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Recommended Strategy for the Disposal of Remote-Handled Transuranic Waste

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Abstract

The current baseline plan for RH TRU waste disposal is to package the waste in special canisters for emplacement in the walls of the waste disposal rooms at the Waste Isolation Pilot Plant (WIPP). The RH waste must be emplaced before the disposal rooms are filled by CH waste. Issues which must be resolved for this plan to be successful include:

1. Construction of RH waste preparation and packaging facilities at large-quantity sites;
2. Finding methods to get small-quantity site RH waste packaged and certified for disposal;
3. Developing transportation systems and characterization facilities for RH TRU waste;
4. Meeting lag storage needs; and
5. Gaining public acceptance for the RH TRU waste program.

Failure to resolve these issues in time to permit disposal according to the WIPP baseline plan will force either modifications to the plan, or disposal or long-term storage of RH TRU waste at non-WIPP sites. The recommended strategy is to recognize, and take the needed actions to resolve, the open issues preventing disposal of RH TRU waste at WIPP on schedule. It is also recommended that the baseline plan be upgraded by adopting enhancements such as revised canister emplacement strategies and a more flexible waste transport system.

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TABLE OF CONTENTS

ACRONYMS 3
PREFACE 4
INTRODUCTION 5
  Purpose 5
  Statement of the Problem. 5
CURRENT STATE OF RH TRU WASTE 6
BASELINE PLAN -- PERMANENT DISPOSAL AT WIPP 8
CONSEQUENCES OF FAILING WITH THE BASELINE PLAN 11
UNRESOLVED ISSUES 11
  Facilities Issues 12
  Transportation Issues 12
  Waste Characterization Issues 13
  Small-Quantity Site Issues 14
  Defense vs. Non-Defense Waste Classification Issues 14
  Lag Storage Issues for RH TRU Waste 15
  Public Involvement Issues 15
  DOE Decision Making Issues 16
NEEDED & DESIRABLE ENHANCEMENTS TO THE BASELINE PLAN 17
  Enhanced emplacement options 17
  Volume reduction 19
  Transportation Enhancements 20
RECOMMENDED STRATEGY AND ACTIONS NEEDED TO ACCOMPLISH IT ... 20
REFERENCES 23

ACRONYMS

ANL	Argonne National Laboratory
ANL-E	Argonne National Laboratory East
ANL-W	Argonne National Laboratory West
C&C	Consultation and Cooperation Agreement
C of C	Certificate of Compliance
CH	Contact-handled
D&D	Decontamination and Decommissioning
DOE	United States Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
ER	Environmental Restoration
FFC Act	Federal Facility Compliance Act
FSAR	Final Safety Analysis Report
FSEIS	Final Supplemental Environmental Impact Statement
HANF	Hanford
HFEF	Hot Fuels Examination Facility
HQ	Headquarters
IDB	Integrated Data Base
INEL	Idaho National Engineering Laboratory
KAPL	Knolls Atomic Power Laboratory
LANL	Los Alamos National Laboratory
NDA	Non-Destructive Assay
NDE	Non-Destructive Examination
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NuPac	Nuclear Packaging, Inc.
ORNL	Oak Ridge National Laboratory
P.L.	Public Law
RCRA	Resource Conservation and Recovery Act
RH	Remote-handled
SAR	Safety Analysis Report
SARP	Safety Analysis Report for Packaging
SEIS	Supplemental Environmental Impact Statement
TMI	Three Mile Island
TRU	Transuranic
WAC	Waste Acceptance Criteria
WHPP	Waste Handling and Packaging Plant (ORNL)
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing Facility (Hanford)
WVDP	West Valley Demonstration Project

PREFACE

This document was originally designed to be a revision of, and successor to, "*Recommended Strategy for the Remote-Handled Transuranic Waste Program* DOE/WIPP 90-058 Rev. 1, June 1991" [Ref. 1]. Much material was drawn from this predecessor report. Early drafts of the current document benefited from reviews by members of the DOE RH TRU Waste Interface Working Group chaired by Sheila Lott of WTAC (WIPP Technical Assistance Contractor). Reviews by members of the Defense Transuranic Waste Integration (DTWI) Team are also gratefully acknowledged.

With the move of the DOE national TRU waste program to the Carlsbad Area Office, Timothy Harms (EM-351), the DOE sponsor originally requesting the revision, has been reassigned to other projects. Also because of the move of the DOE national TRU waste program to Carlsbad, the author of this report and most of the other members of his Sandia Laboratories organization are transferring to other programs. It is hoped that this SAND report will preserve the efforts spent on this task over the last year in a form that can be used, and built on, by those that follow in working on RH waste issues, thus preventing duplication of effort and saving the TRU waste program time and money.

Recommended Strategy for the Disposal of Remote-Handled Transuranic Waste

INTRODUCTION

Purpose

The purpose of this document is to describe the current plan for disposal of Department of Energy (DOE) defense related remote-handled (RH) transuranic (TRU) waste at the Waste Isolation Pilot Plant (WIPP), to identify issues and critical actions necessary to execute the plan, to identify solutions for the issues and desirable enhancements to the current plan, and to describe consequences (largely unfavorable) of not succeeding with the current plan. The intent is to present a high-level, DOE-wide strategy and alternatives, not a detailed operational plan for each individual DOE site. It is not intended that this document provide a schedule for RH TRU waste disposal activities.

Statement of the Problem.

Remote handled transuranic waste is any TRU waste with a radiation dose rate at the surface of the waste container exceeding 200 mrem/h. RH TRU waste is potentially hazardous to workers, the public, and the environment. Alpha-emitting isotopes present serious health risks if inhaled or ingested, and the high beta and gamma radiation dose rates at the surfaces of the containers present handling hazards. Some RH TRU waste contains hazardous materials and is thus mixed TRU waste.

