management and permanent disposal of the above-mentioned waste forms in geologic repositories. This study points out areas of concern and the need to examine the issues before the wastes are processed for geologic disposal. Good waste management practices may offer unique opportunities to address the safeguards issues identified here. A judicious approach to examining the safeguards requirements of waste disposal programs may also contribute to DOE's new effort to establish and maintain public confidence in its environmental restoration programs.

I. INTRODUCTION

In nuclear material safeguards parlance, radioactive wastes are measured discards.* Although radioactive wastes have been accumulating in the U.S. for half a century, only during the last two decades has there been a concerted effort to address the problems of long-term storage and permanent disposal. Presently, there are well-established programs in place to develop sound technological solutions for interim and long-term management of these radioactive wastes. After considerable study and debate, the U.S. programs were codified in the

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* Although DOE considers spent nuclear fuels as a waste form in the Nuclear Waste Policy Act, spent fuels in the U.S. in fact are not measured discards. Spent fuels will not have either domestic or international safeguards terminated. Because several reports from Los Alamos have addressed spent fuel safeguards,[1-7] further *discussions of spent fuel safeguards in this document will be limited.*

Nuclear Waste Policy Act of 1982.[8] According to this legislation, it is the responsibility of the U.S. Department of Energy (DOE) to develop strategies, systems, and technologies for the long-term isolation of all spent nuclear fuels (SNFs), high-level wastes (HLWs), and transuranic (TRU) wastes in the U.S. Because of the unique socio-political atmosphere surrounding radioactive waste management, there are still considerable challenges to the scientific community for developing technological solutions, including safeguards strategies, that are acceptable to a concerned free society.

DOE Order 5820.2A establishes policies, guidelines, and minimum requirements by which the DOE manages its radioactive and mixed wastes and contaminated facilities.[9] However, DOE 5820.2A does not apply to the management of commercially generated SNFs or HLWs, nor to the geologic disposal of HLWs produced by the Department's activities and operations. Such materials are managed by the Office of Civilian Radioactive Waste Management under the requirements of the Nuclear Waste Policy Act and its amendments (Public Law 97-425). This means that only domestic safeguards are applicable to the storage, management, processing, and vitrification of HLWs on DOE sites, although the vitrified HLWs to be placed in a common geologic repository as commercial spent fuels and HLWs may come under both domestic and international safeguards.

The geologic repository for permanent disposal of high-level radioactive wastes and spent fuel in the U.S. is to be licensed by the Nuclear Regulatory Commission (NRC).[10] Because the U.S. has standing agreements with the International Atomic Energy Agency (IAEA) to make available all civilian nuclear facilities for IAEA safeguards, if the discards criteria for international safeguards are not properly met, then a situation could arise when a repository could have international safeguards and no domestic safeguards. At a recent meeting organized by the IAEA, some consultants recommended that 6500 ppm of plutonium be a permissible maximum concentration in vitrified HLWs.[11] A separate consultants' group provided another set of recommendations to the IAEA on the geologic disposal of SNFs.[12] These recommendations have yet to become part of IAEA's safeguards criteria.

This report identifies some of the key issues that ought to be considered in evaluating safeguards requirements for radioactive waste materials now in U.S. inventory and destined for geologic disposal. The material presented here is intended to stimulate discussions on the subject within the safeguards community and to help develop strategies and systems for safeguarding large quantities of fissile and fertile materials contained in waste forms that are destined for long-term storage and geologic disposal. This report, while identifying safeguards issues, hopes to highlight potential problems. If the safeguards community shares these concerns, certain actions can be taken to resolve them on a timely basis. Alternatively, it is possible to make an informed decision to designate all radioactive wastes presently located on DOE sites as discards from fuel cycles with no safeguards relevance.

II. SCOPE OF THIS STUDY

The waste forms identified here are only those that come under the purview of DOE Order 5820.2A and those included in the integrated database (IDB) managed for the U.S. DOE.[13] Other waste forms may not yet be characterized and quantified properly for inclusion in the database; these wastes may contain quantities of fissile materials that would make them part of the safeguards problems identified here. An example of a waste form that is not yet characterized is discarded materials from the decommissioning of large-scale nuclear material processing facilities with undetermined holdup of special nuclear material (SNM). Of the radioactive waste forms listed in the IDB, three major categories of wastes containing fissile materials are discussed in this report. This discussion excludes commercially generated SNFs managed by the Office of Civilian Radioactive Waste Management (OCRWM) under the requirements of the Nuclear Waste Policy Act of 1982 and its amendments.

