Department of Energy

Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831—

September 30, 1996

Mr. Michael Toquer
U. S. Nuclear Regulatory Commission
Division of Fuels Cycles, Safety, and Safeguards
Office of Nuclear Materials MS-T8A33
Washington, D.C. 20555

Dear Mr. Toquer:

ADDITIONAL SCOPE FOR THE TRANSURANIC WASTE PRIVITIZATION PROJECT IN OAK RIDGE, TENNESSEE

The purpose of this letter is to provide you and your staff with further information on the additional scope for the Transuranic (TRU) Waste Privitization Project not originally included in the proposal. As discussed with you on September 25, 1996, we have included a draft map of the proposed treatment site, a summary of the TRU isotope content for all sludges, and a draft revised Statement of Work, which now includes the TRU solids.

The Department of Energy, under new Environmental Management leadership, has developed a plan to treat all waste streams in the next decade. The most safe and efficient solution to treat all the TRU solid waste in Oak Ridge is to include this scope in the existing Invitation for Bid. I hope this provides some of the initial information necessary at this time. I would like to travel to Washington and visit you and your management staff at the earliest convience to further discuss the details of this project.

If you have any questions or comments, please call me at (423) 241-3498.

Sincerely,

Gary L. Riner

Gary L. Riner, Program Manager
TRU Waste Program

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SECTION B - SUPPLIES OR SERVICES AND PRICES/COSTS

B-1. **ORO B01 Items Being Acquired (APR 1984)**

The Contractor shall furnish all personnel, facilities, equipment, material, supplies, and services (except as may be expressly set forth in this contract as furnished by the Government) and otherwise do all things necessary for, or incident to, the performance and providing the following items of work:

Item 1 -- Removal, Treatment, Containerization, and Disposal Certification of Remote Handled Transuranic Sludge and characterization, re-packaging, and disposal certification of RH and CH solids at the Oak Ridge National Laboratory.

Item 2 -- Reports in accordance with "Reporting Requirements Checklist" Form DOE F 1332.1 and the clause entitled "Uniform Reporting System."

B-2. **ORO B60 Price (Alternate 2) (MAY 1990)**

In consideration of the performance under this contract, the Contractor shall be paid the consideration identified below; which consideration shall constitute complete payment for all services and materials furnished and accepted pursuant to the statement of work and reporting requirements checklist.

Fixed and Fixed Unit Price Amounts:	Unit Cost	Extended Cost
1. Phase I, Licensing and Permitting		
a. RCRA Part B (as necessary)		$______
b. NRC license		$______
c. CAA Permit (as necessary)		$______
d. NPDES (as necessary)		$______
Total Phase I		$______
2. Phase II, Design, Construction, and Operational Testing		$______
3. Phase III, Removal and Treatment Operations (Volume of Untreated Waste)		
a. Sludge		
- Guaranteed minimum of 700 Cubic Meters		$______
- For Any Additional Quantities	$______/m3	
b. RH Solids		
- Guaranteed minimum of 150 Cubic Meters		$______
- F any additional quantities	$______/m3	
c. CH Solids		
- Guaranteed minimum of 907 cubic meters		$______
- For any additional quantities	$______/m3	
d. Supernate		
- Guaranteed minimum of___ cubic meters		$______
- For any additional quantities	$______/m3	
Phase IV Decontamination and Decommissioning		$______
Total Contract		$______

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PROPOSED ALTERNATE DELIVER SCHEDULE
(See clause F.1 Time of Deliver)

Fixed and Fixed Unit Price Amounts:	Unit Cost	Extended Cost
1. Phase I, Licensing and permitting		
a.		$_____
b.		$_____
c.		$_____
d.		$_____
Total Phase I		$_____
2. Phase II, Design, Construction, and Operational Testing		$_____
3. Phase III, Removal and Treatment Operations (Volume of Untreated Waste)		
a. Sludge		
- Guaranteed minimum of 700 cubic meters		$_____
- For any additional quantities	$_____/$m^3$	
b. RH Solids		
- Guaranteed minimum of 150 cubic meters		$_____
- For any additional quantities	$_____/$m^3$	
c. CH Solids		
- Guaranteed minimum of 907 cubic meters		$_____
- For any additional quantities	$_____/$m^3$	
d. Supernate		
- Guaranteed minimum of _____ cubic meters		$_____
- For any additional quantities	$_____/$m^3$	
Phase IV Decontamination and Decommissioning		$_____
Total Contract		$_____

The amount shown above for Phase II will not be reimbursed as a separate line item under this contract but will be recovered as part of the per cubic meter price shown for Phase III. The amount for Phase II is stated above to assure that adequate funds are available to allow the contractor to proceed with Phase II effort.

Total funds not to exceed $20M for Phase I are obligated herewith and are available for payment. The Contractor will not proceed to subsequent phases until DOE has given a notice to proceed and has modified this clause indicating that adequate funds are available to pay for performance of the next phase.

The contractor will be held accountable for determining the final waste volume of the treated 700 M^3 of sludge. A penalty of $________ per M^3 will be assessed against the contractor for final volumes that exceed this quantity.

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SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

C-1. ORO C01 Statement Of Work (APR 1984)

TREATMENT OF TRANSURANIC WASTE AT THE OAK RIDGE NATIONAL LABORATORY

TABLE OF CONTENTS

1. INTRODUCTION

This statement of work (SOW) defines the scope of actions for the disposal certification of:

1. a minimum of 700 m^3 transuranic sludges and _________ m^3 of low-level liquid supernate located in the Melton Valley Storage Tanks

2. a minimum of 150 m^3 of Remote Handled (RH) Transuranic Solids to be delivered to the contractors treatment facility

3. a minimum of 900 m^3 of Contact Handled (CH) Transuranic Solids to be delivered to the contractors treatment facility

The treatment process shall treat the waste to meet Resource Conservation and Recovery Act (RCRA) land disposal restrictions (LDRs) and the U.S. Department of Energy's (DOE) Waste Isolation Pilot Plant (WIPP) waste acceptance criteria[1] (WAC) or the DOE Nevada Test Site (NTS) WAC[2].

DOE intends to lease to the contractor the Melton Valley tanks (MVSTs) and an adjacent area for construction of the treatment facility. The DOE will provide the contractor control over the Melton Valley storage tanks and treatment area during the construction, removal, treatment, and decontamination and decommission. The DOE has designated an area for the construction of the treatment facility. This area was the location of the now cancelled Waste Handling Pilot Plan (WHPP). The area was characterized and investigated as part of the proposed WHPP, thus minimizing the siting cost for the treatment unit[3]. The DOE will provide existing plant utilities (electrical and potable water) to the boundary of the designated treatment area for tie-in by the contractor. A description of the existing utilities currently located at the treatment area and the cost for the utilities are provided in the Reading Room reference documents. In addition, access to the tanks and designated treatment area from Tennessee State Highway 95 will be provided. The roadway from Highway 95 will be modified to accommodate forty-foot trailers having a gross weight of up to 80,000 pounds. Security at the Highway 95 access will be the responsibility of the contractor. The tanks, treatment area, and access road will be separated by fence from the ORNL reservation to allow independent access by the contractor.

The contractor will be responsible for making all emergency response arrangements as required by permits or licenses and coordinating with ORNL any emergency situation which may affect the contractor or ORNL personnel.

The contractor will be responsible for obtaining all regulatory permits and licenses required to construct and operate the treatment facility. The contractor will be responsible for interfacing with the final disposal site personnel to ensure certification of the final waste form. The contractor will be responsible for obtaining certified disposal containers and loading these containers into an approved shipping container (i.e., TruPact II, 72B Cask, etc.) and onto the transport vehicle.

If the disposal site is the WIPP, DOE will assume responsibility of the certified final waste once loaded onto the transport vehicle. If the disposal site is Nevada or any other site selected by the contractor, the contractor will be responsible for the transportation and associated cost and the disposal cost. DOE will assume responsibility of the final waste upon signing the receipt paperwork at the disposal site.

The maximum number of available shipments to WIPP beginning October 1, 2002 is 10 RH shipments per week containing an RH cask. Beginning ________________ ____________ CH shipments to WIPP will be available.