RH TRU waste is currently stored at a variety of locations, none of which have been designed as being suitable for indefinite, long-term storage. The 1993 Integrated Data Base (IDB)[Ref. 2] lists seven sites with RH TRU waste. These are Oak Ridge National Laboratory (ORNL), the West Valley Demonstration Project (WVDP), Hanford (HANF), Los Alamos National Laboratory (LANL), Idaho National Engineering Laboratory (INEL), Nevada Test Site (NTS), and Knolls Atomic Power Laboratory (KAPL). In the future, other DOE sites may find that they have, or may generate, additional RH TRU waste. Since WIPP is limited to defense waste, the RH TRU waste at WVDP and KAPL may not currently be eligible for disposal at WIPP.

Safety of the public, DOE workers, and the environment will be enhanced when the RH TRU waste is disposed in a permanent repository isolated from the accessible environment. Current RH TRU waste storage sites require expenditure of a

great deal of resources, both in personnel and money, for monitoring, inspection, maintenance, security, and oversight. Prompt resolution of RH TRU storage issues leading to disposal will greatly reduce these costs. Actual and potential radiation doses to workers required to inspect and maintain the storage locations will be lowered or eliminated. Buildings, land, and facilities now used to house and secure RH TRU waste could be returned to other productive uses. None of these benefits can be realized until disposal begins.

Several major challenges must be met before RH TRU waste disposal can begin. These include finalizing and committing to the strategy to be pursued for disposal, developing public confidence and stakeholder buy-in for the strategy, identifying the highest priority items for making early and continuing progress toward resolving open issues, and identifying and committing resources (people, facilities, funding) to accomplishing the goals. Key to all of these challenges is having a well-informed management structure at DOE that can provide leadership and vision and can make timely decisions and resource commitments. The remainder of this report:

1. describes the current state of RH TRU waste in the United States,
2. describes the current baseline plan for disposing of the waste at WIPP,
3. points out the consequences (mostly unfavorable) of failing to execute the baseline plan,
4. describes the open issues that must be resolved before RH TRU waste can be disposed at WIPP,
5. describes some enhancements to the baseline plan that should be pursued, and
6. lists the actions that need to be taken to succeed in disposing of RH TRU waste.

CURRENT STATE OF RH TRU WASTE

Current volumes, total activity, and projected future generation of RH TRU waste for the seven sites with identified RH TRU waste and Argonne National Laboratory (ANL)-East are shown in Table 1. Current volumes are shown graphically in Figure 1. The data are from the 1993 Integrated Data Base [Ref. 2]. The majority by volume (about 57% of a total of 2005.5 m^3 in Table 1) is located at ORNL. Another 25% is at WVDP and 10% is at HANF. The majority by total as-stored radioactivity (about 72% of a total projected 674,030 curies) is at Hanford. This is due to the fission products mixed with

Table 1. Current and projected quantities of RH TRU waste stored at the major RH TRU waste sites through 1992 and projected for 1993-2020. All values are from the 1993 IDB [Ref. 2].

Site	Volume[1] (m^3)	All Activity As Stored[2] (kCi)	TRU Activity As Stored[3] (kCi)	All Activity Decayed[4,6] (kCi)	TRU Activity Decayed[5,6] (kCi)	Projected 1993-2020[7] (m^3)
ANL-E	0.0	0.0	0.0	0.0	0.0	47.6
HANF	201.0	482.10	0.56	40.39	0.69	4,909.5
INEL	75.0	10.53	0.10	7.98	0.10	0.0
KAPL	2.4	0.11	0.00	0.11	0.00	25.2
LANL	78.4	3.46	0.09	0.34	0.09	830.
NTS	5.3	0.25	0.00	0.18	0.00	unknown
ORNL	1,144.2	177.68	1.12	160.78	1.09	487.0
WVDP	499.2	0.00	0.00	0.00	0.00	no est.
Sum	2,005.5	674.03	1.87	209.78	1.97	6,299.3

[1]1993 IDB, Table 3.1. [2]1993 IDB, Table 3.2.
[3]1993 IDB, Table 3.3. [4]1993 IDB, Table 3.4.
[5]1993 IDB, Table 3.5. [6]Decayed to Dec. 31, 1992.
[7]1993 IDB, Table 3.17, sum of total generation from all periods.

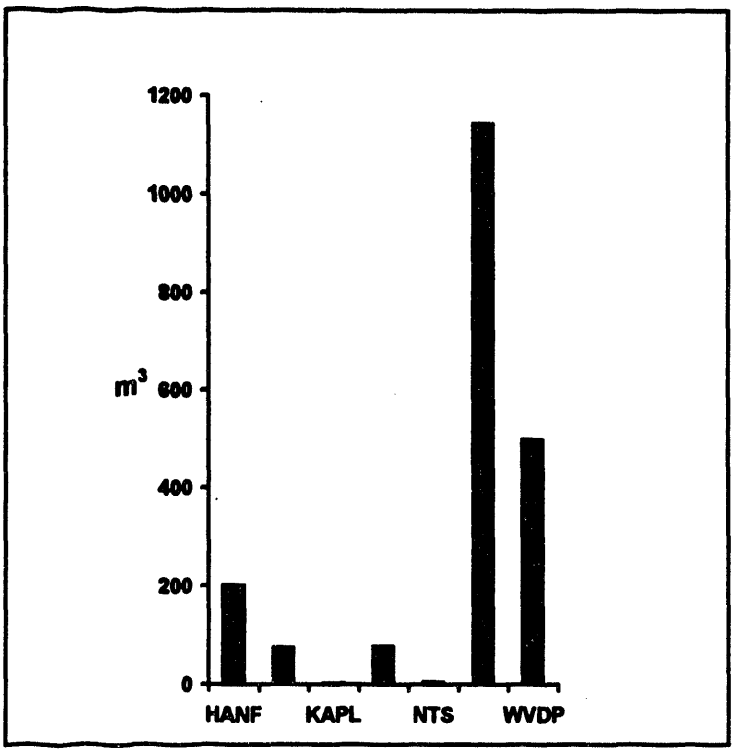

Figure 1. Volume of RH TRU Waste at DOE sites as of December 31, 1992. Data from 1993 IDB [Ref. 2].

