Department of Energy
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MAR 31 1995

Mr. Mark Weidler
New Mexico Environment Department
Camino de Los Marquez #4
Post Office Box 26110
Santa Fe, New Mexico 87502

Dear Mr. Weidler:

For your information, I am enclosing the Waste Isolation Pilot Plant Remote-Handled Transuranic Waste Disposal Strategy, DOE/WIPP 95-1090. The Strategy has been prepared to describe the Department of Energy approach for the disposal of remote-handled transuranic waste at the Waste Isolation Plant (WIPP). The completion of this document also fulfills the WIPP Disposal Decision Plan Milestone entitled "Complete Remote-Handled Strategy". If you require further assistance, please contact Mark Matthews of my staff at (505) 234-7467.

Sincerely,

George E. Dials
Manager

Enclosure

950326

DOE/WIPP-95-1090

WASTE ISOLATION PILOT PLANT REMOTE-HANDLED TRANSURANIC WASTE DISPOSAL STRATEGY

MARCH 31, 1995

UNITED STATES DEPARTMENT OF ENERGY
CARLSBAD AREA OFFICE
CARLSBAD, NEW MEXICO

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EXECUTIVE SUMMARY

The remote-handled transuranic (RH-TRU) waste disposal strategy described in this report identifies the process for ensuring that cost-effective initial disposal of RH-TRU waste will begin in Fiscal Year 2002. The strategy also provides a long-term approach for ensuring the efficient and sustained disposal of RH-TRU waste during the operating life of WIPP. This two-part strategy relies on a technical baseline and a waste work-off plan for RH-TRU waste disposal.

Initial disposal will be achieved by evaluating alternatives to the current disposal technical baseline and by selecting cost- and schedule-effective ways to prepare waste for disposal in Fiscal Year 2002. Because Oak Ridge National Laboratory stores about 85 percent of the current inventory, the strategy is to assess the effectiveness of modifying their facilities to package waste, rather than constructing new facilities. In addition, the strategy involves identification of ways to prepare waste at other sites to supplement waste from Oak Ridge National Laboratory. DOE will also evaluate alternative packagings, modes of transportation, and waste emplacement configurations, and will select preferred alternatives to ensure initial disposal as scheduled.

The long-term strategy provides a systemwide planning approach that will allow sustained disposal of RH-TRU waste during the operating life of WIPP. The DOE's approach is to consider the three relevant systems -- the waste management system at the generator/storage sites, the transportation system, and the WIPP disposal system -- and to evaluate the system components individually and in aggregate against criteria for improving system performance.

Portions of the strategy have been implemented. However, to ensure full implementation, in Fiscal Years 1996 and 1997 DOE will (1) decide whether existing facilities at Oak Ridge National Laboratory or new facilities to package and certify waste are necessary; (2) select the optimal packaging and mode of transportation for initial disposal; and (3) select an optimal disposal configuration to ensure that the allowable limits of RH-TRU waste can be disposed. These decisions will be used to identify funding requirements for the three relevant systems and schedules for implementation to ensure that the goal of initial disposal is met.

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LIST OF ACRONYMS

ANL	Argonne National Laboratory
ANL-E	Argonne National Laboratory-East
ANL-W	Argonne National Laboratory-West
BIR	Baseline Inventory Report
C of C	Certificate of Compliance
CDR	Conceptual Design Report
CFR	Code of Federal Regulations
CH-TRU	Contact-handled transuranic waste
CP	Compliance Package
DOE	U.S. Department of Energy
ECP	Engineering Change Proposal
EPA	U.S. Environmental Protection Agency
INEL	Idaho National Engineering Laboratory
LANL	Los Alamos National Laboratory
NRC	U.S. Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
QAPjP	Quality Assurance Project Plan
RH-TRU	Remote-handled transuranic waste
SARP	Safety Analysis Report for Packaging
SRS	Savannah River Site
TA-54	LANL Waste Management Facility
TRU	Transuranic waste
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant

1.0 INTRODUCTION

The purpose of this document is to articulate the U.S. Department of Energy's (DOE) strategy for the disposal of remote-handled transuranic (RH-TRU) waste in the Waste Isolation Pilot Plant (WIPP). TRU waste is material contaminated with alpha-emitting radionuclides that are heavier than uranium with half-lives greater than 20 years and in concentrations greater than 100 nanocuries per gram. TRU waste is classified according to the radiation dose rate at the package surface. RH-TRU waste has a package surface radiation dose rate exceeding 200 millirem/hour (contact-handled [CH] waste is 200 millirem/hour or less). The WIPP Land Withdrawal Act of 1992 (LWA), Public Law 102-579, established certain RH-TRU waste-related limits stating that surface dose rates may not exceed 1,000 rem/hour, that no more than five percent by volume of the RH-TRU waste may have a surface dose rate that would exceed 100 rem/hour, that canisters may not exceed 23 curies/liter maximum activity (averaged over the volume of the canister), and that total activity in the repository may not exceed 5.1 million curies. The WIPP LWA also set the total capacity of WIPP to 175,600 cubic meters (6.2 million cubic feet) of TRU waste (both CH and RH). The *Agreement for Consultation and Cooperation* (DOE and State of New Mexico, 1987) limits the capacity of RH-TRU waste to 7,080 cubic meters (250,000 cubic feet).

The strategy for the disposal of RH-TRU waste must account for the waste management plans at the generator/storage sites, the packaging and transportation system,[1] and the facility and operational design of WIPP. The strategy must also objectively reconsider the disposal technical baseline in light of changes in the regulatory climate, current and projected RH-TRU waste inventory, funding limitations, and other issues. In addition, the strategy must be sufficiently flexible in the long term to be responsive to pending actions that could affect the entire DOE complex. These actions include future decisions to be rendered, for example, under the Programmatic Environmental Impact Statement for Waste Management and under Consent Agreements arising from compliance with the Federal Facility Compliance Act.

The objectives of the strategy are to:

- Provide an approach, based on the disposal technical baseline and initial waste work-off plan, that will ensure that initial disposal of RH-TRU waste will commence in Fiscal Year 2002; and
- Provide a long-term strategic approach to ensure efficient and sustained disposal during the operating life of WIPP.

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[1] Transportation system includes packaging and facilities to load packaging; emergency preparedness, training, and response; and modes of transportation.

This RH-TRU waste disposal strategy re-examines previous assumptions and understandings within the context of limitations established by the WIPP LWA, the *Agreement for Consultation and Cooperation* (DOE and State of New Mexico, 1987), and other relevant documents. This strategy only addresses RH-TRU waste that would be acceptable for disposal in WIPP; disposal strategies for the potential excess inventory will be addressed during the development of comprehensive disposal recommendations, as required by the WIPP LWA.

Section 2 of this document discusses the disposal technical baseline and the concept of a waste work-off plan as fundamental elements of the strategy. Section 3 presents the DOE's strategy for initial disposal. Section 4 discusses the strategy for sustained disposal, and Section 5 discusses implementation of the strategy. References are listed in Section 6, and Appendix A elaborates on the strategy for sustained disposal.

2.0 DISPOSAL TECHNICAL BASELINE AND WASTE WORK-OFF PLAN

The disposal technical baseline is a fundamental element of the strategy for disposal of RH-TRU waste. For purposes of this strategy document, the disposal technical baseline is defined as DOE's current, documented approach to the retrieval, characterization and certification,[2] storage, treatment, packaging, transportation, and disposal of RH-TRU waste. The disposal technical baseline presented in Section 2.1 encompasses three primary systems: the generator/storage site waste management system, the transportation system, and the WIPP disposal system.

A waste work-off plan will be developed that considers the available waste inventory and the disposal technical baseline. The waste work-off plan is defined as the waste disposal schedule during the operating life of WIPP, based on the selection of wastes within the disposal inventory. The inventory of TRU waste available for disposal in WIPP is presented in the *WIPP Transuranic Waste Baseline Inventory Report, Rev. 1* (DOE, 1995). An envelope of acceptable waste inventory will be identified and appropriate waste acceptance criteria (WAC) will be developed (DOE, 1994). It is possible that the outcome of DOE's compliance with the final disposal regulations (40 CFR Part 191) and their implementing criteria (40 CFR Part 194), the Land Disposal Restrictions (40 CFR Part 268), and the requirements for miscellaneous units of permitted treatment, storage, and disposal facilities (40 CFR Part 264) will affect the selection of specific RH-TRU wastes for disposal at WIPP.