A. MVST Sludges and Supernate

There is approximately 700 cubic meters (m^3) of TRU waste sludge contained in the low-level liquid waste system at ORNL. The sludge is contained in eight stainless-steel tanks located in two below grade concrete vaults at Melton Valley. There are four tanks in each vault. Each tank is 60 feet long and 12 feet in diameter and contains a variety of piping entering the tank from the top and internal piping running parallel to the bottom of the tank. Detailed vault, valve, and piping diagrams are provided in the engineering drawings[4]. Two separate ventilation systems have been installed by DOE to provide a negative pressure within each of the eight tanks and vaults. This ventilation system minimizes the potential for release of radionuclides from the tanks. Each system has a pre-filter and HEPA for particulate removal. The ventilation ducting is above the vault system and manufactured of 304-L stainless steel. The contractor will be responsible for the routine inspection and replacement of the ventilation system filters. No modifications shall be made to the vault, tanks, piping, and ventilation system without approval by the DOE. If a modification is requested, the contractor shall submit to the government a written description of the proposed vault, tank, or ventilation system modification for review and approval. The government may request additional information, approve, or deny the request within 30 calendar days. If additional information is requested the government will approve or deny within 30 calendar days after receipt. If the proposed modification is denied by the government, resolution will be achieved under its Section 52.233-1 Disputes. If the proposed modifications are acceptable, the government, will inform the contractor in writing. Detailed drawings and operational procedures are provided in the engineering drawings[5].

The typical Melton Valley waste sludge profile contains a bottom layer of waste sludge approximately 4 feet deep with depth ranges from 19 inches to about 68 inches[6].

The waste sludge is classified as TRU because it is contaminated with alpha emitting radionuclides with an atomic number greater than 92 and half-lives greater than 20 years in concentrations greater than 100 nanocuries per gram.

The TRU waste sludge has a dose rate greater than 200 mrem/hr at the waste container surface requiring it to be remote-handled (RH). The waste sludge dose rate ranges are expected to be 1.0B2.8 R/h per 250 mL sample for the wet waste sludge and #50 R/h per gram (subsample) for the dry sludge. However, the waste sludge is not expected to be homogeneous and may contain higher dose rates within specific areas of a tank. The curie content totals approximately 135,000 Ci, with the TRU species expected to be present only in the waste sludge. The most current and best available characterization data report is provided, but the data may not be totally representative of all the waste sludge in the tanks[6].

The waste sludge is in the alkaline regime with pH ranges of approximately 12 to 13.5. The waste sludge contains some heavy metals listed under RCRA as hazardous, including cadmium, chromium, lead, and mercury; however, a toxicity characteristic leaching procedure (TCLP) has not been performed on the sludge[6]. Neither the sludge or the supernate contain RCRA "listed" hazardous waste. Since the MVSTs are part of the ORNL low-level wastewater system, they are presently excluded from RCRA

permitting under the ORNL Permit by Rule application[7].

An aqueous top layer of supernate covers the waste sludge in each tank. The typical tank contains a supernate layer of approximately 6.5 feet deep. The supernate dose rate ranges are expected to be from 0.1 - 0.5 R/h per 250 mL sample[6]. Based on the most recent analysis, the supernate does not meet the definition of a transuranic waste and is considered to be low-level waste. The pH of the supernate ranges from approximately 7.0 to 13.1 and contains heavy metals in the low-parts per million range[6]. As with the waste sludge, the supernates are heterogenous and the most current characterization data may not be totally representative of the supernate in the eight tanks.

Gamma-radiation readings in the pipe tunnel range from 75 mR/hr to 5 R/hr and smear samples indicated beta readings ranged from 4 mR to 400,000 mR. All smear samples read less than 20 dpm for alpha. These levels are based on the most current readings and may not reflect existing radiation levels in the pipe tunnel[8]. Limited radiation surveys in tanks W-23, W-25, W-30, and W-31 vaults have been performed and show gamma-radiation readings at the top of the vault shield plug at approximately 100 mR/hr and approximately 2 R/hr at the top of the tank[8].

B. RH and CH TRU Solids

The contractor will remove the RH and CH TRU solids from their current containers, characterize, treat to meet the LDR's and the WIPP or NTS WAC. The contractor has the option of sorting the solids and removing the material which causes the waste to meet the definition of RCRA hazardous. This material can be treated to meet the LDR's separately from other non-RCRA solids. The contractor will then repackage into DOT approved containers. In addition to meeting the LDR's and WIPP or NTS WAC, the contractor will be required to reduce the volume of the solids by at least 50 percent through consolidation, repackaging, compaction, or other method chosen by the contractor. The DOE will be responsible for removal of the RH casks and CH drums/boxes from their existing storage areas and delivery to the contractors treatment facility. DOE will deliver to the contractrs facility _______ (specify rate) of RH casks, _______ CH drums, and _____ CH boxes. The contractor has the option of constructing a separate processing facility for the solids or a combined process for both the sludge and solids. The solids processing facility is to be in the same leased area as the sludge treatment facility.

Presently, the DOE has approximately 150 m^3 of retrievable RH TRU solids in containers within concrete casks. The solid waste is a heterogeneous mixture primarily consisting of glass, plastic, tubing, filters, pumps, protective clothing, metal cans/drums, glove boxes, cloth and other miscellaneous items such as wood, carbon, cloth wipes, and sample bottles. Other items associated with glove box operations, laboratory operations, hot cell clean-up operations, equipment repair and maintenance, sources, and radiochemical processing for isotope separation and purification are expected to be present[9]. The RH solids have not been adequately characterized for chemical and radiological constituents to determine if they are hazardous or non-hazardous and transuranic or low level.

The RH solids are stored in cylindrical concrete casks, 55-gallon stainless steel drums, and one box. There are three types of casks (Type 3, 4, and 5) used to store RH solids, each with varying wall thickness for radiation shielding. The outer dimensions of all three casks are 7.5 feet high by 4.5 feet in diameter[9, 10].

Dose rates on the exterior of the containers are expected to range from 1 to 3500 mrem per hour but higher readings may exist[9]. DOE expects that some of the RH solids may now be CH due to the storage period of the short-lived gamma and neutron-emitting radioisotopes. Radioisotopes that have been identified in the RH solids are Plutonium-239, Plutonium-240, Americium-241, Californium-252, Curium-244, Uranium-233, and unidentified radioisotopes. Fission products such as Rubidium-106, Strontium-90, Antimony-125, Europium-154, Europium-155, Cesium-134, and Cesium-137 are also expected to be present.[9]

The DOE expects the RH solids may contain small amounts of hazardous material such as mercury (primarily from light bulbs, thermometers and other lab waste, lead (primarily as shielding) and oil/solvents (i.e., cleaning rags).

Presently, the DOE has approximately 907 m^3 of retrievable CH TRU solids at ORNL stored in 55-gallon drums (3,434) and Type 15 boxes (59)[10]. The CH solids are a heterogeneous mixture containing a mixture of paper/cloth debris, glass debris, metal debris, plastic, rubber, electronic equipment, unknown liquids, and unknown solids. Other items associated with glove box operations, laboratory operations, hot cell clean-up operations, equipment repair and maintenance, sources, and radiochemical processing for isotope separation and purification are expected to be present[9]. As with the RH solids, the CH solids wastes have not been characterized for chemical and radiological constituents to determine if they are hazardous or non-hazardous and transuranic or low-level.

There are approximately _____ of _____ drums identified by the Waste Evaluation and Assay Facility (WEAF) as containing liquids, of which, _____ (___ with liquids) contain material which may make the waste meet the RCRA definition of hazardous[9]. The potential hazardous material was identified using generator records or real time radiographic analysis. The material identified which may make the waste RCRA hazardous are lead, mercury, compressed gas cylinders, and aerosol cans[9].

Radioisotopes that have been identified in the CH solids are Actinium-227, Americium-241, Americium-243, Berkelium-249, Californium-249, Californium-252, Curium-240, Curium-242, Curium-244, Curium-245, Curium-248, Cobalt-60, Cesium-137, Einsteinium-254, Iodine-131, Iron-59, Neptunium-237, Nickel-63, Plutonium-238, Plutonium-239, Plutonium-240, Plutonium-241, Plutonium-242, Protactinium-231, Promethium-147, Radium-223, Rubidium-106, Strontium-90, Technetium-99, Thorium-230, Thorium-232, Uranium-232, Uranium-233, Uranium-234, Uranium-235, Uranium-236, Uranium-238, Yttrium-90, and Zinc-65[10].