the TRU waste at Hanford. The sum of the current and projected volumes of RH TRU waste is 8,304.8 m^3. This value exceeds the current 7,080 m^3 limit for RH TRU waste at WIPP. (Even if WVDP and KAPL RH TRU waste are excluded as non-defense, the sum of RH TRU waste from the other sites is 7803.2 m^3, a quantity exceeding the WIPP limit.) As the waste currently identified as RH TRU is prepared for shipment to WIPP, the volume is expected to decrease due to compaction, separation of RH from non-RH components, and better characterization showing some of the waste to be contact handled (CH) or not TRU. Potential RH TRU waste generated during decontamination and decommissioning (D&D) and environmental restoration (ER) work is not included in these estimates. If D&D and ER produce significant volumes of RH TRU waste, the WIPP volume limit may be further challenged, and alternative RH TRU waste disposal options will have to be pursued. These options are modifications to WIPP and/or the RH TRU waste capacity limit for WIPP and RH waste disposal at non-WIPP locations. The total curie content of RH TRU waste shown in Table 1 is well below the WIPP limit of 5.1 million curies of RH TRU waste.

Additional data on mixed RH TRU waste are given in the FFC Act Interim, Mixed Waste Inventory Report [Ref. 3]. Since non-mixed RH TRU waste is not covered by the FFC Act Interim Report, data from the 1993 IDB [Ref. 2] are used in Table 1 and elsewhere in this report.

RH TRU waste is in many forms, including solid, liquid, sludge, and contaminated equipment. Most or all of the waste requires repackaging and further characterization before it can go to WIPP for disposal. Some waste needs to be processed to put it into more stable forms. Several facilities to do this work have been proposed, e.g., Waste Handling and Packaging Plant (WHPP) at ORNL and Waste Receiving and Processing Facility 2B (WRAP 2B) at Hanford. Conceptual designs for these facilities have been prepared, but commitments to build them are still pending.

BASELINE PLAN -- PERMANENT DISPOSAL AT WIPP

The current baseline strategy for disposal of DOE RH TRU waste is the following:

1. Build waste handling, packaging, and characterization facilities at major RH TRU waste sites -- e.g., WRAP 2B at Hanford and WHPP at ORNL. Transport small-quantity site RH TRU waste to these sites.

2. Package RH TRU waste into standard RH waste canisters with little or no prior treatment, i.e., treat only as necessary to meet WIPP transportation and waste acceptance criteria (WAC) requirements

3. Transport the waste canisters to WIPP in the NuPac 72B transport cask.

4. Emplace the canisters in horizontal boreholes in the WIPP storage rooms walls before the rooms are filled with CH waste.

Current design calls for WIPP waste canisters to be made of steel and be 26-inches in diameter and 10-feet 1-inch long (outside dimensions) with 0.89 m^3 internal volume. Each canister will contain either (1) three 55-gallon drums, (2) three 30-gallon drums, (3) one ANL-W Hot Fuels Examination Facility (HFEF)-5 can, or (4) loose waste too large for standard drums. Boreholes will be drilled in the walls of the eight WIPP disposal panels and the north-south access drifts (but not the cross drifts). The boreholes will be on 8-foot centers, and each will contain one canister. Canister-emplacement equipment has been designed and tested. It consists of a shielded facility cask holding one canister during movement from the WIPP hot cell at the surface to the underground boreholes. The facility cask mates with the borehole, and a ram pushes the canister into the borehole.

DOE established this strategy and the WIPP RH waste design-capacity limits through several administrative actions and records. The design-capacity limit of 7,080 m^3 (250,000 ft^3) of RH TRU waste was originally set by the Record of Decision, January 28, 1981, and reiterated in the Final Supplemental Environmental Impact Statement (FSEIS) [Ref. 4] in June 1990 and the Final Safety Analysis Report (FSAR) [Ref. 5]. This volume is equivalent to 7955 canisters. The wall space available for RH disposal holes can accommodate approximately 7900 canisters under the baseline plan. A limit of 5.1 million curies of total activity and 23 curies per liter maximum activity (averaged over the volume of the canister) for the RH TRU waste was established by the 11/30/84 Modification to the Consultation and Cooperation (C&C) Agreement between the DOE and the State of New Mexico. Surface dose rates and activity densities for the containers were also established by the C&C Agreement modification 11/30/84. Up to five percent of the RH TRU to be certified for emplacement at the WIPP may have surface dose rates between 100 and 1,000 rem/h. Dose rates at the surface of the remainder of the waste must be less than 100 rem/hr. There

are no good data on how much (if any) of the current RH TRU waste exceeds a 1000 rem/hr surface dose rate. Disposal canister specifications are contained in the WIPP WAC [Ref. 6] and other documents. A summary matrix for the requirements is provided in Figure 2.

