OPERATIONAL CONSIDERATIONS AT THE WIPP RELATING TO THE 10-160B SHIPPING PACKAGE FORREMOTE HANDLED TRANSURANIC WASTE

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ABSTRACT

In March 1999 the Department of Energy (DOE) began disposing contact handled (CH) transuranic (TRU) waste at the Waste Isolation Pilot Plant (WIPP). The DOE is now in the process of obtaining authorizations from regulatory agencies to dispose remote handled (RH) transuranic waste at the WIPP in early 2006 [1]. At the present time (September 2003) the DOE plans to dispose of about 2,800 cubic meters of RH TRU waste.

There are two RH TRU waste shipping packages (note: the words shipping package and cask are used interchangeably) authorized by the Nuclear Regulatory Commission (NRC). The 72B shipping package holds a disposal canister that has an internal volume of 0.89 m^3. The canister can be either direct loaded or loaded with up to three 55-gallon drums containing RH TRU waste. When the 72B shipping package arrives at the WIPP, the disposal canister will be removed from the shipping package and will be placed into an underground horizontal disposal borehole.

The 10-160B shipping package holds up to ten 55-gallon drums containing RH TRU waste. When the 10-160B shipping package arrives at the WIPP, the ten 55-gallon drums will be removed from the 10-160B shipping package. Up to three 55-gallon drums will be placed into a disposal canister. The canister will then be placed into an underground horizontal disposal borehole. Thus there will be additional handling steps at the WIPP associated with the use of the 10-160B shipping package as compared with the use of the 72B shipping package. Adding steps increases the chance of mechanical and electrical problems, as well as administrative and human factor related errors.

This paper addresses several potential disadvantages associated with the use of the 10-160B shipping package as compared with the use of the 72B shipping package. The 10-160B shipping package should only be used under specific circumstances where the unique properties of the shipping package make it a clear choice over the 72B shipping package.

INTRODUCTION

The First Modification to the Consultation and Cooperation Agreement between the State of New Mexico and the DOE agreed to emplace a maximum of 250,000 cubic feet (7,079 m^3) of RH TRU waste in the WIPP [2]. RH TRU waste is radioactive waste that requires shielding in addition to that provided by the container to protect against radiation exposure. The radiation dose rate at the surface of the container may be in the range of 0.2 rem/hr to 1,000 rem/hr. Note that the unit of dose is the rem and thus includes any contribution from neutron radiation.

RH TRU waste will be shipped to the WIPP in one of two Nuclear Regulatory Commission approved shipping packages. The 72B shipping package can hold three 55 gallon drums containing RH TRU waste inside a RH TRU waste disposal canister [3]. The 10-160B shipping package can hold ten 55 gallon drums containing RH TRU waste. [4].

SUMMARY OF THE 72B PROCESS (a detailed description of the process is provided in the RH PSAR, Section 4.3.2, 72-B Cask Waste Handling Process [5]**)**

Once the trailer carrying the shipping package is situated in the Waste Handling Building RH Bay, the shipping package is moved to the Cask Prep Station and then to the Cask Unloading Room. The shipping package is then lowered into the Transfer Cell and into the cask receiver in the Transfer Cell Shuttle Car. The Shuttle Car travels to a position beneath the Facility Cask Loading Room. The Facility Cask is positioned above the Transfer Cell Shuttle Car and the Facility Grapple is lowered through the Facility Cask and the inner lid of the shipping package is removed. The Facility Grapple engages the pintle on the RH TRU Waste Canister. The RH TRU Waste Canister is lifted from the shipping package into the Facility Cask. The Facility Cask Transfer Car transports the Facility Cask onto the waste hoist and the hoist conveys the Facility Cask Transfer Car (containing the Facility Cask which contains the RH TRU Waste Canister) to the underground. The RH TRU Waste Canister is emplaced horizontally in a borehole in the walls of a waste disposal panel.

SUMMARY OF THE 10-160B PROCESS (a detailed description of the process is provided in the RH PSAR, Section 4.3.3, 10-160B Cask Waste Handling Process [5]**)**

Once the trailer carrying the shipping package is situated in the Waste Handling Building RH Bay, the shipping package is moved to the Cask Unloading Room and positioned under the Hot Cell Floor Port. The Hot Cell floor shield plugs are removed using the 15- ton bridge crane. The Hot Cell Crane is lowered through the Hot Cell Port and the 10-160B shipping package lid is lifted up into the Hot Cell. The shipping package contains two 5-drum carriages. The Hot Cell Crane then lifts the top 5-drum carriage into the Hot Cell. Once the top 5-drum carriage is secured in the Hot Cell, the second 5-drum carriage is lifted through the Hot Cell Port into the Hot Cell.

