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NMED Hazardous Waste Bureau

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Date: AUG 10 2012
Refer To: ENV-RCRA-12-0173
LAUR: 12-21591

Mr. Jerry Schoeppner, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Schoeppner:

SUBJECT: SUPPLEMENTAL INFORMATION FOR DISCHARGE PERMIT APPLICATION DP-1132, RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (RLWTF) AND ZERO LIQUID DISCHARGE (ZLD) SOLAR EVAPORATION TANKS

On November 18, 2011, the New Mexico Environment Department (NMED) notified the U. S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) that a comprehensive, up-to-date application was required to issue Discharge Permit (DP)-1132 for the Technical Area 50 (TA-50) Radioactive Liquid Waste Treatment Facility and the TA-52 Zero Liquid Discharge Solar Evaporation Tanks. A Discharge Permit application (ENV-DO-12-0005) and supplement (ENV-DO-12-0019) were submitted to NMED by DOE/LANS on February 16, 2012, and April 2, 2012, respectively. After the above-referenced application and supplement were submitted, DOE/LANS confirmed that they could replace seven vessels at the TA-50 RLWTF with two new storage tank systems with leak detection capability located at the TA-50 Waste Mitigation and Risk Management (WMRM) Facility. This significant and improved change requires DOE/LANS to submit the enclosed supplement and modification to its existing permit application.

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The table below lists the seven vessels DOE/LANS propose to remove from service and the corresponding replacement vessels. These modifications will also remove from service a single-wall pipe that connects the 75,000-gal. influent tank to the clarifiers. Engineering design is currently underway to affect the above-referenced modifications to the TA-50 RLWTF. In the interim, wastewater storage and treatment processes at the TA-50 RLWTF will be conducted in accordance with processes and units described in the DP-1132 permit application and supplement submitted on February 16, 2012, and April 2, 2012, respectively.

Existing Vessel				Replacement Vessel		
Location	Vessel	Vessel Use	Volume (gal.)	Location	Vessel	Volume (gal.)
TA-50-02	75K tank	Influent storage	75,000	TA-50-250	WMRM Tanks (2)	50,000[1]
TA-50-02	WM2-North	Effluent storage	25,000	na	na	na
TA-50-02	WM2-South	Effluent storage	25,000	na	na	na
TA-50-01	Clarifier #1	Chemical precipitation	20,000	TA-50-01	TK71	10,000
TA-50-01	Clarifier #2	Chemical precipitation	20,000	TA-50-01	TK72	10,000
TA-50-01	Gravity Filter	Solids separation	7,000	TA-50-01	filter/sludge/clean[2]	40/500/200[1]
TA-50-90	100K Tank	Influent storage	100,000	na	na	na

[1]Capacity is for each tank.
[2]Microfilter

Please contact Robert S. Beers by telephone at (505) 667-7969 or by email at bbeers@lanl.gov if you have questions regarding this information.

Sincerely,

Alison M. Dorries
Division Leader
Environmental Protection Division
Los Alamos National Security, LLC

Sincerely,

Peter Maggi for

Gene E. Turner
Environmental Permitting Manager
Environmental Projects Office
Los Alamos Site Office
U.S. Department of Energy

AMD:GET:RSB/lm

Enclosures:

1. Supplemental Information, DP-1132 Application, Revised Sections A-8, A-9, and B-12.
2. Supplemental Information, DP-1132 Application, Revised Section B-7.
3. Supplemental Information, DP-1132 Application, Revised RLWTF Processes and Units—Appendix B.
4. Supplemental Information, DP-1132 Application, Revised Process Schematic—Appendix B.
5. Supplemental Information, DP-1132 Application, Revised Scaled Floor Plan—Appendix B.