Per P.L. 102-579 (WIPP Land Withdrawal Act of October 1992) [Ref. 7], no RH TRU waste will be shipped to WIPP until the test phase is completed. Under the current design, RH TRU waste is scheduled to be the first waste emplaced in each room. This is necessary because the emplacement equipment is large and must be out of the room before CH TRU waste goes in. If the RH TRU waste is not emplaced in a room before the CH TRU waste, the opportunity to put RH waste in that room is lost.

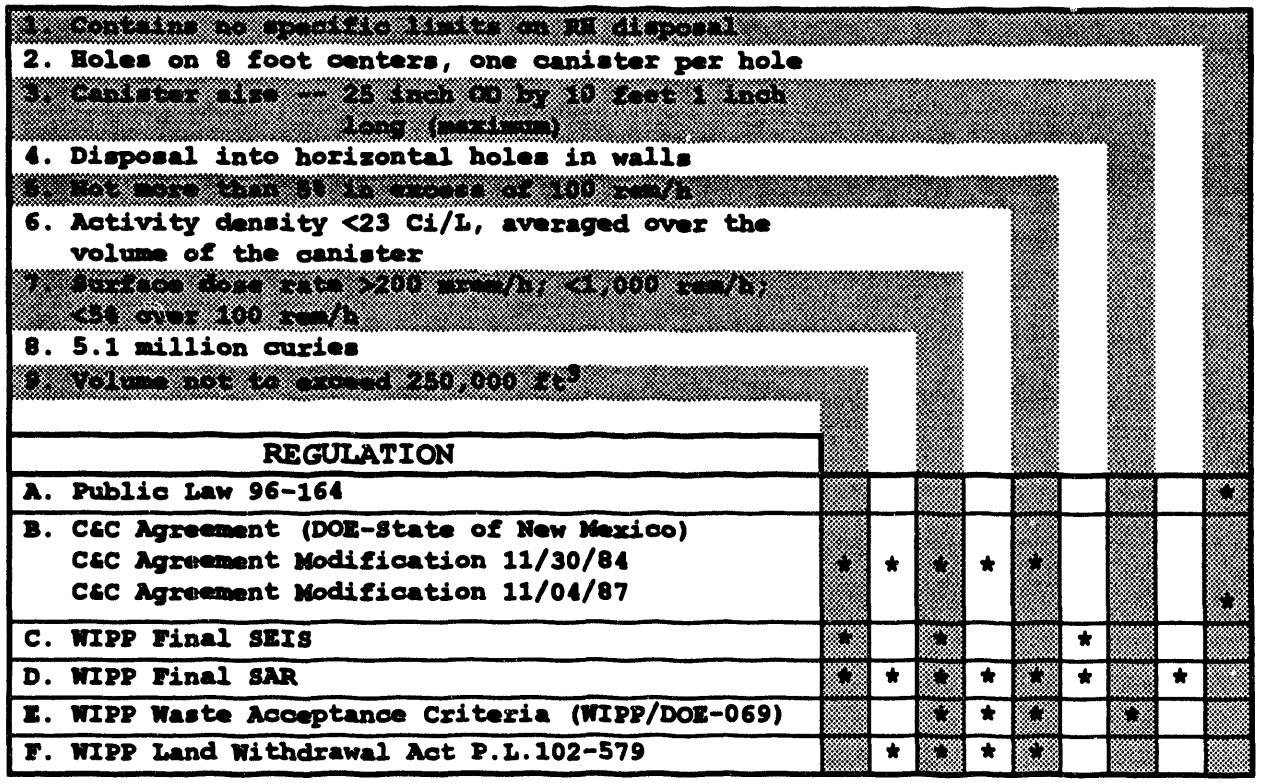

Figure 2. Regulatory Matrix

CONSEQUENCES OF FAILING WITH THE BASELINE PLAN

If RH TRU waste is not successfully disposed at WIPP according to the baseline plan, an alternative strategy for all, or part, of the RH TRU waste will be required. Failure to dispose of the waste at WIPP could involve all RH TRU waste (e.g., WIPP does not open for RH TRU waste), or part of the RH TRU waste (e.g., part of the waste can not meet the acceptance requirements for either WIPP or the transportation system, or CH waste fills the rooms before the RH waste is ready for emplacement). The alternate strategy will be either a deliberately selected strategy or a default strategy.

None of the non-WIPP alternatives have any advantages over the recommended WIPP strategy for achieving RH TRU waste disposal faster, at a lower total system cost, for enhancing public and worker safety, for protecting the environment from harm, and/or enhanced public acceptance. Some of the non-WIPP alternatives include development of other deep geological waste repositories; disposal on the seabed, outside the United States, or in space; processing the RH TRU waste to make it either no longer RH or no longer TRU; conversion of the waste to beneficial uses; long-term surface or near-surface storage; and "doing nothing", i.e., continuing to store the waste at its current locations. Many of these options were studied in previous years and dropped in favor of WIPP. The major effects of selecting an alternate strategy over WIPP are that decisions are postponed, money and other resources are committed at different times and rates, and the RH TRU waste continues to be held at sites close to workers, to the public, and in the habitable environment.

If the baseline plan fails because some or all of the RH TRU waste planned for WIPP can not be emplaced due to storage rooms being filled with CH waste before the RH waste is ready for emplacement, modifications to the WIPP baseline plan could be pursued. Possible modifications includes RH waste canister emplacement at additional locations at WIPP, emplacing canisters at a closer spacing, and mining additional disposal rooms. All alternatives of this type will require additional time and funds to complete the necessary additional analyses, reviews, and approvals.