2.1 Disposal Technical Baseline

The components of the disposal technical baseline are discussed in the following three subsections. The information presented in Section 2.1.1, Generator/Storage Site Waste Management System, is based upon discussions with personnel at the DOE generator/storage sites (Lippis, 1994). The information presented in Section 2.1.2, Transportation System, and Section 2.1.3, WIPP Disposal System, is summarized from various DOE documents.

2.1.1 Generator/Storage Site Waste Management System

The disposal technical baseline calls for the four primary generator/storage sites to maintain waste management facilities to retrieve, characterize and certify, store, treat, and package RH-TRU waste. As noted in Section 2.1.3, the disposal inventory must meet the current waste acceptance criteria, which may undergo further revision following performance assessment modeling and analysis and the regulatory compliance process.

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[2] The DOE is preparing an RH-TRU waste characterization requirements document. It is scheduled for completion in Fiscal Year 1996.

Each of the primary generator/storage sites is planning facilities to retrieve, characterize and certify, and treat for packaging to enable shipment to WIPP. At this time, however, only a relatively small volume of waste is expected to be available when disposal operations are initiated.

Oak Ridge National Laboratory

The largest volume of RH-TRU waste presently in storage is at the Oak Ridge National Laboratory (Table 1). Approximately 990 cubic meters (35,000 cubic feet), the bulk of all the RH-TRU waste in storage, is accounted for by two waste groups at Oak Ridge National Laboratory: heterogeneous solids and process residues. The *WIPP Transuranic Waste Baseline Inventory Report* (DOE, 1995) indicates that 383 cubic meters (13,500 cubic feet) of RH-TRU waste are retrievably stored in concrete casks. Heterogeneous solids consist of cloth, paper, glass, rubber, plastic, and metal packaged in 1-gallon metal paint cans overpacked and sealed into plastic buckets. Approximately 605 cubic meters (21,400 cubic feet) of process residues (TRU-contaminated liquids and sludges) are stored at Oak Ridge National Laboratory in underground storage tanks.

The current baseline for Oak Ridge National Laboratory is to develop plans to mobilize the sludges from the underground storage tanks and transfer the material to a TRU Processing Facility. There, sludges will be concentrated, solidified, and packaged in 55-gallon drums along with solid waste. These waste packages will then be certified for shipment to WIPP. A conceptual design of the TRU Processing Facility has been completed and operations are scheduled to start after 2015.

Hanford Site

Hanford Site presently stores a small amount of RH-TRU waste, but the projected total inventory of RH-TRU waste at Hanford Site is more than 3,000 cubic meters (106,000 cubic feet). Only 33 cubic meters (1,200 cubic feet) of RH-TRU waste are in storage (Table 1), but small volumes of RH-TRU-contaminated waste are known to exist in old caissons at Hanford Site. Additionally, contaminated equipment presently stored in the old processing canyons and tunnels or associated with the high-level waste tanks, pumps, and piping system may become RH-TRU waste when these facilities are decontaminated or dismantled.

The baseline approach to prepare Hanford Site waste for shipment to WIPP is to construct a facility to process RH-TRU waste. However, a study is underway to re-evaluate the overall site waste management requirements, which may change the projected waste management plan for Hanford Site. The study is expected to recommend activities for initial RH-TRU waste preparation and shipment to WIPP and the continued planning of a major system acquisition for a waste processing facility.

Table 1. Stored and Projected RH-TRU Waste at Generator/Storage Sites[a]

	STORED (m^3) (as of December 31, 1993)	PROJECTED (m^3) (1994 - 2022)
PRIMARY SITES		
Hanford Site[b]	33	3,000[c]
Idaho National Engineering Laboratory[d]	40	45
Los Alamos National Laboratory	91	83
Oak Ridge National Laboratory	990	360
OTHER SITES[e]	11	162
TOTAL	1,165	3,650

[a] DOE, 1995.

[b] Hanford Site totals include Argonne National Laboratory-East.