III. WASTE FORMS OF CONCERN

Three categories of waste forms in DOE's waste inventories have potential safeguards concerns.

- *Transuranic (TRU) Waste* is contaminated with alpha-emitting radionuclides of sufficiently long half-life (>20 years) of elements with atomic number greater than 92 and concentrations greater than 100 nanocuries per gram. The TRU waste classification includes all transuranic nuclides, except ^{238}Pu and ^{241}Pu, and includes ^{233}U and its decay products. Some wastes containing ^{238}Pu and ^{241}Pu are handled as TRU wastes according to characteristics of other components.
- *High-level Waste (HLW)* results from the reprocessing of SNFs and irradiated targets generally containing most of the nonvolatile fission products. HLWs from facilities that recover uranium and plutonium contain approximately 0.5% of these elements, while HLWs from a facility that recovers only uranium contain 0.5% of uranium and essentially all the plutonium from the materials processed in the facility.
- *Miscellaneous Radioactive Materials (MRMs)* consist of a variety of highly radioactive waste forms that do not fall in the categories of spent fuels, HLWs, or TRU wastes, but will qualify for geologic disposal. These include intact or damaged spent fuel elements from reactors, debris from reactor accidents, solids remaining after experimental testing, TRU-type commercial wastes, Waste Isolation Pilot Project (WIPP) noncertifiable defense TRU wastes, and high-activity sources. DOE Order 5820.2A includes these wastes in the category of "special-case wastes." Disposal systems for these wastes must be justified by a specific performance assessment through the National Environmental Policy Act.[14]

HLWs are now located at Hanford, the Idaho National Engineering Laboratory, the Savannah River Site, and at West Valley, New York. Except for a small percentage of HLWs located at West Valley, all HLWs in the U.S. originated from defense production activities. Almost all the TRU wastes in the U.S. originated from defense-related activities during the past five decades. The majority of these wastes are now located at Hanford, the Idaho National Engineering Laboratory, the Savannah River Site, Oak Ridge National Laboratory, Los Alamos National Laboratory, Mound Laboratory, the Nevada Test Site, and the Rocky Flats Plant. A limited amount of TRU waste is buried at Sandia National Laboratory in Albuquerque, New Mexico. MRMs have originated from a variety of sources, including recovery operations from the Three Mile Island-2 (TMI-2) reactor accident. Inventories of MRMs are located at Argonne National Laboratory, Babcock & Wilcox Lynchburg Technology

Center, Battelle Pacific Northwest Laboratory, Hanford 200 Area Burial Grounds, Idaho National Engineering Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and the Savannah River Site.

The present U.S. strategy for long-term management of radioactive wastes involves the direct disposal of SNFs and vitrified HLWs in common geologic repositories and a separate geologic repository for TRU wastes. MRMs are likely to share the same repository as SNFs and vitrified HLWs. The scenarios for long-term isolation of these waste forms in geologic repositories have distinct and unique safeguards problems quite different from those encountered in developing safeguards systems for conventional bulk-handling and item-accounting facilities.

IV. A HISTORICAL PERSPECTIVE

Until the early 1970s, DOE facilities discarded almost all radioactive wastes generated as unmeasured streams. Even after 1970, the reliability of measurements of fissile plutonium in waste forms, especially measurements using nondestructive assay (NDA) techniques, were in serious doubt because of poor knowledge of the isotopic content of plutonium and limitations in measurement technologies.

All low-level radioactive wastes were lumped together and placed in shallow land burial before 1970. "There was no perceived need for segregating transuranic wastes from low-level wastes."[15] In 1970, the Atomic Energy Commission adopted a policy requiring that waste containing more than 10 nanocuries of alpha activity per gram be packaged and stored separately from other radioactive wastes. TRU waste was defined as material contaminated with alpha-emitting nuclides of long half-life to a level greater than 10 nanocuries per gram.