Re-packaging of the RH TRU waste drums occurs in the Hot Cell. Individual 55-gallon drums are removed one at a time from the drum carriage and lowered into a Facility Canister. This process is repeated until three 55 gallon drums are placed in a Facility Canister. This is repeated until three facility canisters are loaded. Recall that the 10-160B shipping package can carry up to ten 55 gallon drums of RH TRU waste. One drum remains in the Hot Cell. After the receipt of three 10-160B shipping packages, the three extra drums (one extra drum per shipment) will be loaded into a Facility Canister.

The Transfer Cell Shuttle Car is positioned under the Hot Cell Shield Valve. The Hot Cell Crane lifts the loaded Facility Canister and lowers it into the shielded insert in the Shuttle Car. The Shuttle Car then moves to a position beneath the Facility Cask Loading Room. The Facility Cask is positioned above the Transfer Cell Shuttle Car and the Facility Grapple is lowered through the Facility Cask and engages the pintle on the RH Waste Canister. The Facility Canister is lifted from the shielded insert in the Shuttle Car into the Facility Cask. The Facility Cask Transfer Car transports the Facility Cask onto the waste hoist and the hoist conveys the Facility Cask Transfer Car (containing the Facility Cask which contains the RH Waste canister) to the underground. The Facility Canister is emplaced in a borehole.

ADDITIONAL STEPS IN THE RH TRU WASTE HANDLING WITH THE 10-160B SHIPPING PACKAGE

When a 72B Cask arrives at the WIPP, it already has a waste canister that has been direct loaded or contains three 55 gallon drums of TRU waste. The drums inside the canister are not removed or handled. That canister is disposed. If the operations with the 72B cask serve as a baseline, then operations associated with the 10-160B cask result in an incremental increase in the number of steps handing 55 gallon drums of RH TRU waste and an increase in the number of crane operations. Table I is a brief listing of these additional steps.

Table I Listing of Incremental Steps for 10-160B Cask

Listing of Incremental Steps for 10-160B Cask	
Activity	Additional Crane Operation
Lift Hot Cell Shield Plug	1
Lift Lid off 10-160B Cask	1
Lift Loaded Top 5-drum Carriage from 10-160B and Place in Hot Cell	1
Lift Loaded Bottom 5-drum Carriage from 10-160B and Place in Hot Cell	1
Lift 3 Drums, one at a time, and Place into Facility Canister	3
Place Lid on Facility Canister	1
Lift Facility Canister and Place into Shielded Insert in Shuttle Car	1
Lift 3 Drums, one at a time, and Place into Facility Canister	3
Place Lid on Facility Canister	1
Lift Facility Canister and Place into Shielded Insert in Shuttle Car	1
Lift 3 Drums, one at a time, and Place into Facility Canister	3
Place Lid on Facility Canister	1
Lift Facility Canister and Place into Shielded Insert in Shuttle Car	1
Lift 1 drum for storage	1
Lift Empty Bottom 5-drum carriage and place into 10-160B Cask	1
Lift Empty Top 5-drum carriage and place into 10-160B Cask	1
Replace Lid on 10-160B Cask	1
Replace Hot Cell Shield Plug	1
Total Additional Lifts	24

There are at least 24 crane lifts associated with unloading the 10-160B cask and operations in the Hot Cell. In the 24 crane lifts there are at least 11 additional movements of full waste drums, two movements of loaded 5-drum carriages and two movements of empty 5-drum carriages. The use of the 10- 160B cask patently increases crane operations and significantly contributes to the RH TRU waste “dance of the drums” (i.e., the frequent movement of Contact-Handled waste drums by forklift and crane is sometimes referred to as “the dance of the drums” to highlight the fact that the waste drums are frequently repositioned; this repositioning costs money, time and increases the risk of an incident).

HOISTING AND RIGGING ACCIDENTS

Hoisting and rigging incidents can be classified as due to human error or equipment failure. The Navy reports that human error caused the majority (90%-96%) of crane accidents during 1999 through 2002 [6] as shown in Table II.