The applicable laws, codes, and regulations that may be associated with this project include, but are not limited to, National Fire Protection Association (NFPA), Superfund Amendments and Reauthorization Act (SARA), Toxic Substance Control Act (TSCA), Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), Clean Air Act (CAA), Occupational Safety and Health Act (OSHA), Federal Hazardous Materials Transportation Act (FHMTA), and Nuclear Regulatory Commission (NRC). At a minimum, the DOE anticipates the contractor will have to obtain permits and/or licenses from the Tennessee Department of Environment and Conservation (TDEC), the Environmental Protection Agency (EPA), and Nuclear Regulatory Commission (NRC).

The closure and decommissioning and decontamination plans submitted to the regulatory agencies by the contractor for licenses and/or permits shall include the removal from the site all equipment and structures erected by the contractor. Upon completion of the project, the contractor will perform the closure and decommissioning and decontamination and removal from the site all treatment equipment as specified in their license and/or permit.

The contractor is responsible for secondary waste disposal, additional laboratory analyses, and radiological monitoring. The ORNL has a program for providing these services for a fee and can be contacted to determine the available services and associated costs.

2. DESCRIPTION OF SERVICES

A description of services to be provided consist of the following three phases.

Phase I - The contractor shall obtain all applicable state and federal permits and licenses required to remove the waste sludge from the MVSTs, construct the treatment facility(s) for the sludge and solids, and treat the waste. If required by the regulatory agency(ies), the DOE will co-sign the license and/or permit applications. The contractor shall inform the DOE if waste sludge samples are needed for characterization or testing, under this phase. The DOE will provide up to 5 gallons of the waste sludge to the contractor for characterization or testing.

The contractor will be responsible for all interfacing with the WIPP or NTS during this phase, including but not limited to documentation, quality assurance plans, audits, characterization, and final waste form certification to ensure the waste meets the disposal facility WAC.

Phase II - This phase is considered the site preparation, construction, and pre-operational portion of the project. During this phase, the contractor shall:

$ Sign lease agreement for transfer of MVSTs and treatment facility area from DOE to the contractor.
$ Complete final design of the treatment facility.
$ Mobilize to the site.
$ Provide all materials, labor, and additional utilities for site preparation and construction of the treatment facility.
$ Meet all applicable local, state, and federal codes and standards.
$ Perform sludge sampling, pre-operational system testing, or other operational demonstration as required by applicable permits or licenses.
$ Continue interface with the WIPP or NTS for final waste form certification.

Phase III - This phase is considered the treatment portion of the project. During this phase the contractor shall:

$ Perform pre-treatment sampling and characterization of the sludge, as needed.
$ Measure volume of waste sludge and supernate in each of the eight Melton Valley storage tanks to develop a baseline volume.
$ Remove the sludge from each of the eight Melton Valley storage tanks.
$ Continue routine preventative maintenance and operation of all government furnished property in accordance with current procedures.
$ Transfer the waste from the storage tanks to the contractors treatment unit.
$ Continue interface with WIPP or NTS to ensure final waste certification.
$ Treat the waste to meet the RCRA LDR's and WIPP or NTS WAC (current revisions).
$ Procure WAC-approved containers.
$ Containerize and obtain final waste form certification from WIPP or NTS.
$ Perform closure per the RCRA permit of all the contractors equipment and material or government equipment and material contaminated by the contractor during the treatment process except the existing tanks and ventilation system.
$ Remove, treat, and dispose the supernate from each of the 8 tanks.
$ Dispose all secondary waste generated during the project.
$ Remove all waste sludge or other contaminated material that may have

spilled during the project.

Contractor shall be responsible for clean-up and complete remediation of any impacted media.

$ Remove all waste sludge removal and treatment equipment including structures erected by the contractor and all other contractor materials and equipment associated with the project from the site.

If the contractor has to leave the treatment area and enter ORNL, the DOE will perform radiological screening on the contractor's personnel, material, and equipment that will be entering. The DOE will also monitor the radiation dose rates at the boundary of the treatment area. Unless specifically included in the contractors NRC license, the dose rate at the contractor area boundaries shall not exceed those specific in 10 CFR 835.

Additional information not specifically referenced in this SOW is listed in Appendix C and can be reviewed at the DOE reading room.

3. SCHEDULE

The contractor shall follow the schedule in Clause F.1 Time of Delivery. This schedule allows the DOE to comply with the Oak Ridge Federal Facility Compliance Agreement (FFCA)/Consent Order (CO)[11]. A copy of the FFCA/CO is available in the DOE Reading Room.

4. DELIVERABLES

The contractor shall submit to DOE two hard copies of each deliverable and one 3.5-inch, computer diskette containing the deliverable in the MicroSoft™ Word program. The deliverables marked with an "*" are for DOE's information only, no DOE approval will be given.

Phase I	Schedule
Permitting plan*	As updated
Project management plan*	As updated
Copies of permit and license applications and related correspondence*	As specified in permitting plan
Preliminary design report*	As specified in management plan
Copies of issued permits and licenses*	Upon issuance

Phase II	Schedule
Final design report*	As complete
Systems operational testing report*	As complete
Final safety analysis report*	As complete
Readiness to operate report*	As complete
ES&H plan*	As complete

Phase III	Schedule
Waste sludge and supernate volumes	As determined for each tank
Waste form certification	No later than June 30, 2001
RCRA closure certification*	As required in RCRA permit
D&D certification*	No greater than 4 years after completion of treatment

5. REFERENCES

1. *Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria*, January 1996 DOE/WIPP-069 Revision 5 Draft C. (Reading Room Document Number 2.1)

2. *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements*, NCO-325 (Rev. 1) June 1992, USDOE. (Reading Room Document Number 10.1)

3. Waste Handling Pilot Plant and Melton Valley Storage Tank Site Information. (Reading Room Document Number 8.1)

4. ORNL Liquid Low-Level Waste System Information for the Melton Valley Storage Tanks and Associated Piping. (Reading Room Document Number (3.1)

5. Melton Valley Ventilation System Drawings (Reading Room Document Number 8.1) and Operations Procedures. (Reading Room Document Number 7.2)

6. M. B. Sears, et al., "*Sampling and Analysis of Radioactive Liquid Wastes and Sludges in the Melton Valley and Evaporator Facility Storage Tanks at ORNL*," ORNL/TM-11652, September 1991. (Reading Room Document Numbers 4.1 and 11.1)

7. Resource Conservation and Recovery Act Permit by Rule Application, ORNL/M-5033, March 1991 (Reading Room Document Number 20.6)

8. Radiological Survey of at the Melton Valley Tanks Pipe Tunnel. (Reading Room Document Number 24.0)

9. *Feasibility Study for Processing ORNL Transuranic Waste in Existing and Modified Facilities*, ORNL/M-4692 Volumes I-V September 15, 1995 (Reading Room Document Number 1.1)

10. ORNL TRU Waste Summary Report, October 1996 (Reading Room Document Number ___)

11. State of Tennessee, Department of Environment and Conservation, Division of Solid Waste Management, Commissioner's Order, Case 95-0514, September 26, 1995. (Reading Room Document Numbers 20.1 and 20.2) and Federal Facility Agreement for the Oak Ridge Reservation, January 1, 1992 (Reading Room Document Number 20.3)

APPENDIX A

ACRONYMS

CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CWA	Clean Water Act
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
ES&H	environmental safety and health
FFCA/CO	Federal Facilities Compliance Act/Consent Order
FHMTA	Federal Hazardous Materials Transportation Act
HEPA	High Efficiency Particle Air
LDR	Land disposal restrictions
NEPA	National Fire Prevention Association
NEPA	National Environmental Policy Act of 1969
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Act
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act of 1986
SOW	statement of work
TDEC	Tennessee Department of Environment and Conservation.
TRU	transuranic
TSCA	Toxic Substances Control Act
WAC	waste acceptance criteria
WHPP	Waste Handling Pilot Plan
WIPP	Waste Isolation Pilot Plant

APPENDIX B

DEFINITIONS

Characterization: All measurements that must be made on a waste material, waste treatment product or process treatment intermediate to insure that it meets transportation, treatment, and final waste certification. Examples of tests include, but are not limited to, under characterization are: radioactive materials assay, chemical characterization for elemental composition, oxidative or reductive potential, reactivity, leachability, and physical characterization such as hardness, bulk density, and particle size.