Before 1970, defense TRU wastes were placed in shallow land burial using a variety of packaging materials, including metal containers and plastic bags. About 53% of TRU wastes generated through 1970 is believed to be disposed at commercial sites outside the DOE complex.[16] Over the years, many of the older disposal containers have been breached and have contaminated adjacent soil. It is very difficult to estimate the actual quantity of contaminated soil, as noted in the IDB report. The estimates of contaminated soil containing TRU nuclides range from 100 000 to 2 000 000 m^3.

The change to retrievable storage was the beginning of better accounting for TRU wastes and their SNM content. Another noteworthy development was the change in definition of TRU wastes, which resulted in an overall reduction in TRU-waste volumes because of the revised classification. In 1984, DOE revised the minimum radioactivity concentration level for TRU wastes from 10 nanocuries/g to greater than 100 nanocuries/g. This change and the development of instrumentation to detect these low levels of radioactivity have reduced the volume of TRU wastes in retrievable storage. The amount of transuranics in wastes generated after this period may be reasonably well estimated. However, more than 75% of the known inventories of TRU wastes are classified as "buried" wastes generated before the initiation of "retrievable" storage. A 1977 estimate indicates that only 1.6 million ft^3 of the 11 million ft^3 of contact-handled TRU wastes were in retrievable mode.[17]

The first attempt at evaluating inventory differences at nuclear facilities in the U.S. culminated in 1977. These educated estimates of cumulative inventory differences at nuclear facilities excluded uranium enrichment facilities and the Rocky Flats plutonium recycling facilities. The 1976 estimate of 1490 kg of plutonium, 690 kg of ^{235}U as enriched uranium, and 40 kg of

^{233}U was accompanied by facility-specific statements about the reasons for decreases in inventories. One of these facility-specific functional statements is typical of others in that the plutonium inventory difference before 1970 resulted from unmeasured waste being buried in controlled government burial grounds. The decommissioning of buildings and the disposal of old equipment and subsequent accumulation of holdup in the replacement equipment were also important factors in the inventory differences.[18] Of these, some were subject to intensive investigations that resulted in the identification and partial recovery of some of the unaccounted fissile materials.* The continuing practice of periodic reporting of inventory differences from most of the DOE facilities indicates that the cumulative inventory differences still constitute large amounts of fissile materials. Records of the history of waste management in the U.S. provide reasons to believe that at least some of the inventory differences are materials lost to unmeasured waste streams.[19-21]

V. U.S. WASTE INVENTORIES

Nuclear fuel cycles generate a variety of waste forms that require long-term isolation from the biosphere. In the U.S., both civilian and defense fuel cycles have accumulated large quantities of radioactive wastes. Table I is a summary of various radioactive waste forms in the U.S. that require special disposal strategies.[13]

TABLE I. U.S. Radioactive Waste Inventory at the End of 1990[a]

Waste Form	Quantities
Spent nuclear fuels[b]	6 700 m^3 (22 000 Mt)
High-level wastes[b]	398 000 m^3 (100 million gallons)
TRU wastes[b]	290 000 m^3 (10 million ft^3)
Miscellaneous radioactive materials[b]	254 Mt
Low-level wastes	4 104 000 m^3 (145 million ft^3)
Uranium mill tailings	118 000 000 m^3 (4 billion ft^3)
Mixed low-level wastes	106 800 m^3 (4 million ft^3)
Wastes from environmental restoration activities	10 149 070 m^3 (358 million ft^3)

[a]This inventory does not include waste forms that are not yet characterized or properly quantified.

[b]Material forms that may contain significant quantities of fissile materials.

* Some of these unaccounted materials were recovered from the Uranium Fabrication Facility at Apollo, Pennsylvania and the Z-trench at Hanford.

Among these waste forms, SNFs, HLWs from spent fuel reprocessing, TRU wastes from defense fuel cycles, and a variety of miscellaneous radioactive materials now in DOE's inventories are of interest to nuclear material safeguards. However, as pointed out earlier, safeguards issues of SNFs are not addressed in this report. Although some of these HLWs, TRU wastes, and MRMs originated in the commercial sector (such as the spent fuels from the TMI-2 accident and some of the HLWs at West Valley, New York), they are presently part of waste inventories at DOE sites, subject to DOE Order 5820.2A. These waste forms contain fissile and fertile materials in differing quantities; all have the potential to become materials for which safeguards should be applied. Because none of the other waste forms (shown in Table I) are known to contain any significant levels of fissile materials, this paper will not address them.