Table II Navy Crane Incidents 1999-2002

Navy Crane Incidents				
Fiscal Year	1999	2000	2001	2002
Total Number of Incidents	305	251	184	179
Number due to equipment failure/percentage	12/4	13/5	18/10	18/10
Number due to human error/percentage	293/96	238/95	166/90	161/90

The staff of the NRC recently (July 2003) published NUREG-1774, *A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 through 2002* [7]. That report indicates that "poor program implementation was a major contributor to crane performance"… examples of poor program implementation include failure to perform surveillance tests, not following procedures, load path violations, and not obtaining necessary plant conditions prior to load movements." [7, p 7].

An earlier work by the Environmental Evaluation Group, *Probability of Failure of the TRUDOCK Crane System at the Waste Isolation Pilot Plant*, EEG-74 [8] which was prepared in 2000, estimated a lower human error rate than what was experienced by the Navy during the time period 1996, 1997, 1998. Table III shows the data for that time period. The majority (90% to 95%) of crane incidents as reported by the Navy 1996 through 1998 [6] are the result of human error as shown in Table III.

Table III Navy Crane Incidents 1996-1998

Navy Crane Incidents			
Fiscal Year	1996	1997	1998
Total Number of Incidents	154	167	196
Number due to equipment failure/percentage	7/4.6	16/9.6	11/5.6
Number due to human error/percentage	147/95.4	151/90.4	185/94.4

"The EEG Report (EEG-74) predicted a much lower human error rate (e.g., a 25 percent contribution) than is experienced in U.S. Navy reports or in the commercial U.S. nuclear power plant industry. The lower human error rate for the WIPP is attributed to greater training." [7, p 67] The Navy data (used in EEG-74), Table III above, show a relatively constant percentage of crane incidents caused by human error, greater than about 90% for 1996 through 1998.

In October 1996 the DOE Office of Oversight in the Office of Environment, Safety and Health produced a compelling special study of hoisting and rigging incidents within the Department of Energy [9]. The study covered the 30 month period from November 1993 until March 1996. "Inattention to detail, closely followed by deficiencies in work organization and planning, is the leading cause for crane accidents" [9, Executive Summary].

During August 2002 the WIPP Management and Operations (M&O) Contractor conducted a performance dry run (PDR) of the RH waste handling process [11]. Several areas of improvement were identified by the Team that evaluated the PDR. One such item was to "Limit duties of the crane operator: The Crane operators were observed doing multiple tasks and suggest limiting the duties only to crane operations." [11, p 15]. Thus, there is a strong awareness by the M&O Contractor that Crane Operators require completely focused attention on the task at hand, safety operating the crane.

July 2003 DOE AUDIT REPORT, OFFICE OF THE INSPECTOR GENERAL (IG), OFFICE OF AUDIT SERVICES [10]

This report, in part, suggests that if the 10-160B cask was used extensively, that shipments to the WIPP could be reduced 33% [10, p 4] and that there would be a cost saving of $7,921,966. Cost should not be the sole metric in evaluating the use of the 10-160B. Engineers know that economy of scale and economy of scope can lead to reduced dollar cost, generally in paper studies. A more reasonable assessment of the use of the 10-160B shipping container should consider the risk associated with the increased handling of waste drums and crane lifts at the WIPP.

CONCLUSIONS AND RECOMMENDATIONS

Compared with operations at the WIPP associated with a 72B shipping container, the use of a 10-160B shipping container results in at least 24 additional crane lifts, at least 11 additional movements of full waste drums, two movements of loaded 5-drum carriages and two movements of empty 5-drum carriages. Using a risk informed approach, it would seem reasonable to reduce or minimize the number of times a crane is operated and the number of times a drum of RH TRU waste is moved. Accordingly, it would seem reasonable, that before there is any planned increase in the use of the 10-160B cask, that the DOE complete a thorough cost and risk analysis of the planned increase.

REFERENCES

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3 "Certificate of Compliance No. 9212, rev. 2, RH-TRU 72-B," Docket No. 71-9212, Nuclear Regulatory Commission (2002 Dec).

4 "Certificate of Compliance No. 9204, rev. 8, CNS 10-160B," Docket No. 71-9204, Nuclear Regulatory Commission (2002 Oct).

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