Decommissioning: The actions taken, as required by permits, licenses, and regulations, to reduce the potential health and safety impacts of contaminated facilities and includes activities to remove radioactive materials or to demolish the facilities.

Decontamination: The removal of radioactive contamination from all facilities and equipment by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques as required to meet license, permit, or regulatory release criteria.

Environmental, Safety and Health Plan: Written document that describes all procedures to be followed to ensure the health and safety of project personnel and visitors.

Hazardous Waste: Those wastes that are designated hazardous by EPA regulations.

Low-Level Waste (LLW): Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent fuel or 11e(2) byproduct material. Test specimens of fissionable material irradiated only for research and development, and not for the production of power or plutonium, may be classified as low-level waste provided the concentration of transuranic is less than one hundred nCi/g of waste.

Mixed Waste: Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act.

nCi/g: For waste product destined for WIPP, this term refers to the total curies per gram of TRU
material of the waste. Nano (n) stands for 1 H 10^{-9}.

Package: The packaging, with its radioactive contents, as presented for transport (10 CFR 71.4, 49 CFR 173.403).

Packaging: The assembly of components necessary to ensure compliance with packaging requirements of 49 CFR Subpart 1. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shock. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging (10 CFR 71.4, 49 CFR 173.403).

Pricing Quantity: The approximately 700 m^3 of waste described in *Sampling and Analysis of Liquid Waste and Sludge in the Melton Valley and Evaporator Facility Storage Tanks at ORNL* (ORNL/TM-11652, September 1990).

Primary Waste Treatment Product: That product which is produced from the contractors treatment of TRU waste that is the key high volume generated during processing.

Readiness to Operate Report: Written document describing the results of the engineering evaluation and system operation testing.

Remote Handled Transuranic Waste: Packaged waste whose external dose rate exceeds 200 mrem per hour.

Safety Analysis Report: Written document that details the safety review performed on the treatment system and the results of the review.

Secondary Waste: Wastes which are generated as a result of waste removal or treatment, maintenance operations, equipment changeout that may be contaminated but do not contain bulk quantities of the treated waste product. This includes additional aqueous liquid that may be generated during the removal or treatment process.

Systems Operational (SO) Testing: Testing conducted of the entire treatment system, including all characterization, pretreatment segregation and sizing, and all treatment system components to include the final product analysis and waste product certification.

Transuranic Mixed Waste (TRUMW): Waste containing a mixture of radioactive and hazardous constituents as defined in the Atomic Energy Act and the Resource Conservation and Recovery Act respectively, with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than or equal to 100 nCi/g of waste at the time of assay.

Transuranium Radionuclide (TRU): Any radionuclide having an atomic number greater than 92 and a half life greater than 20 years.

Waste Container: Any receptacle (i.e., drums, boxes, bins) used to contain radioactive waste.

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APPENDIX C

ADDITIONAL READING ROOM CONTENTS

The documents listed below are for informational purposes only and cannot be considered current or accurate.

$ Waste Isolation Pilot Plant (WIPP) No migration Variance Petition[a].

$ Waste Isolation Pilot Plant RCRA Part B Permit Application[a].

$ R.N. Ceo, et al., "Physical Characterization of Radioactive Sludges in Selected Melton Valley and Evaporator Facility Storage Tanks," ORNL/TM-11653, October 1990 (Reading Room Document Number 4.2)

$ J.W. Autrey, et al., "Sampling and Analysis of the Inactive Waste Storage Tanks Contents at ORNL," ORNL/ER-13, September 1990 (Reading Room Document Number 4.3)

$ Results of the 1995 Characterization of Gunite and Associated Tanks at Oak Ridge National Laboratory," ORNL/ER/Sub/87/99053.79, February 1996 (Reading Room Document Number 4.4)

$ Cost to vendor for electrical, water, sewer, process water treatment, ambulance service, fire service (Reading Room Document Number 9.1)

$ M.B. Sears, et al., "Sampling and Analysis of Inactive Radioactive Waste Tanks W-17, W18, WC-11 through WC-15 at ORNL," ORNL/TM-13017, December 1995 (Reading Room Document Number 4.5)

$ DOE Order Number 232.1, "Occurrence Reporting and Processing of Operations Information," October 1995 (Reading Room Document Number 16.1)

$ "Phase IcSafety Analysis Report Update Program Hazard Screening," ORNL/M-5034, August 1995 (Reading Room Document Number 17.1)

$ Melton Valley Nuclear Criticality Information for Tanks W-21, W-22, W-23, W-24, W-25, W-26, W-27, W-28, W-29, W-30, and W-31, ORNL/M-5038 and ORNL/M-5036 (Reading Room Document Numbers 17.2 and 17.3)

$ Excavation/Penetration Permit Procedures, ORNL/M-5049 (Reading Room Document Number 18.1)

$ ORNL NPDES Permit, February 1986 (Reading Room Document Number 19.1)

$ J.R. Devore, et al., "Technology Study of Gunite Tank Sludge Mobilization at Oak Ridge National Laboratory, Oak Ridge, Tennessee," ORNL/ER-286, December 1994 (Reading Room Document Number 14.1)

$ ORNL's Position Paper on the Regulatory Status of the Liquid Low Level Waste System, June 20, 1994 (Reading Room Document Number 20.8)

$ Characterization of Hydrofracture Grouts for Radionuclide Migration ORNL/TM-8798 (Reading Room Document Number 22.3)

$ Rheology of Sludge-Slurry Grouts, ORNL/TM-7497 (Reading Room Document Number

22.4)

$ T.M. Gilliam and J.A. Loflin, "Leachability Studies of Hydrofracture Grouts," ORNL/TM-9879, November 1986 (Reading Room Document Number 22.6)

$ E.W. McDaniel, et al., "Strontium Leachability of Hydrofracture Grouts for Sludge-Slurries," ORNL/TM-8198, March 1982 (Reading Room Document Number 22.7)

$ T.D. Hylton, et al., "Sludge Mobilization with Submerged Nozzles in Horizontal Cylinder Tanks," ORNL/TM-13036, October 1995 (Reading Room Document Number 23.1)

$ OHF Tanks Contents Removal Project Investigation of Commercial Applications, ORNL/M-5048, October 1995 (Reading Room Document Number 23.3)

$ M.B. Sears, J.L. Botts, and J.M. Keller, "Exploratory Tests of Washing Radioactive Sludge Samples from the Melton Valley and Evaporator Facility Storage Tanks at ORNL", ORNL/M-1528 September 1991

$ R.D. Spence, et al., "Development of Grout Formulations for 106AW Waste: Moisture-Experimental Results and Analysis," ORNL/TM-12437/V1, September 1993 (Reading Room Document Number 22.1)

$ J.R. Parrott, Jr., et al., "Oak Ridge National Laboratory Liquid Waste Treatment System Waste Evaluation Criteria," ORNL/M-5041, July 1991

$ Copies of 10 CFR 830, 835, 191, and 194 (Reading Room Document Numbers 6.1, 6.3, 6.4, and 6.5)

$ DOE Release Criteria for Decontamination of Treatment Unit (Reading Room Document Number 15.1)

$ Oak Ridge National laboratory, National Pollutant Discharge Elimination System, Best Management Plan, ORNL/M-5035, December 1995 (Reading Room Document Number 20.4)

$ "Application to Ship Defense Low-Level Radioactive Waste to the Nevada Test Site," ORNL/M-5042, January 1995 (Reading Room Document Number 20.7)

$ "Radiological Control Manual," Lockheed Martin Energy Systems, ORNL/M-5037, December 1992 (Reading Room Document Number 21.1)

$ 10 CFR 61 Qualification Testing of ORNL Radioactive Liquid Low-Level Waste," LN Technologies Corp., June 1988 (Reading Room Document Number 22.5)

$ *TRU Waste LDR Treatment Increment Task* ORNL/M-5103, May 17, 1995 (Reading Room Document Number 1.3)