None of the waste forms of potential safeguards concern have had an accurate accounting of their SNM contents. Some of the reported SNM contents of various waste forms are summarized in Table II. All the data presented in Table II are current best estimates and are likely to change when better estimates become available.

TABLE II. Fissile & Fertile Materials in U.S. Inventories of Radioactive Wastes at the End of 1989

Waste Form	Quantity of Fissile Materials
High-level wastes[a]	3.1 Mt of Pu 1.2 Mt of Np and Am
Transuranic wastes	3.0 Mt of TRUs
Miscellaneous radioactive materials (DOE sites)[b]	5.6 Mt of ^{235}U, 1.3 Mt of ^{233}U, and 0.4 Mt of Pu

[a]Ref. 22. These estimates are based on 1986 data.

[b]1990 data taken from Ref. 13, Tables C1-C9. These waste forms are also reported to contain 178 Mt of uranium and 76 Mt of thorium.

In addition to the above estimates, some of these waste forms might contain part of the fissile materials declared as inventory differences at U.S. nuclear material production facilities. Since 1977, the U.S. NRC and the U.S. DOE have been reporting the declassified inventory differences of the U.S. nuclear material production facilities in the open literature. The compilation of such data from all U.S. commercial facilities and most defense production facilities shows that large quantities of fissile materials are not accounted for in their materials accountancy system. For example, the cumulative inventories of three defense production facilities reported in the open literature include over 1 Mt of plutonium and a variety of other fissile materials.[23]

VI. SAFEGUARDS ISSUES

All waste forms containing SNM, especially those that are not declared as measured discards, should be under domestic safeguards. The present strategy of placing TRU wastes in a separate geologic repository implies that these wastes will be only under domestic safeguards in the future. Almost all the high-level liquid wastes in the U.S. have originated from defense fuel cycles, except for a small fraction of wastes at the West Valley site that have originated from civilian fuel cycle activities. At the present time, the disposal scenario for HLWs in the U.S. is to vitrify the wastes and place them in geologic repositories, along with spent nuclear fuels from civilian nuclear power plants. The MRMs are also likely to be placed in the same repository. The potential sharing of a geologic repository by civilian fuel cycle spent fuels and defense fuel cycle waste creates the possibility of vitrified HLWs and MRMs coming under both domestic and international safeguards.

Data presented in Table II and reported inventory differences (IDs) of fissile materials from defense production facilities indicate the likelihood of greater than 15 Mt of fissile materials in these waste forms. Because the total volume of these waste forms is about 700000 m^3, it would seem a herculean task to recover all these fissile materials in HLWs and TRU wastes by employing any of the known recovery methods. However, during the last two years, there have been several proposals to chemically isolate actinides from radioactive waste forms and to transmute them to short-lived or stable nuclides.[24-26] These proposals seem to suggest that recovery of fissile materials from existing radioactive waste materials is feasible and probably economically viable.

In the international safeguards arena, economic considerations (cost of SNM recovery) are not accepted as major deterrents to diversion.[11] The present U.S. position is that costs up to ten times the commercial production costs would not be considered a deterrent to diversion. It is assumed that all waste forms can be processed to recover SNM by some method or another, although many known methods are not economical. Because of the declared presence of fissile materials within waste matrices, these waste forms have the potential to be diverted, and, what is more important, they can become potential conduits for planned diversions. Therefore, it is important to design safeguards systems not only to identify the SNM contents of the HLWs and TRU wastes but also to deter diversion of nuclear materials through these media and to continue to apply safeguards unless the relevant criteria are satisfied.

VII. SAFEGUARDS SYSTEMS AND STRATEGIES

Systems have yet to be developed for maintaining nuclear material safeguards for SNM contained in radioactive waste materials. In recent years, people in the international safeguards arena have been discussing this subject.[11,12,27] However, the development of strategies and systems to safeguard nuclear materials contained in radioactive waste, including SNFs, is still in its infancy.