UNRESOLVED ISSUES

To be able to execute the current emplacement plan (and avoid the unfavorable consequences just described), all open issues preventing movement of RH TRU to, and emplacement at,

WIPP must be resolved before the first CH TRU waste arrives at WIPP. First CH waste disposal at WIPP is currently anticipated for 1998. If the issues are not settled by this time, either emplacement of CH TRU waste at WIPP will be delayed, or the opportunity to place the RH TRU waste in WIPP as planned will be lost forever. Either case will result in programmatic delays, additional expense in the form of continued high costs of maintaining the RH TRU where it is now and/or developing alternate disposal facilities, and other negative impacts. The public will also be forced to wait longer before realizing the benefits of moving the RH TRU waste to a safer location. The following describes the issues that must be resolved in order to emplace RH TRU waste in WIPP according to the baseline plan.

Facilities Issues

The most serious obstacle to having RH TRU waste ready to go to WIPP is the lack of the major facilities needed to prepare the waste for shipment and emplacement. The facilities are required to characterize, repackage, and, in some case, treat RH TRU waste to meet the requirements of the WIPP WAC and the transportation system. Proposed facilities include WHPP at ORNL and WRAP 2B at Hanford. While some preliminary design work has been done for these facilities, there is currently no commitment to fund and build them. Similar facilities may be needed at other sites. It will take several years to get major facilities of this type built and operating. WHPP is a 1998 line item project for ORNL. If the project is approved and built as anticipated, it would not be operational until about 2006, seven years after the currently anticipated WIPP opening date. WRAP 2B at Hanford faces a similar "earliest possible" opening date. Perhaps enough RH TRU waste canisters can be loaded at other facilities to bridge the time between WIPP opening and opening of WHPP and WRAP 2B. If not, and if construction of WHPP and WRAP 2B are delayed, much of the baseline RH waste capacity at WIPP will be wasted.

Small-quantity sites and other sites without RH TRU waste packaging, characterization, and treatment facilities will need to be able to send their waste to the sites that do have the facilities. This can not be done until the major facilities are built, and transportation issues are resolved.

Transportation Issues

There is currently no transportation system available to ship RH TRU waste canisters to WIPP. The NuPac 72B cask is intended to fill this need, and the cask design is complete. Fabrication has been suspended, but work to obtain an NRC

Certificate of Compliance (C of C) is continuing. The cask is designed to transport one RH TRU waste canister that will contain either: (1) three 55-gallon drums, (2) three 30-gallon drums, (3) one HFEF-5 can, or (4) loose waste too large for standard drums. Since the NuPac 72B cask is a smaller version of the Three Mile Island (TMI) NuPac 125B cask that has already received a Nuclear Regulatory Commission (NRC) C of C, DOE is seeking a C of C for the NuPac 72B based on a written analysis of the design. The draft cask Safety Analysis Report for Packaging (SARP) is at the DOE Carlsbad Area Office awaiting clearance to go out for independent technical review. When this is complete, the SARP will be submitted to the NRC. The anticipated date for issue of the C of C is July 1998.

Waste Characterization Issues

Before RH TRU waste can go to WIPP, it must be characterized to ensure it meets the requirements of the WIPP WAC and the NuPac 72B cask transportation system. Key to designing a characterization program is knowing the characterization requirements. For RH TRU waste going to WIPP, this includes knowing the WIPP Waste Acceptance Criteria and the characterization requirements for the RH TRU waste transport system. The sooner these are (relatively) firmly established, the sooner a realistic characterization program can be established.

Characterization capabilities must include chemical (e.g., for Resource Conservation and Recovery Act [RCRA] hazardous materials and gas-generation potential), radiological (e.g., surface dose rates and radionuclide inventory), fissile content (e.g., for criticality safety and heat generation), and physical content (e.g., for free liquids and energy-storage devices).

Various oversight groups for WIPP (e.g., the Blue Ribbon Panel) have recommended that non-destructive analysis (NDA) be performed on TRU waste for credibility. In preliminary discussions with the NRC regarding the certificate of compliance activities for the NuPac 72B cask, the NRC questioned how the radionuclide contents of an RH TRU waste container could be verified. Since the NRC had previously accepted NDA as a method of identifying radionuclide contents of CH TRU waste, NDA was identified as an acceptable technique for RH waste. NDA capability thus needs to be developed for RH TRU waste. Some development work has been done at the Los Alamos National Laboratory and a small system built to assay one-gallon cans, but there is no funding for further development. [Ref. 1] Other promising characterization techniques that need further development are non-destructive examination (NDE) and process knowledge.

Small-Quantity Site Issues

Small-quantity RH TRU sites have challenges that differ from those of the large-quantity RH TRU sites. Small-quantity sites have from one or two up to several hundred containers of RH TRU waste. These small quantities do not justify dedicated processing, characterization, and packaging facilities costing hundreds of millions of dollars, and there are currently no plans to construct such facilities at all of the small-quantity sites. Instead, the needs of small-quantity sites must be met by finding ways to move their RH TRU waste to characterization and packaging facilities at the large-quantity sites. Key to this is finding means for transporting the waste in a regulatory-compliant manner. This means DOE and the small-quantity sites must work with the Environmental Protection Agency (EPA), Department of Transportation (DOT), and other regulatory agencies to reach agreements on mutually acceptable means of safely shipping these relatively small amounts of RH TRU waste. A basis for this could be establishing a "worst-case" or "most hazardous" RH TRU waste form and establishing criteria for a safe container and means of shipping this waste. All small-quantity site RH TRU waste could then be shipped in this manner since all the waste would be no more hazardous than the "worst-case" waste the system was designed to handle. Additional processing may be necessary to bring some wastes within the "worst-case" criteria. Some NDA and NDE capability, perhaps in the form of a remote-handled mobile characterization unit, could be used at the small sites as a supplement to process knowledge to verify that the waste falls in the "worst-case" envelope.