$ *Site Access Road Alternatives for the Waste Handling and Packaging Plant* Lee Wan and Associates, Inc., June 1988 (Reading Room Document Number 1.4)

$ *Site Characterization Report for the Proposed Transuranic Waste Handling and Packaging Plant* ORNL/TM-10965, March 1989 (Reading Room Document Number 1.5)

$ *Design Alternatives Report for the Cesium Removal Demonstration* ORNL/TM-12939, September 1995. (Reading Room Document Number 1.6)

$ *Feasibility Study for Melton Valley Storage Tank Sludge Mobilization and Transport to Grade Level* ORNL/M-5101, March 31, 1988. (Reading Room Document

Number 3.2)

$ *Computer Simulation of Mobilization and Mixing of Kaolin with Submerged Liquid Jets in 25,000-Gallon Horizontal Cylindrical Tanks* Pacific Northwest Laboratory/Battelle #PNL-10503, March 1995. (Reading Room Document Number 3.3)

$ *Modeling and Analysis of ORNL Horizontal Storage Tank Mobilization and Mixing* Pacific Northwest Laboratory/ Battelle #PNL-9961, June 1994. (Reading Room Document Number 3.4)

$ *Fluid Dynamic Studies for a Simulated Melton Valley Storage Tank Slurry* ORNL/TM-12781, July 1994. (Reading Room Document Number 3.5)

$ *Computer Modeling of ORNL Storage Tank Sludge Mobilization and Mixing* Pacific Northwest Laboratory/Battelle #PNL-8855, September 1993. (Reading Room Document Number 3.6)

$ *Fluid Dynamic Demonstrations for Waste Retrieval and Treatment* ORNL/TM-12660, February 1994. (Reading Room Document Number 3.7)

$ *Sluicing Operations at Gunite Waste Storage Tanks* ORNL/NFW-84/42, September 1984. (Reading Room Document Number 4.7)

$ *Oak Ridge National Laboratory Waste Area Grouping 1 Gunite and Associated Tanks Operable Unit Treatability Study Work Plan, Oak Ridge, Tennessee* ORNL/M-5100, January 1995. (Reading Room Document Number 4.8)

$ *Gunite and Associated Tanks Operable Unit Baseline Report and Treatability Study Work Plan, Oak Ridge National Laboratory, Oak Ridge, Tennessee* ORNL/M-5105, October 1995. (Reading Room Document Number 4.9)

$ *Technology Study of Gunite Tank Sludge Mobilization at Oak Ridge National Laboratory, Oak Ridge, Tennessee* ORNL/ER-286, December 1994. (Reading Room Document Number 4.10)

$ *Treatment Requirements for Decontamination of ORNL Low-Level Liquid Waste* ORNL/TM-11799, October 1991. (Reading Room Document Number 15.2)

$ *Prioritization Ranking of Probability and Consequence of Leaks from Active Liquid Low-Level Waste Tank Systems at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* ORNL/M-5104, April 3, 1992. (Reading Room Document Number 15.3)

$ *The Emergency Avoidance Solidification Campaign of Liquid Low-Level Waste at Oak Ridge National Laboratory* ORNL/TM-11536, January 1992. (Reading Room Document Number 20.9)

$ *Evaluation and Testing of Metering Pumps for High-Level Nuclear Waste Slurries* Pacific Northwest Laboratory/Battelle #PNL-5851, June 1986. (Reading Room Document Number 22.9)

$ *Evaluation and Ranking of the Tank Focus Area Solid Liquid Separation Needs (U)* ORNL/M-5102, August 17, 1995. (Reading Room Document Number 25.1)

$ *Liquid and Gaseous Waste Operations Department Annual Operating Report CY 1995* ORNL/TM-13164, March 1996. (Reading Room Document Number 26.1)

$ *Waste Sludge Resuspension and Transfer Development Program* ORNL/TM-71,

February 1980. (Reading Room Document Number 27.1)

$ *Selection of Immobilization Technology for TRU Waste* EG&G Rocky Flats #RFP-4292, December 31, 1989. (Reading Room Document Number 28.1)

$ *FY 1995 Separation Studies for Liquid Low-Level Waste Treatment at Oak Ridge National Laboratory* ORNL/TM-13101, January 1996. (Reading Room Document Number 29.1)

[a]These documents can be reviewed at the Office of Scientific and Technical Information DOE Public Ready Room, Oak Ridge, Tennessee.

C-2. ORO C20 Reports (APR 1986)

Reports shall be prepared and submitted in accordance with the reporting requirements delineated below and the clause entitled "Uniform Reporting System."

DOE F 1332.1
(11-84)

U.S. DEPARTMENT OF ENERGY FORM APPROVED
REPORTING REQUIREMENTS CHECKLIST OMB NO. 1900-1401

1. PROGRAM/PROJECT TITLE

R moval, Treatment, Containerization, and Disposal Certification of Transuranic Waste

2. IDENTIFICATION NUMBER

DE-IB05-95OR22516

3. PARTICIPANT NAME AND ADDRESS

4. PLANNING AND REPORTING REQUIREMENTS

A. General Management — Frequency

[ ] Management Plan
[ ] Status Report
[ ] Summary Repor

B. Schedule/Labor/Cost

[ ] Milestone Schedule/Plan
[ ] Labor Plan
[ ] Facilities Capital Cost of Money Factors Computation
[ ] Contract Facilities Capital and Cost of ey
[ ] Cost Plan
[ ] Milestone Schedule/Status
[ ] Labor Management Report
[ ] Cost Management Report

C. Exception Reports

[ ] Conference Record

[ ] Hot Line Report

D. Performance Measurement

[ ] Management Control System Description
[ ] WBS Dictionary

[ ] Index
[ ] Element Definition

[ ] Cost Performance Reports

[ ] Format 1 - WBS
[ ] Format 2 - Function
[ ] Format 3 - Baseline

E. Financial Incentives — Frequency

[ ] Statement of Income and Expense

[ ] Balance Sheet
[ ] Cash Flow Statement
[ ] Statement of Changes in Financial Position
[ ] Loan Drawdown Report
[ ] Operating Budget
[ ] Supplementary Information

F. Technical

[ ] Notice of Energy RD&D Project (Required with any of the following)

[ ] Technical Progress Report

[ ] Draft for Review
[ ] Final for Approval

[ ] Topical Report
[ ] Final Technical Report

[ ] Draft for Review
[ ] Final for Approval

[ ] Software
[ ] Other (Specify) ____________

5. FREQUENCY CODES

A - As Required	M - Monthly	S - Semi-Annually
C - Change to Contractual Agreement	O - Once After Award	X - With Proposal/Bid/Application or with Significant Changes
F - Final (end of effort)	Q - Quarterly	Y - Yearly or Upon Renewal of Contractual Agreement

6. SPECIAL INSTRUCTIONS (ATTACHMENTS)

[X] Report Distribution List/Addressees
[ ] Reporting Elements
[ ] Due Dates
[ ] Analysis Thresholds
[ ] Work Breakdown Structure
[ ] Other

7. PREPARED BY (SIGNATURE AND DATE)	8. REVIEWED BY (SIGNATURE AND DATE)

DRAFT

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* Contractor: Required reports should be addressed specifically to the attention of the Contracting Officer's Representative (COR) and Contract Specialist assigned by the Contracting