[c] An additional 42,888 m^3 of "suspect" mixed RH-TRU waste has been reported by Hanford Site in data submittals. However, insufficient information is available on the processes that would generate this waste. Additional information has been requested from Hanford Site for inclusion in future revisions to the *WIPP Transuranic Waste Baseline Inventory Report.*

[d] Idaho National Engineering Laboratory and Argonne National Laboratory-West are collocated in Idaho; the RH-TRU waste from both sites will be coordinated for shipment to WIPP.

[e] Other sites include Savannah River Site, Knolls Atomic Power Laboratory, Battelle Columbus Laboratory, Bettis Atomic Power Laboratory, and possibly other small-quantity sites.

Idaho National Engineering Laboratory

Idaho National Engineering Laboratory currently has 40 cubic meters (1,400 cubic feet) of RH-TRU waste in retrievable storage and is projected to generate about 45 cubic meters (1,600 cubic feet) (Table 1). Interim storage of RH-TRU waste was initiated at the Idaho National Engineering Laboratory in 1976 with the establishment of the Intermediate Level Transuranic Storage Facility located in the Radioactive Waste Management Complex. The

Intermediate Level Transuranic Storage Facility was established for retrievable storage of RH-TRU waste with radiation levels greater than 200 mrem/hr and less than 4,500 rem/hr (WIPP's maximum dose rate is 1,000 rem/hr).

Baseline activities that support scheduled disposal of RH-TRU waste include the development of process knowledge information and storage capability. A storage monitoring program to ensure container integrity and retrieval capability is being developed. A long-term storage assessment is also being performed to ensure that adequate storage capability exists at the Idaho National Engineering Laboratory.

Existing CH-TRU waste certification facilities are being assessed to determine if and to what extent the facilities can be modified for preparing and certifying RH-TRU waste for WIPP disposal. This information will be used to develop detailed plans for activities that will support WIPP disposal. In addition, a major system acquisition, the Idaho Waste Processing Facility, is planned to accomplish the necessary RH-TRU waste preparation to enable sustained disposal.

Los Alamos National Laboratory

About 91 cubic meters (3,200 cubic feet) of RH-TRU waste is in storage at Los Alamos National Laboratory. As shown on Table 1, an additional 83 cubic meters (2,900 cubic feet) will be newly generated.

To date, approximately 16 canisters of RH-TRU waste (about 16 cubic meters [560 cubic feet]) have been loaded and placed in storage at Los Alamos National Laboratory's waste management facility (TA-54). These canisters were packaged and characterized under earlier waste acceptance criteria and may need additional hazardous material characterization. An additional 75 cubic meters (2,600 cubic feet) of RH-TRU waste in storage at TA-54 will require retrieval, characterization, and packaging.

The current baseline calls for Los Alamos National Laboratory to use its hot cell facility (Wing 9) to prepare RH-TRU waste for shipment to WIPP. Preparation will include processing necessary to assure that the waste meets the waste acceptance criteria, and characterization to aid final package certification. Loading of shipping casks will also be accomplished at the Wing-9 hot cell facility.

Other RH-TRU Waste Sites

Several other small-quantity sites currently store or anticipate generation of RH-TRU waste (Table 1). The DOE will be developing plans to manage these small quantities of RH-TRU waste and will include the necessary activities in future waste management planning.

2.1.2 Transportation System

U.S. Nuclear Regulatory Commission (NRC) certified Type B packaging is required for the transport of RH-TRU waste. The packaging currently included in the baseline for the shipment of all WIPP-destined RH-TRU waste is the RH-72B shipping cask. The RH-72B cask has been designed to meet NRC Type B requirements; a final safety analysis report for packaging has been prepared; and DOE will apply to the NRC for a Certificate of Compliance for this cask.

The RH-72B shipping cask is a cylinder consisting of a separate inner vessel within an outer cask protected by impact limiters. Neither the inner vessel nor the outer cask is vented. The inner containment vessel will be made of stainless steel and provide a cavity for the payload canister. The outer cask will also be made of stainless steel constructed of two concentric shells enclosing a cast-lead shield. The cask is designed to accept one RH-TRU waste canister.