Small-quantity sites have a small fraction of the total RH TRU waste, but they also typically have a small fraction of the facilities, resources, and personnel to handle and manage RH TRU waste. The impact of RH TRU waste problems to a small-quantity site is very significant, and the potential for violation of environmental and personnel safety regulatory requirements may be comparable to large sites. The potential impact (to the environment, the public, and to DOE) of an accidental release at a small-quantity site is perhaps greater than that at some large-quantity sites because small-quantity sites are more likely to be located in, or near, high population centers.

Defense vs. Non-Defense Waste Classification Issues

WIPP is currently limited to waste resulting from "defense applications and programs". (Department of Energy National Security and Military Applications of Nuclear Energy Act of 1980, Public Law 96-164.) While much of the existing

DOE RH TRU clearly meets the "defense waste" requirement, some does not. Small quantity sites are especially affected. Many have waste from projects conducted for a variety of sponsors, some non-defense and some where the defense designation is currently ambiguous. A clear definition of what is "defense waste" eligible for disposal at WIPP should be developed. An administrative and/or legislative change in the WIPP requirements permitting all DOE RH TRU waste to go to WIPP would be of great benefit to many sites and could save DOE the expense of developing additional repositories for non-defense RH TRU waste.

Lag Storage Issues for RH TRU Waste

Lag storage is the storage space available to accommodate a backlog of certified RH TRU waste, either at the generator site awaiting shipment, or at WIPP (or some other repository) awaiting emplacement. There is little lag storage available for RH TRU waste in the RH TRU system as currently planned. WIPP has the capacity for storing seven filled canisters in the WIPP hot cell and, according to the WIPP FSAR, there is an outdoor storage area to store six RH TRU waste trailers. Additionally, storage at WIPP may be restricted by limits imposed by RCRA. Hanford may be able to store five canisters, and ORNL may have the capacity to store up to fifty canisters. The WIPP receipt/emplacement rate will have to be closely coordinated so that lag storage is minimal. A systems approach to reviewing and providing the necessary lag storage and the number of transportation casks and trucks versus the forecasted generation rates (including uncertainty, variability, and other factors such as road construction, weather, etc.) is required.

Public Involvement Issues

The reality in the United States in recent years is that progress on potentially controversial waste issues, whether it be radioactive waste, hazardous waste, siting a municipal landfill, sewage treatment, or almost any similar project is at best slow and contentious unless the public has had a broad, meaningful, and early opportunity to participate in the planning and execution of the project. DOE originally presented the WIPP project to the public in a "decide, announce, and defend" mode. With hindsight, it can be seen this contributed to the many delays in WIPP opening. In recent years DOE has begun to recognize the necessity and value of public involvement. Most DOE sites and the National Transuranic Waste Program Office (NTPO) in Carlsbad, NM now have public participation offices and operate programs involving the public in activities concerning their facilities. This process needs to continue and be expanded to

specifically consider RH TRU issues. In addition to these local programs, a national-level public participation forum on RH TRU waste issues involving the "grass roots" public needs to be established. RH TRU waste is a national problem and the current plan of disposing of RH TRU waste at WIPP is a national solution. There are currently no public involvement activities involving a broad cross section of grass roots participants working on this national issue. National public participation activities to date consist of guidance from DOE HQ to the field on how to conduct local programs, and activities with high level national officials such as national and western governors conferences and the State and Tribal Government Working Group.

DOE Decision Making Issues

All key decisions on RH TRU waste issues are currently made, or at least approved, at DOE Headquarters. Those involving major activities or adoption or change in strategy are expected to come from the DOE Secretary or Assistant Secretary level. Frequently, decisions are not made specifically on RH TRU waste, but rather on a broader scale on TRU waste or mixed waste levels. In these cases, RH waste is often treated as a small volume, secondary issue, and full consideration of its special needs and requirements are delayed (or ignored) while the concerns of the much larger volume CH wastes get the attention. If the RH-waste issues are to be successfully settled, they must have a forum at DOE HQ that considers them on their own merits and then generates decisions to resolve the issues. The decision making process must remain flexible and responsive to input from public participation activities.

DOE HQ decisions are needed on several key issues. These include:

1. Clearly establish the RH TRU strategies to be followed; e.g., disposal of all RH TRU waste at WIPP according to the current baseline plan; disposal at WIPP using an enhanced emplacement plan; disposal of all, or part, of the RH waste at a non-WIPP site; indefinite storage (without disposal) of all, or part, of the RH TRU waste, etc.

2. Approval and funding for construction and operation of RH major TRU processing, packaging, and characterization facilities at large-volume sites.

3. Action to ensure timely certification and construction of the RH TRU waste shipping cask (NuPac 72B).

4. Action to resolve RH TRU technical issues such as waste acceptance criteria, packaging requirements, characterization requirements, and transportation requirements.

5. Continue to actively pursue and support broad, national public participation programs.

NEEDED & DESIRABLE ENHANCEMENTS TO THE BASELINE PLAN

Several enhancements and additions to the baseline plan for RH TRU waste emplacement are desirable to make the system more cost effective and efficient. If RH TRU waste is not ready for emplacement in WIPP on a schedule compatible with CH TRU waste emplacement, some of these may be necessary to preserve the capability to emplace the full allotment 7,080 m^3 of RH TRU waste. Some of these may also be required if part of the RH TRU waste can not be qualified for WIPP, either because it can not meet the WIPP WAC, or because the quantity of RH TRU waste exceeds the allowed capacity of WIPP.