Radionuclide Inventory for the Oak Ridge Transuranic Sludge Wastes

Storage Tanks	Radionuclides	Concentration (Ci/m^3)	Volume (m^3)	Activity (Ci)	Half-Life (years)	Specific Activity (Ci/g)	Radionuclide Mass (g)
Old Hydrofracture Facility (GR-W095)	Pu-238	7.16E-01	2.30E+01	1.65E+01	8.64E+01	1.74E+01	9.46E-01
	Pu-239	2.22E-01	2.30E+01	5.11E+00	2.44E+04	6.14E-02	8.32E+01
	Am-241	3.53E-01	2.30E+01	8.12E+00	4.58E+02	3.24E+00	2.51E+00
	Total TRU	*1.29E+00*	*2.30E+01*	*2.97E+01*	*NA*	*NA*	*8.66E+01*
	H-3	2.24E-03	2.30E+01	5.15E-02	1.23E+01	9.72E+03	5.30E-06
	C-14	3.05E-02	2.30E+01	7.02E-01	5.73E+03	4.46E+00	1.57E-01
	Co-60	5.06E+00	2.30E+01	1.16E+02	5.27E+00	1.13E+03	1.03E-01
	Sr-90	7.59E+02	2.30E+01	1.75E+04	2.81E+01	1.41E+02	1.24E+02
	Cs-137	2.40E+01	2.30E+01	5.52E+02	3.00E+01	8.70E+01	6.34E+00
	Eu-152	2.72E+00	2.30E+01	6.26E+01	1.24E+01	1.90E+02	3.29E-01
	Eu-154	2.17E+00	2.30E+01	4.99E+01	1.60E+01	1.45E+02	3.44E-01
	Eu-155	3.64E-01	2.30E+01	8.37E+00	1.81E+00	1.27E+03	6.59E-03
	Th-232	2.50E-02	2.30E+01	5.75E-01	1.39E+10	1.11E-07	5.19E+06
	U-233	3.03E-01	2.30E+01	6.97E+00	1.62E+05	9.47E-03	7.36E+02
	Cm-244*	5.25E+00	2.30E+01	1.21E+02	1.81E+01	8.09E+01	1.49E+00
	Cf-252*	2.59E+00	2.30E+01	5.96E+01	2.65E+00	5.35E+02	1.11E-01
	Total Non-TRU	*8.02E+02*	*2.30E+01*	*1.84E+04*	*NA*	*NA*	*5.19E+06*
	Total Inventory	*8.03E+02*	*2.30E+01*	*1.85E+04*	*NA*	*NA*	*5.19E+06*

Radionuclide Inventory for the Oak Ridge Transuranic Sludge Wastes

Storage Tanks	Radionuclides	Concentration (Ci/m³)	Volume (m³)	Activity (Ci)	Half-Life (years)	Specific Activity (Ci/g)	Radionuclide Mass (g)
Gunite and Associated Tanks (OR-W096)	Pu-238[a]	2.00E-02	1.65E+02	3.31E+00	8.64E+01	1.74E+01	1.90E-01
	Pu-239	1.58E-01	1.65E+02	2.61E+01	2.44E+04	6.14E-02	4.26E+02
	Pu-240	1.74E-02	1.65E+02	2.88E+00	6.24E+03	2.39E-01	1.20E+01
	Am-241[a]	2.10E-01	1.65E+02	3.47E+01	4.58E+02	3.24E+00	1.07E+01
	Pu-242[a]	1.65E-03	1.65E+02	2.73E-01	3.79E+05	3.90E-03	7.00E+01
	Pu-244	7.27E-05	1.65E+02	1.2[illegible]-02	7.60E+07	1.93E-05	6.23E+02
	Total TRU	*4.07E-01*	*1.65E+02*	*6.73E+01*	*NA*	*NA*	*1.14E+03*
	H-3	1.25E-03	1.65E+02	2.07E-01	1.23E+01	9.72E+03	2.13E-05
	Co-60[a]	5.63E-02	1.65E+02	1.10E+01	5.27E+00	1.13E+03	9.70E-03
	Sr-90	5.99E+01	1.65E+02	9.91E+03	2.81E+01	1.41E+02	7.03E+01
	Cs-134[a]	3.04E-02	1.65E+02	5.03E+00	2.07E+00	1.29E+03	3.90E-03
	Cs-137	3.93E+01	1.65E+02	6.50E+03	3.00E+01	8.70E+01	7.47E+01
	Eu-152[a]	1.10E-01	1.65E+02	1.82E+01	1.24E+01	1.90E+02	9.58E-02
	Eu-154[a]	7.44E-02	1.65E+02	1.23E+01	1.60E+01	1.45E+02	8.49E-02
	Eu-155[a]	6.32E-02	1.65E+02	1.05E+01	1.81E+00	1.27E+03	8.23E-03
	Th-232	6.80E-04	1.65E+02	1.12E-01	1.39E+10	1.11E-07	1.01E+06
	U-233[a]	4.30E-02	1.65E+02	7.11E+00	1.62E+05	9.47E-03	7.51E+02
	U-234	1.03E-01	1.65E+02	1.70E+01	2.48E+05	6.17E-03	2.76E+03
	U-235	7.89E-04	1.65E+02	1.31E-01	7.13E+08	2.14E-06	6.11E+04
	U-236	5.25E-05	1.65E+02	8.68E-03	2.39E+07	6.34E-05	1.37E+02
	U-238	3.27E-02	1.65E+02	5.41E+00	4.51E+09	3.33E-07	1.62E+07
	Pu-241	6.52E-04	1.65E+02	1.08E-01	1.33E+01	1.12E+02	9.63E-04
	Cm-244[a]	5.78E-01	1.65E+02	9.56E+01	1.81E+01	8.09E+01	1.18E+00
	Cf-252[a]	4.52E-04	1.65E+02	7.48E-02	2.65E+00	5.35E+02	1.40E-04
	Total Non-TRU	*1.00E+02*	*1.65E+02*	*1.66E+04*	*NA*	*NA*	*1.73E+07*
	Total Inventory	*1.01E+02*	*1.65E+02*	*1.67E+04*	*NA*	*NA*	*1.73E+07*

Radionuclide Inventory for the Oak Ridge Transuranic Sludge Wastes

Storage Tanks	Radionuclides	Concentration (Ci/m^3)	Volume (m^3)	Activity (Ci)	Half-Life (years)	Specific Activity (Ci/g)	Radionuclide Mass (g)
Melton Valley Storage Tanks (OR-W098)	Pu-238	2.71E-01	4.43E+02	1.20E+02	8.64E+01	1.74E+01	6.90E+00
	Pu-239	1.63E-01	4.43E+02	7.22E+01	2.44E+04	6.14E-02	1.18E+03
	Pu-240	1.19E-02	4.43E+02	5.27E+00	6.24E+03	2.39E-01	2.21E+01
	Am-241*	4.30E-01	4.43E+02	1.90E+02	4.58E+02	3.24E+00	5.88E+01
	Cm-243*	3.37E-01	4.43E+02	1.49E+02	3.20E+01	4.60E+01	3.25E+00
	Total TRU	*1.21E+00*	*4.43E+02*	*5.37E+02*	*NA*	*NA*	*1.27E+03*
	C-14	1.46E-02	4.43E+02	6.47E+00	5.73E+03	4.46E+00	1.45E+00
	Co-60	2.41E+00	4.43E+02	1.07E+03	5.27E+00	1.13E+03	9.45E-01
	Sr-90	1.09E+02	4.43E+02	4.83E+04	2.81E+01	1.41E+02	3.42E+02
	Cs-134*	9.32E-02	4.43E+02	4.13E+01	2.07E+00	1.29E+03	3.20E-02
	Cs-137	1.75E+01	4.43E+02	7.75E+03	3.00E+01	8.70E+01	8.91E+01
	Eu-152*	9.31E+00	4.43E+02	4.12E+03	1.24E+01	1.90E+02	2.17E+01
	Eu-154	5.03E+00	4.43E+02	2.23E+03	1.60E+01	1.45E+02	1.54E+01
	Eu-155*	1.34E+00	4.43E+02	5.94E+02	1.81E+00	1.27E+03	4.67E-01
	Th-232	1.46E-03	4.43E+02	6.47E-01	1.39E+10	1.11E-07	5.84E+06
	U-232	5.52E-02	4.43E+02	2.45E+01	7.17E+01	2.15E+01	1.14E+00
	U-233	9.75E-02	4.43E+02	4.32E+01	1.62E+05	9.47E-03	4.56E+03
	U-234	1.16E-03	4.43E+02	5.14E-01	2.48E+05	6.17E-03	8.33E+01
	U-235	6.71E-05	4.43E+02	2.97E-02	7.13E+08	2.14E-06	1.39E+04
	U-236	3.96E-05	4.43E+02	1.75E-02	2.39E+07	6.34E-05	2.77E+02
	U-238	3.34E-03	4.43E+02	1.48E+00	4.51E+09	3.33E-07	4.44E+06
	Cm-244	2.81E+00	4.43E+02	1.24E+03	1.81E+01	8.09E+01	1.54E+01
	Total Non-TRU	*1.48E+02*	*4.43E+02*	*6.54E+04*	*NA*	*NA*	*1.03E+07*
	Total Inventory	*1.49E+02*	*4.43E+02*	*6.60E+04*	*NA*	*NA*	*1.03E+07*