The RH-TRU shipping cask payload capacity (including canister) is 3,636 kilograms (8,000 pounds). The RH-TRU waste canister is a U.S. Department of Transportation 7A Type A carbon steel single-shell container. The canister is vented through a high-efficiency particulate air-grade filter.

The baseline calls for the transport of the RH-72B shipping cask by tractor-trailer. Although DOE has not yet selected the final mode of transportation (truck, commercial rail, dedicated rail, or combination), planning to date has focused on truck transport.

Tractors will be late model and will meet Federal Motor Carrier Safety Regulations, comply with DOE contractual agreements, and have special safety equipment (for example, radiation detection instruments). A contract for tractors meeting these requirements has been established.

The trailer will be designed to transport a single RH-72B shipping cask. Trunnions will be used to tie down the cask. The trailer will be designed to comply with U.S. Department of Transportation requirements, and the trunnion will be designed to comply with the applicable NRC requirements. The disposal technical baseline calls for sufficient RH-72B shipping casks and tractor-trailer combinations to accommodate RH-TRU waste disposal operations of about 350 canisters per year.

2.1.3 WIPP Disposal System

The waste disposal area of WIPP consists of eight panels, each of which contains seven rooms. Currently, a 25-year operating life is estimated to fill the waste disposal area with RH-TRU and CH-TRU waste. In addition to regulatory restrictions, the disposal of RH-TRU waste is limited by thermal and structural considerations of the facility and by physical considerations of equipment. For these reasons, the design disposal configuration for RH-

TRU waste calls for the drilling of boreholes on 8-foot centers into the walls of the rooms in advance of placement of CH-TRU waste.

In addition, the disposal inventory must meet waste acceptance criteria prior to transport and emplacement underground. The waste acceptance criteria establish limits for the physical, radiological, and chemical composition of the waste, as well as provide specifications for packaging waste. Although Revision 4 of the *TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (DOE, 1991) is part of the WIPP baseline, the waste acceptance criteria may change in response to the compliance process. These revised waste acceptance criteria will be used to ascertain the acceptable disposal inventory and will be comprised of the following:

- Facility safety and transportation system criteria that address transport and handling, and waste emplacement criteria that address the disposal process;
- Performance-based criteria as identified by performance assessment modeling and analysis; and
- Regulatory requirements resulting from the permitting process to operate and close WIPP.

The WIPP is capable of processing an average of 7,080 cubic meters (250,000 cubic feet) of CH-TRU waste and 283 cubic meters (10,000 cubic feet) of RH-TRU waste per year. In 1994, a computer simulation concluded that CH-TRU waste could be processed at an average rate of 7,065 cubic meters (249,000 cubic feet) per year, given the existing equipment configuration and assuming two shifts per day operating on a 5-day work week (Westinghouse Waste Isolation Division, 1994). As yet, no similar computer simulations have been performed for RH-TRU waste.

Disposal operations have three components at WIPP: aboveground operations, transfer into the underground, and underground operations. Aboveground, the RH-TRU waste operations area is located in the east half of the Waste Handling Building. This area includes structures and equipment for unloading shielded RH-TRU waste shipping casks and transferring the waste to a shielded facility cask via the hot cell. RH-TRU waste will arrive at WIPP in a shielded shipping cask, which will contain a single waste canister (see Section 2.1.2 for detail). The transport vehicle will be moved into the RH-TRU waste bay of the Waste Handling Building. The impact limiter collars will be removed, and the cask upended and placed in a vertical position on the shipping cask transfer car. The outer lid of the cask will then be removed and the cask moved into the shielded cask unloading room.

In preparation for transfer into the underground, the waste canister will be removed from the shipping cask and processed through the hot cell, where the canister will be inspected and overpacked, if necessary. The canister will then be transferred into the canister shuttle car, lifted into the shielded facility cask, and enclosed. The facility cask will be rotated to a

horizontal position, moved by the transfer car to the waste shaft elevator, and lowered to the underground.

Once underground, the facility cask will be placed on the waste transfer machine assembly for emplacement into a horizontal borehole. After the canister has been emplaced in the borehole, a shield plug will be inserted into the borehole.