Enhanced emplacement options

If RH TRU waste emplacement capability for the baseline storage plan is not developed in time to emplace RH waste in WIPP before the first rooms are filled with CH waste, alternative RH waste emplacement options at WIPP might be employed. Use of one or more of these would allow the full, authorized RH waste allotment for WIPP to be placed in fewer disposal rooms. This means CH TRU waste could be loaded into some rooms before RH waste is ready for emplacement. In most cases, using an alternative emplacement method will require modifications to existing written agreements, criticality safety and thermal load limit analyses, performance assessments, policies, and/or descriptive documents. Since preparing and negotiating approvals for these changes will take time, probably several years, a decision to pursue one or more of them needs to be made well before WIPP opens. Even if WIPP is ready to accept RH TRU waste on schedule when WIPP first opens, one or more of these options could be used to increase the total RH TRU capacity of WIPP beyond the current 7,080 m^3 to accommodate a greater volume of RH TRU waste.

1. ***Use longer boreholes and emplace more than one RH TRU canister in each borehole.***
   There are no regulatory requirements that restrict how many canisters may be emplaced in a horizontal borehole. Drilling holes long enough to accommodate two RH canisters should be feasible.

2. ***Place canisters at closer-than-8-foot centers.***
Boreholes for canister placement could be moved closer than 8 feet. A 6-foot spacing, for example, would allow emplacement of the total RH waste allotment in three-fourths of the wall space required using 8-foot spacing. Emplacement at two (or more) heights from the floor can also increase the total number of canisters placed in a given length of wall. Criticality safety limits must still be maintained. The current WIPP Criticality Safety Analysis Report allows a 5.63-foot minimum distance between RH TRU waste canister center lines based on a fissile loading of 600 grams per canister. Placing canisters on 6-foot centers meets this requirement. Emplacement hardware would need to be redesigned to accommodate emplacement at other than one standard height from the floor.

3. ***Emplace RH waste canisters in the cross-drift walls.***
This adds additional emplacement locations but may also require handling equipment design modifications and/or enlargement of the cross drifts.

4. ***Modify the RH TRU waste-handling facility to handle drums as well as canisters, utilize drums as much as possible, and place more than three drums in a borehole.***
Advantages of this option are a reduced RH TRU waste volume (as measured by the outer dimensions of the outer containers) and reduced metal (fewer canisters) in the repository. Use of drums rather than canisters makes the waste more compact because void space in the canister and the volume of the canister materials are no longer part of the emplacement volume. Less metal means less potential for gas generation. This option would require major modifications to the RH handling facilities and design and emplacement approvals. New shipping and handling containers would need to be designed, built, and certified. This method has economic advantages to waste generators in that many fewer waste canisters need to be purchased. Transporting drums instead of canisters may allow lighter, higher volume shipping packages for the large percentage of RH TRU waste with lower activity levels, thereby reducing the number of required shipments and the size of the NuPac 72B cask fleet.

5. ***Emplace the RH TRU waste vertically in the floor of the repository in addition to the ribs.***
Emplacement in the floor of disposal rooms, as well as in the walls, will greatly increase the available disposal space. This change would have to be addressed in the Performance Assessment, both from a point of view of the

amount of material that could be penetrated during a post-closure drilling operation, and from the point of view of whether 10- to 20-foot deep holes in the floor would pass through rock layers that could degrade WIPP performance. New emplacement equipment would be required for floor emplacement. However, if drum shipment is used, the handling and emplacement technology could be adapted from existing U.S. and foreign facility designs.

6. ***Mine additional rooms for the RH TRU waste.*** Additional rooms, on the same or a new horizon, could be designed and mined specifically to meet the needs, volume, and schedule of RH TRU waste.

A decision to revise the WIPP RH disposal geometry either by adding more holes in the existing walls or placing more than one canister in a hole could affect the source geometry data used in the WIPP Performance Assessment and require additional Performance Assessment analyses to be performed. A decision to dispose of RH TRU waste at WIPP without canisters would involve a modification to several of the regulatory documents, to the WIPP Waste Handling Building, and to underground emplacement equipment. These modifications would not be required until about the year 2005 when the WHPP at ORNL (a 1998 line item facility) and the WRAP Module 2B at Hanford are planned to go on-line. RH TRU waste disposal at WIPP without the canisters could mitigate the volume issue by reducing the space required to dispose of the waste.

A decision to increase the available wall space at WIPP by changing the emplacement design of WIPP could require modifications to the FSEIS, the FSAR, and other documents. Although this alternative could be expected to require several years for approval before the additional space could be used, disposal of all wastes could continue with the existing design while the design and approval process proceeds.

Volume reduction

Equipment and services are available to significantly reduce the volume of TRU waste. This is accomplished by removing non-radioactive components of the waste (e.g., air by compaction of the waste or carbon by incineration). The relatively small volume of the RH waste stream will probably limit the options that will be economically viable unless central treatment facilities are used. Development work has been done on CH TRU waste incinerators, and a CH TRU waste high force compactor (i.e., supercompactor) is commercially operational. These systems may require some modifications or procedure changes to safely handle RH waste.