Radionuclide Inventory for the Oak Ridge Transuranic Sludge Wastes

Storage Tanks	Radionuclides	Concentration (Ci/m³)	Volume (m³)	Activity (Ci)	Half-Life (years)	Specific Activity (Ci/g)	Radionuclide Mass (g)
Evaporator Storage Facility (OR-W097)	Pu-238	4.45E-01	9.50E+01	4.23E+01	8.64E+01	1.74E+01	2.43E+00
	Pu-239	1.57E-01	9.50E+01	1.49E+01	2.44E+04	6.14E-02	2.43E+02
	Pu-240	1.13E-01	9.50E+01	1.07E+01	6.24E+03	2.39E-01	4.49E+01
	Am-241	9.16E-02	9.50E+01	8.70E+00	4.58E+02	3.24E+00	2.69E+00
	Pu-242	9.35E-05	9.50E+01	8.88E-03	3.79E+05	3.90E-03	2.28E+00
	Total TRU	*8.07E-01*	*9.50E+01*	*7.66E+01*	*NA*	*NA*	*2.95E+02*
	C-14	1.04E-02	9.50E+01	9.88E-01	5.73E+03	4.46E+00	2.22E-01
	Co-60	3.82E+00	9.50E+01	3.63E+02	5.27E+00	1.13E+03	3.21E-01
	Sr-90	2.03E+01	9.50E+01	1.93E+03	2.81E+01	1.41E+02	1.37E+01
	Tc-99	6.49E-03	9.50E+01	6.17E-01	2.14E+05	1.69E-02	3.65E+01
	Cs-134*	2.73E-01	9.50E+01	2.59E+01	2.07E+00	1.29E+03	2.01E-02
	Cs-137	1.14E+01	9.50E+01	1.08E+03	3.00E+01	8.70E+01	1.24E+01
	Eu-152	3.60E-01	9.50E+01	3.42E+01	1.24E+01	1.90E+02	1.80E-01
	Eu-154	1.81E+01	9.50E+01	1.72E+03	1.60E+01	1.45E+02	1.19E+01
	Eu-155	3.94E-01	9.50E+01	3.74E+01	1.81E+00	1.27E+03	2.95E-02
	Th-232	1.26E-03	9.50E+01	1.20E-01	1.39E+10	1.11E-07	1.08E+06
	U-233	4.87E-01	9.50E+01	4.63E+01	1.62E+05	9.47E-03	4.89E+03
	U-234	1.10E-03	9.50E+01	1.05E-01	2.48E+05	6.17E-03	1.69E+01
	U-235	2.08E-04	9.50E+01	1.98E-02	7.13E+08	2.14E-06	9.25E+03
	U-236	2.68E-04	9.50E+01	2.55E-02	2.39E+07	6.34E-05	4.02E+02
	U-238	1.57E-02	9.50E+01	1.49E+00	4.51E+09	3.33E-07	4.47E+06
	Pu-241	1.81E+00	9.50E+01	1.72E+02	1.33E+01	1.12E+02	1.54E+00
	Cm-244	1.69E+01	9.50E+01	1.61E+03	1.81E+01	8.09E+01	1.98E+01
	Total Non-TRU	*7.39E+01*	*9.50E+01*	*7.02E+03*	*NA*	*NA*	*5.57E+06*
	Total Inventory	*7.47E+01*	*9.50E+01*	*7.10E+03*	*NA*	*NA*	*5.57E+06*

Radionuclide Inventory for the Oak Ridge Transuranic Sludge Wastes

Storage Tanks	Radionuclides	Concentration (Ci/m³)	Volume (m³)	Activity (Ci)	Half-Life (years)	Specific Activity (Ci/g)	Radionuclide Mass (g)
ALL TANKS	Pu-238	2.51E-01	7.26E+02	1.82E+02	8.64E+01	1.74E+01	1.05E+01
	Pu-239	1.63E-01	7.26E+02	1.18E+02	2.44E+04	6.14E-02	1.93E+03
	Pu-240	2.60E-02	7.26E+02	1.89E+01	6.24E+03	2.39E-01	7.90E+01
	Am-241	3.33E-01	7.26E+02	2.42E+02	4.58E+02	3.24E+00	7.47E+01
	Pu-242	3.88E-04	7.26E+02	2.82E-01	3.79E+05	3.90E-03	7.23E+01
	Cm-243	2.06E-01	7.26E+02	1.49E+02	3.20E+01	4.60E+01	3.25E+00
	Pu-244	1.66E-05	7.26E+02	1.20E-02	7.60E+07	1.93E-05	6.23E+02
	Total TRU[b]	***9.79E-01***	***7.26E+02***	***7.11E+02***	*NA*	*NA*	***2.79E+03***
	H-3	3.56E-04	7.26E+02	2.58E-01	1.23E+01	9.72E+03	2.66E-05
	C-14	1.12E-02	7.26E+02	8.16E+00	5.73E+03	4.46E+00	1.83E+00
	Co-60	2.14E+00	7.26E+02	1.56E+03	5.27E+00	1.13E+03	1.38E+00
	Sr-90	1.07E-02	7.26E+02	7.76E+04	2.81E+01	1.41E+02	5.50E+02
	Tc-99	8.49E-04	7.26E+02	6.17E-01	2.14E+05	1.69E-02	3.65E+01
	Cs-134	9.95E-02	7.26E+02	7.23E+01	2.07E+00	1.29E+03	5.60E-02
	Cs-137	2.19E+01	7.26E+02	1.59E+04	3.00E+01	8.70E+01	1.83E+02
	Eu-152	5.84E+00	7.26E+02	4.24E+03	1.24E+01	1.90E+02	2.23E+01
	Eu-154	5.52E+00	7.26E+02	4.01E+03	1.60E+01	1.45E+02	2.77E+01
	Eu-155	8.95E-01	7.26E+02	6.50E+02	1.81E+00	1.27E+03	5.12E-01
	Th-232	2.00E-03	7.26E+02	1.45E+00	1.39E+10	1.11E-07	1.31E+07
	U-232	3.37E-02	7.26E+02	2.45E+01	7.17E+01	2.15E+01	1.14E+00
	U-233	1.43E-01	7.26E+02	1.04E+02	1.62E+05	9.47E-03	1.09E+04
	U-234	2.43E-02	7.26E+02	1.77E+01	2.48E+05	6.17E-03	2.86E+03
	U-235	2.48E-04	7.26E+02	1.80E-01	7.13E+08	2.14E-06	8.43E+04
	U-236	7.12E-05	7.26E+02	5.17E-02	2.39E+07	6.34E-05	8.15E+02
	U-238	1.15E-02	7.26E+02	8.38E+00	4.51E+09	3.33E-07	2.51E+07
	Pu-241	2.37E-01	7.26E+02	1.72E+02	1.33E+01	1.12E+02	1.54E+00
	Cm-244	4.22E+00	7.26E+02	3.07E+03	1.81E+01	8.09E+01	3.79E+01
	Cf-252	8.21E-02	7.26E+02	5.96E+01	2.65E+00	5.35E+02	1.11E-01
	Total Non-TRU	***1.48E+02***	***7.26E+02***	***1.07E+05***	*NA*	*NA*	***3.84E+07***
	Total Inventory[b]	***1.49E+02***	***7.26E+02***	***1.08E+05***	*NA*	*NA*	***3.84E+07***

a. For the radionuclides noted above, the Ci/m³ value provided was not published in the draft Rev. 3 of the Oak Ridge TWBIR (dated 6/14/96) because of the presence of "<" values in the measured data. In those cases above, this upper limit value was conservatively assumed to be the actual concentration of the radionuclide.

b. As reported in the draft TWBIR Rev. 3 submittal from Oak Ridge, the total mass of the sludge is approximately 1E+06 kg. Therefore, based on the total radionuclide inventory shown, the isotopic mass concentration is about 3.8% and the TRU concentration is approximately 711 nCi/g.