In the U.S., existing domestic safeguards systems do not specifically exclude SNM contained in radioactive waste materials. However, at the present time, no strategies or programs are designed to maintain safeguards for SNM contained in waste materials that have been accumulating for the past 50 years. There should be a recognition that HLWs, TRU wastes, and other miscellaneous radioactive materials now in DOE's custody and destined for geologic disposal may contain at least 15 Mt of fissile materials. Such recognition is necessary for the systematic examination of the safeguards requirements of radioactive waste materials now in storage at DOE sites and the development of both short- and long-term strategies for maintaining safeguards. The long-term management of all these three waste forms will require recovery operations, processing, repackaging, and transportation. These opportunities may be adapted properly to evaluate the safeguards requirements of these waste management regimes by estimating the fissile contents of materials that are destined for geologic emplacement.

VIII. POSSIBLE APPROACHES

In an ideal safeguards regime, radioactive wastes are "measured discards." Measured discards satisfying discards criteria seldom reenter the safeguards regime.* However, in the case of HLWs and TRU wastes in the U.S., there were no well-defined safeguards criteria for discards. Also, over the years, the SNM contents of wastes have reached rather high levels; their safeguards requirements must be reevaluated.

It is recognized that the distribution of SNM in most of the HLWs and some of the TRU wastes is indeed sparse. Assuming a uniform distribution of SNM in waste matrices, the HLWs and TRU wastes in the U.S. contain less than 25 ppm of fissile materials. These concentrations appear rather innocuous, although the total amount (approximately 15 Mt) of fissile materials in these wastes is a very large quantity of SNM to be discarded without appropriate safeguards. The uncertainties of these reported quantities are likely to be large, and there are no simple methods to verify any of these quantities. Establishing safeguards regimes for such materials in diverse matrices is extremely difficult and will offer considerable challenges to the safeguards community.

Although some of the waste forms at DOE sites have the potential to come under IAEA safeguards during geologic emplacement, only domestic safeguards are examined here. The HLWs in the U.S. are at four major locations, and TRU wastes are at nine sites. Presently, these wastes are in complex matrices with a wide variety of physical and chemical characteristics. It is extremely difficult to attempt to verify the SNM contents of these waste forms by any of the known technologies. However, there is a national plan to move the stored TRU wastes to a geologic repository in a salt bed in Carlsbad, New Mexico, and to vitrify all HLWs and place them in a geologic formation(s) somewhere in the continental U.S. These strategies allow for some simple method of verifying the SNM contents of repository packages leaving storage locations or processing facilities.

Presently, all the HLWs, MRMs, and TRU wastes stored in the U.S. are at DOE facilities under protective custody. It is highly unlikely that these materials will be stolen from their present storage locations. However, movement of these waste forms for geologic emplacement may be monitored for estimating the quantities of SNM being transferred to disposal facilities, and they may be kept under containment and surveillance until they are placed in their final disposal location.

A variety of NDA techniques are available to estimate the SNM contents of TRU wastes.[15,28,29] On the other hand, the estimation of SNM contained in vitrified HLWs as borosilicate glass cannot be made by any of the presently known NDA techniques. However,

* There are few instances, such as raffinate evaporation ponds in General Electric and Siemans fuel fabrication facilities, where measured discards have reentered NRC safeguards regimes due to evaporation and changes in compositions.

the vitrification process requires removing stored wastes and converting them through batch processing into a calcine. It may be possible to sample these calcines in batches and get a better estimate of their SNM content through destructive analyses. Thus, there are opportunities to better estimate the SNM contents of HLWs and TRU wastes during processing and packaging for geologic placement.

Safeguards for long-term retrievable storage should be different from those for geologic permanent storage. Long-term storage can range from a few years to a few decades, and possibilities of diversion from interim storage are more likely than from permanent disposal facilities.

For a closed repository, it is desirable to maintain continuing assurance that the waste materials are still there. However, this may not be the most important requirement in the context of geologic disposal. What may be assuring and reasonably achievable is that the wastes are not being brought to the surface, reprocessed underground, or transferred offsite. Surveillance systems designed to achieve these objectives may be more appropriate to maintaining safeguards for all waste forms in geologic repositories.