2.2 Waste Work-off Plan

The WIPP waste work-off plan will be developed from the disposal technical baseline and the WIPP disposal inventory. Table 1 in Section 2.1 presents a summary of the RH-TRU waste inventory. The waste work-off plan is defined as the transuranic waste disposal schedule during the operating life of WIPP, based on the selection of wastes within the disposal inventory that will meet the final waste acceptance criteria. The waste work-off plan is intended to be a dynamic plan, designed to reflect the availability, operational status, and efficiencies of all components of the transuranic waste management system. Thus, at any time, the waste work-off plan will represent DOE's understanding of:

- The status of waste management facilities at the generator/storage sites, including the construction, operational, and planning status of waste characterization and certification facilities, treatment facilities for waste packaging, and storage facility capacity;

- The volume of waste that has been certified to the waste acceptance criteria, packaged, and is ready to be loaded into shipping casks for shipment to WIPP;

- The volume of projected waste that will be prepared for certification and shipment to WIPP;

- The current status of the transportation system. This status includes the construction and availability of shipping casks and the transportation fleet, operational status of the communication and tracking system, status of transport vehicles, and status of the WIPP facilities and capability to unload shipping casks; and

- The current status of WIPP disposal operations. In this context, disposal operations consider both CH and RH waste (because RH-TRU waste is emplaced prior to CH-TRU waste) and include the status and availability of waste-handling equipment and facilities, the available workforce, and the status and availability of disposal equipment and facilities.

The waste work-off plan, like the disposal technical baseline, is a fundamental element in the strategy for disposal. The first RH-TRU waste work-off plan will be developed in Fiscal Year 1998. In preparation for disposal operations, DOE has developed a strategy for initial disposal of RH-TRU waste (Section 3) that will be used as one means to validate the feasibility and usefulness of the work-off plan.

3.0 STRATEGY FOR INITIAL DISPOSAL

The DOE's goal is to achieve initial disposal of RH-TRU waste in Fiscal Year 2002. The DOE's strategy to achieve this goal is to evaluate alternatives to the current disposal technical baseline with the intent of selecting cost- and schedule-effective ways to ensure that waste is available for initial disposal. More specifically, the strategy for initial disposal is to (1) focus on Oak Ridge National Laboratory as the largest storer of waste, assessing whether it would be cost- and schedule-effective to modify its facilities to package waste for initial disposal, in lieu of constructing new facilities; (2) identify cost- and schedule-effective ways to package waste at other sites to ensure availability of sufficient waste by 2002; (3) evaluate alternative packagings and modes of transportation, and select the preferred means to transport waste; and (4) assess alternative underground waste disposal configurations and select a preferred configuration that assures the repository will accommodate the allowable waste volume.

The following subsections describe the existing facilities evaluation at Oak Ridge National Laboratory and planning for shipment from Los Alamos National Laboratory and Idaho National Engineering Laboratory, the plans for the transportation system and the alternative packaging evaluation, and the plans for the WIPP disposal system and the alternative disposal configuration assessment. The schedule to implement DOE's strategy for initial disposal is shown on Figure 1.

3.1 Waste Management Systems at the Generator/Storage Sites

The DOE's strategy for initial disposal will focus on Oak Ridge National Laboratory in Oak Ridge, Tennessee, because it stores about 85 percent of all RH-TRU waste (Table 1 in Section 2.1). Preliminary analysis indicates that modified existing facilities at Oak Ridge National Laboratory will be sufficient to certify and load waste for initial disposal. Although initial disposal is planned to focus on waste removal from Oak Ridge National Laboratory, DOE recognizes that a limited amount of waste from other sites, such as Los Alamos National Laboratory, can be available to ensure that the goal of initial disposal is achieved.

The current baseline calls for the development of a new TRU waste Processing Facility at Oak Ridge National Laboratory. However, since the facility would not become operational until after 2015, a study was initiated at Oak Ridge National Laboratory to evaluate the cost, schedule, and feasibility of using existing facilities to provide the required treatment capability for solid RH-TRU waste and tank liquids and sludges. A preliminary analysis concluded that existing facilities, if modified, could potentially treat waste but that additional storage capacity would be needed.

Given the potential to use existing facilities, DOE's approach is to continue the study to better define specific project scope and potential cost differences. The study will identify the