Transportation Enhancements

A large portion of RH TRU waste is expected to have surface dose rates of 30 to 50 rem/hr, well below the 1,000 rem/h maximum that the NuPac 72B cask is expected to accommodate. A study should be performed to identify existing certified Type B packages and to assess their suitability for shipping RH TRU waste to WIPP and to central processing and packaging facilities in 30- and 55-gallon drums. This study should specifically address the number, status, and availability of the casks, the capacity in terms of number of containers of various sizes and radionuclide inventory, the maximum radiation fields, transportation restrictions (e.g., due to size and weight), and other relevant parameters. Use of a drum cask of this type will reduce the total number of shipments of RH TRU waste to WIPP and should be more economical. Drums could then be emplaced directly or transferred to RH waste canisters at WIPP.

A feasibility study should also be performed to determine if a TRUPACT-II could be certified with a shielding insert (e.g., the "half pack" concept) allowing the transport of RH TRU waste drums with surface dose rates up to 30 to 50 rem/h. This alone should cut the number of shipments nearly in half.

RECOMMENDED STRATEGY AND ACTIONS NEEDED TO ACCOMPLISH IT

Disposal of RH TRU waste at WIPP according to the current baseline plan with some enhancements for increasing WIPP capacity and flexibility, and for reducing some costs, is the recommended strategy. The following are the major actions that must be taken to successfully execute the strategy. The order of the items is not necessarily indicative of their importance. All are necessary to successfully dispose of the RH TRU waste at WIPP.

1. Complete the design, fund, and build waste retrieval, handling, processing, characterization, and packaging facilities. This includes facilities such as WHPP at ORNL, WRAP 2B at Hanford, and mobile remote-handled characterization equipment for use at small-quantity sites. These are expensive, but they are crucial to having RH TRU waste packaged and ready for timely emplacement at WIPP. Without these facilities, it is estimated that only about 320 RH TRU waste canisters can be packaged for WIPP -- about 300 at the INEL and about 20 at LANL. Even if WIPP does not open, facilities of this type will be needed to prepare the RH TRU waste for disposal at other sites or for long-term storage.

2. Resolve RH TRU waste transportation issues. This includes obtaining an NRC C of C for the NuPac 72B cask and building sufficient casks to handle the waste load. In parallel with this, action should be taken to identify (or design and build) a simple, less expensive, and higher volume transportation system for the RH TRU waste being shipped from the small-quantity sites to the processing and packaging facilities and for shipping the lower-activity RH TRU waste to WIPP. Much of the RH TRU waste is in 30-gallon and 55-gallon drums and the majority has surface dose rates of 30 to 50 rem/h or less. Some existing Type B casks may be suitable. This would result in great savings by reducing the number of NuPac 72B casks needed and would add needed versatility and flexibility to the RH TRU waste transportation system.

3. Continue to support existing public involvement programs concerning TRU, and especially RH TRU, waste. Initiate new programs to involve a broad range of stakeholders, including "grass roots" level participants, in seeking national-level solutions to RH TRU waste disposal issues.

4. Resolve small-quantity site issues. Key to this is to find ways, working with regulators (EPA, DOT, NRC, etc.), to safely move the small quantities of RH TRU waste from the small-quantity sites to processing, packaging, and characterization facilities at the large-quantity sites with minimal processing, packaging, and characterization expenses at the small-quantity sites. The existing Small-Quantity Site Interface Working Group has begun addressing many of these issues.

5. Complete development work on RH TRU waste characterization techniques and build the necessary facilities. This includes characterization for fissile, radioactive, and hazardous (e.g., toxic, corrosive) content as well as physical properties such as heat generation and free liquid content.

6. Work on getting WIPP open must continue and must include provisions for RH, as well as CH, TRU waste. This includes such tasks as performance assessment, the Land Withdrawal Act study plan, the No-Migration Determination, and public participation/stakeholder involvement activities.

7. The RH TRU waste canister emplacement scheme at WIPP needs to be reviewed and finalized. In order to place the full, currently allocated 7,080 m^3 of RH TRU waste in WIPP, it appears some deviation from the current emplacement plan

needs to be developed. Placing canisters at closer-than-8-foot centers, making emplacement holes deep enough for two canisters, and emplacing waste in cross-drift walls are three alternatives to be considered.

8. Under current plans RH TRU waste will all be emplaced in standard RH TRU waste canisters. The canisters and emplacement gear are designed for high dose rate waste. The majority of the RH waste is expected to have dose rates of 30 to 50 rem/h or less. Alternative, simpler emplacement options at the WIPP for this lower dose-rate RH waste should be developed. For example, direct emplacement of waste in 55-gallon drums will reduce the number of RH TRU waste canisters that need to be built and reduce the gas-generation potential from metal corrosion by eliminating many canisters.

9. Finalize waste characterization and acceptance criteria and requirements for both WIPP and RH TRU waste transportation system, at least to the point the needed major facilities can be designed and built.

10. Establish a clear definition of what is "defense waste" eligible for disposal at WIPP. Seek a change in the WIPP requirements so that all DOE RH TRU waste may be disposed at WIPP.

11. Resolve lag storage issues. Current plans for moving RH TRU waste to WIPP have little or no provisions for lag storage. The plans assume facilities will package and ship RH TRU waste at the same rate it is emplaced at WIPP. This is not a realistic expectation.

12. Gather data to estimate how much of the existing RH TRU waste has surface dose rates <100 rem/h, between 100 and 1000 rem/h, and greater than 1000 rem/h.

13. Design, fund, build, and test new RH TRU waste handling and emplacement hardware at the WIPP to accommodate the alternative RH TRU waste containers. Redesign, fund, modify, and test the current baseline RH TRU waste handling and emplacement hardware for use with the canisters.

14. DOE HQ needs to insure that all involved parties have up-to-date information on the strategy being pursued, the open issues and activities underway to close them, and understand that flexibility is needed in order to be able to incorporate input from ongoing public involvement programs.

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