IX. PRAGMATIC ALTERNATIVES

The introduction of safeguards for radioactive waste materials is going to create an additional burden for present safeguards systems. Because these material forms and disposal scenarios were not part of the early safeguards regime development, there is a need to examine the safeguards requirements of the waste materials objectively and to arrive at some pragmatic approaches that address the problems. One alternative is not to take any action to reintroduce the waste materials into a safeguards regime. However, it would be prudent to make such a decision based on the best information available and in a manner that is justifiable. The other alternative is to consider bringing the three waste forms discussed here into a safeguards regime. Some possible approaches under this latter scenario are the following:

- For HLWs and TRU wastes, a verification system could be instituted to estimate the SNM contents of waste materials being transferred to final processing for permanent disposal. If this approach can confirm present estimates of SNM contained in waste materials leaving storage locations, then it would also be a valuable confidence-building measure.

- Attempts to estimate SNM contents of HLWs and TRU wastes can help to rectify some of the very large cumulative IDs of SNM at the facilities and potentially help identify waste matrices that may lend themselves to economic recovery of SNM that has been improperly discarded.

- Once a reasonable estimate of the SNM contained in processed wastes is made, continuity of knowledge can be maintained using containment and surveillance measures during the residence of the wastes at storage facilities and while the wastes are in transit to permanent repositories.

Although it is challenging to develop strategies and systems necessary for safeguarding SNM contained in very large quantities of radioactive waste forms, a variety of existing safeguards measures can be readily adapted to address this problem. Some additional new technologies may be required to maintain a satisfactory safeguards regime for these radioactive waste forms to prevent their diversion and their potential use as media for planned diversions.

X. ENVIRONMENTAL RESTORATION AND SAFEGUARDS

According to recent estimates, DOE's environmental restoration and waste management facilities are located at 111 sites distributed in 34 states. In recent years, the DOE has made definite commitments to cleaning up and restoring its nuclear research and production sites within a thirty-year period.[30] The proposed activities constitute a unified approach to solving the problems of wastes from DOE's nuclear activities of the past five decades. In response to the Nuclear Waste Policy Act and its amendments, DOE has issued revised orders to manage all radioactive and mixed wastes at DOE sites in compliance with all applicable federal, state, and local environmental, safety, and health laws and regulations. The progress currently being made toward accomplishing these goals ensures that the HLWs, TRU wastes, and MRMs in storage at DOE sites and those produced will be placed in long-term storage in the near future.

Research and development conducted during the past two decades is leading the way to sound technologies for the long-term management of several of the radioactive and hazardous waste forms at DOE sites. At the same time, the technical community is puzzled profoundly by public and political opposition to waste management programs fueled by public perceptions of risk.[31,32] In recognition of this reality, the DOE's first five-year plan is designed to build a national consensus. A systematic approach to examine the safeguards requirements of waste disposal programs may also contribute to DOE's new effort to establish and maintain public confidence in its environmental restoration programs.

XI. CONCLUSIONS AND RECOMMENDATIONS

The data presented in this paper are based on present knowledge of inventories of SNM in wastes in the U.S. The data should be viewed in the context of waste matrices in which they are distributed, although the totals are likely to attract attention. All the wastes in the U.S. containing fissile materials are presently in secure storage locations and under domestic safeguards. The spent fuels in the U.S. are candidates for international safeguards. The high-level wastes, when placed in the same repository as spent fuels, may have some international safeguards relevance. According to present strategies, the TRU wastes in the U.S. will be totally out of the international safeguards regime.

During the last decade, waste management programs in the U.S. have evolved to a stage where good accounting of waste streams is done routinely as part of good nuclear materials management. Because it is very difficult to extrapolate present practices to accumulated inventories of the past, it would be prudent to examine the issues presented here in proper context and proceed to develop strategies and systems for good materials management practices that will also contribute positively to environmental safety, public concern over radioactive waste disposal, and good nuclear material safeguards.

Within a few years, geologic repository programs in the U.S. are likely to mature to a stage at which final disposal criteria for waste forms will be developed. In the meantime, at least one of the vitrification plants is scheduled to go into full-scale production within a year, and two more plants are to be completed within this decade. Also, the WIPP facility is scheduled to start an experimental phase very soon and that will be followed by large-scale

TRU waste emplacement within this decade. These decisions have already initiated plans for large scale processing and packaging of TRU and high-level wastes. The last chance to examine the SNM contents of these wastes will be during recovery, processing, and packaging for transportation. It would be prudent at this time to discuss the potential value of such an undertaking so that there will be reliable records of SNM buried in the repositories in these waste matrices.

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