$\frac{7.11 \times 10^{2}\ Ci}{3.84 \times 10^{7}\ g} \times 10^{+9}\ \frac{nCi}{Ci} = 1.85 \times 10^{4} = 18500\ \frac{nCi}{g}$

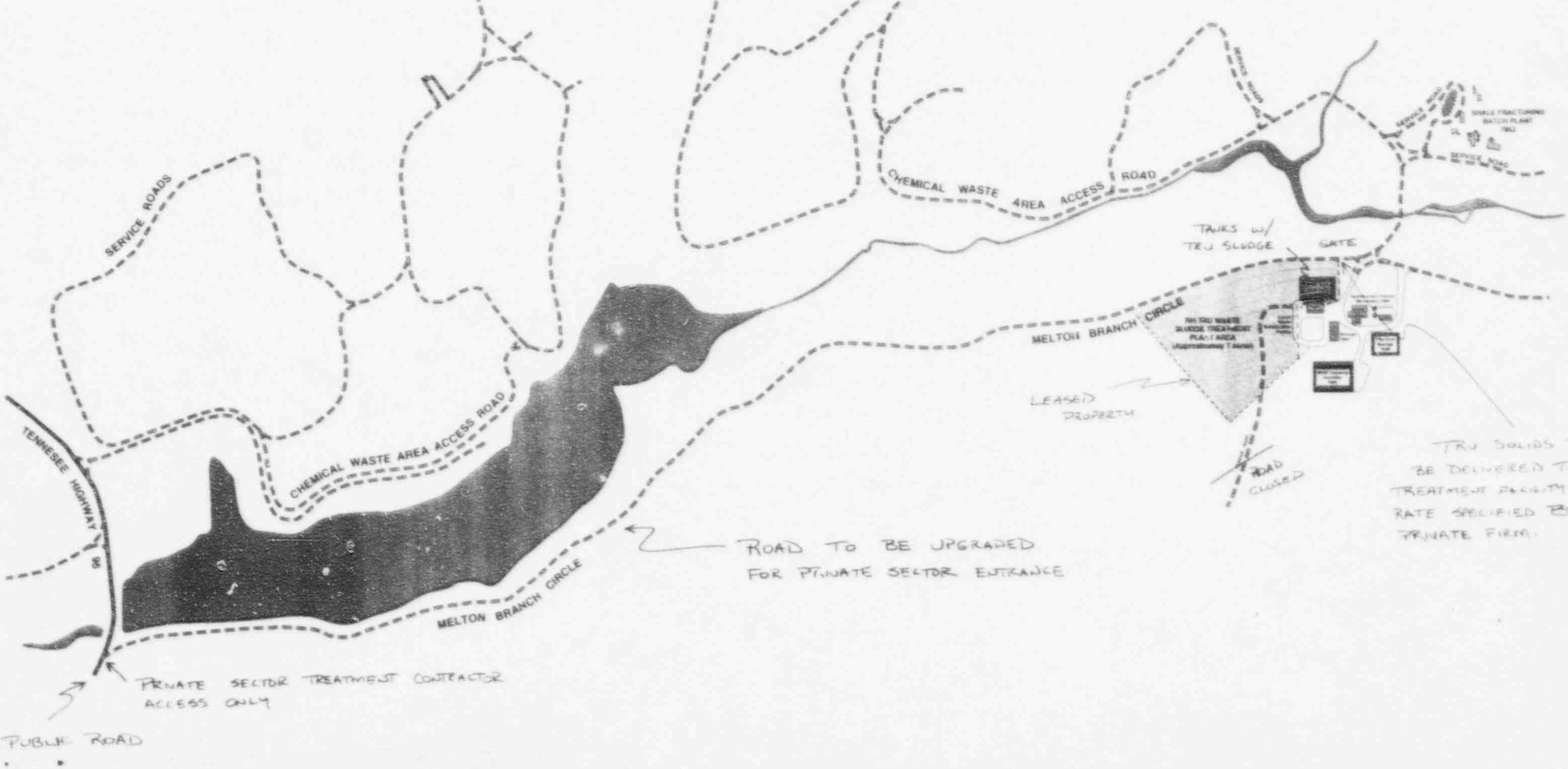
$\frac{7.11 \times 10^{2}\ Ci}{10^{9}\ g} \times 10^{9}\ \frac{nCi}{Ci} = 7.11 \times 10^{2}$ ok

Draft Layout

Transuranic Waste Treatment Project

ORNL

9/26/96



Draft Layout

Transuranic Waste

Treatment Project

ORNL

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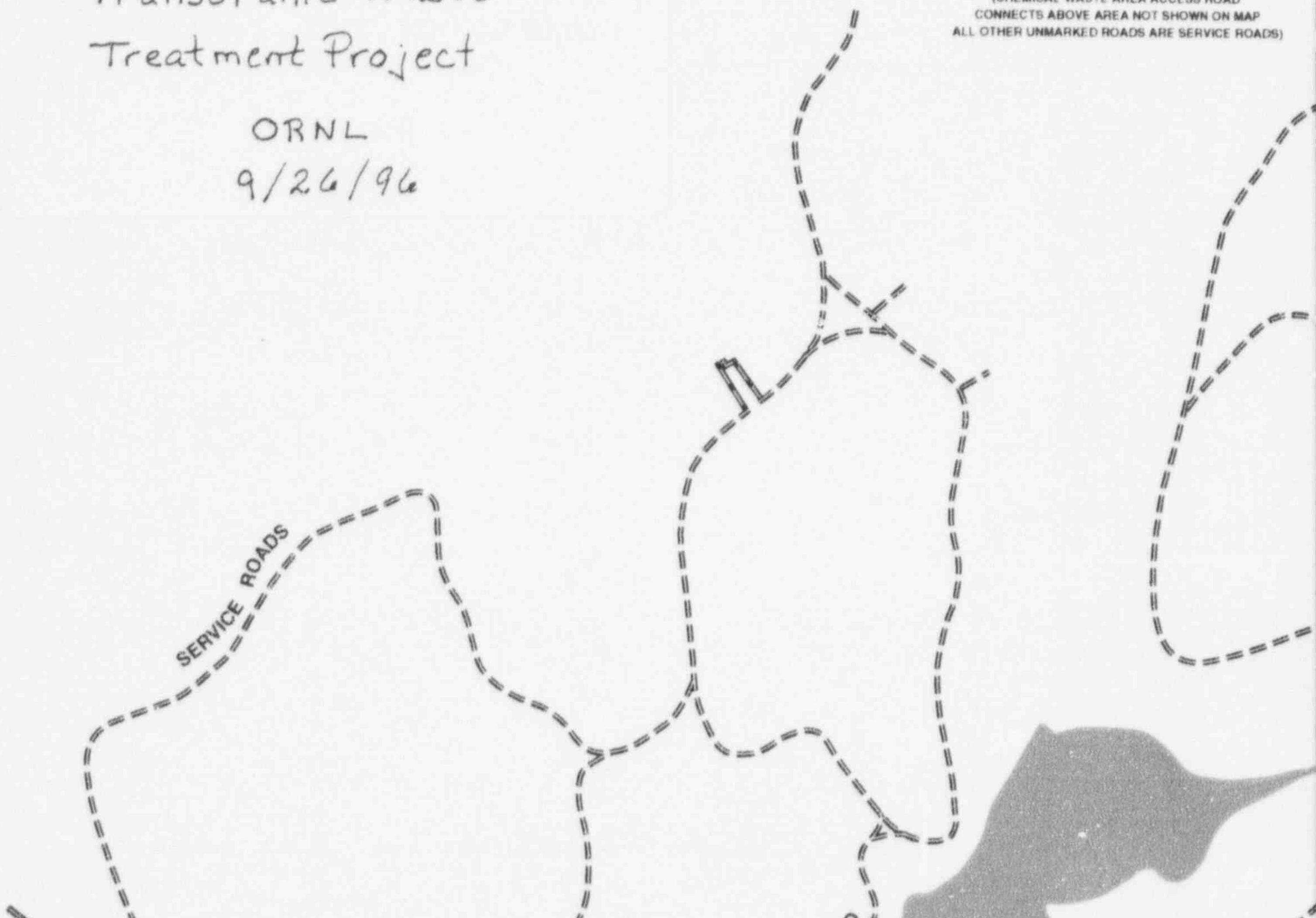

DWG NO. KG 96-2398/MC