Cy: Joni Arends, Concerned Citizens for Nuclear Safety, Santa Fe, NM, w/enc.
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James Hogan, NMED/SWQB, Santa Fe, NM, w/enc.
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Gene E. Turner, LASO-EPO, w/enc., (E-File)
Hai Shen, LASO-EPO, w/enc., (E-File)
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Robert C. Mason, TA55 DO, w/enc., (E-File)
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Chris Del Signore, TA-55-RLW, w/enc., (E-File)
Victor J. Salazar, TA-55-RLW, w/enc., (E-File)
Randal S. Johnson, ENV-ES, w/enc., (E-File)
IRM-RMMSO, w/enc., (E-File)
ENV-RCRA Correspondence File, w/enc., K490

ENCLOSURE 1

Supplemental Information, DP-1132 Application

Revised Sections A-8, A-9, and B-12 – Redline

Revised Sections A-8, A-9, and B-12 – Final

ENV-RCRA-12-0173

LAUR-12-21591

Date: AUG 1 0 2012

A-8. Processing, Treatment, Storage and Disposal System. Briefly describe how wastewater, sludge, etc. is processed, treated, stored, and/or disposed of at your facility. See Supplemental Instructions for examples of system components.

The Radioactive Liquid Waste Treatment Facility (RLWTF) consists of (a) an underground collection system that conveys water to Technical Area (TA) 50 from generators at LANL, (b) structures at TA-50, and (c) Zero Liquid Discharge Solar Evaporation Tanks at TA- 52. At Technical Area 50, Building 50-01 is the primary structure; it houses treatment equipment, process tanks, analytical laboratories, and offices. Adjacent TA-50 structures primarily provide for additional water storage: ~~50-02 (influent),~~ 50-66 (influent), ~~50- 90 (influent),~~ 50-248 (secondary waters), and 50-250 (influent and emergency).

The RLWTF receives and treats radioactive liquid waste (RLW) from generators at Los Alamos National Laboratory. RLW includes small volumes, less than one percent of total influent, that are also characteristically hazardous for corrosivity, which are treated using elementary neutralization. The RLWTF has (1) a main treatment process for low-level RLW, (2) a process for treating transuranic RLW, and (3) a secondary treatment process for waste streams from both the low-level and transuranic processes.

1) The main treatment process consists of influent collection and storage, the treatment of low-level RLW, and the discharge of treated water to the environment. ~~Treatment~~ Process steps include treatment with chemicals in a reaction tank, ~~clarification~~, filtration, ion exchange, and reverse osmosis. Discharge to the environment is via NPDES Outfall #051, solar evaporation at the TA-52 Zero Liquid Discharge (ZLD) Solar Evaporation Tanks, or ~~mechanical~~ evaporation using natural gas at TA-50-257. Two secondary streams are generated by primary treatment, sludge and reverse osmosis concentrate; they are sent to the secondary treatment process.

2) Transuranic RLW treatment consists of influent collection and storage, treatment of the transuranic RLW, and sludge treatment. Treated water is not discharged; it either receives additional treatment (secondary reverse osmosis) or is sent to storage tanks in Building 50-248 for disposition as bottoms. Sludge from the treatment process is concentrated, solidified with cement, and shipped to the Waste Isolation Pilot Plant as a solid transuranic waste.

3) The secondary treatment process treats wastes from the primary and transuranic treatment lines. It consists of a rotary vacuum filter to treat sludge from the main treatment process, secondary reverse osmosis to treat reverse osmosis concentrate from the main process and/or effluent from the transuranic process, and a bottoms disposal step. Wastes from the secondary treatment process are disposed as low-level radioactive solid waste.

A-9. Discharge Locations. List the locations of your facility and of all components of your processing, treatment, storage and/or disposal system. Examples of components include septic tanks, lagoons, leachfields, irrigation sites, mine stockpiles, etc. Additional examples are listed in the Supplemental Instructions. Latitude and longitude are optional unless township, range and section are not available.

Components	Township	Range	Section(s)	Latitude	Longitude
~~RLWTF Mechanical~~ Natural Gas Evaporator (50-257)	19N	6E	22	35° 51' 58.3" 35° 51' 43.4"	-106° 17' 48.5" -106° 17' 51.8"
NPDES Outfall #051 (NM0028355)	19N	6E	22	35° 51' 54"	-106° 17' 52"
TA-52 Zero Liquid Discharge Solar Evaporation Tanks (currently under construction)	19N	6E	22	35° 51' 36"	-106° 17' 12"

B-12. Discharge Volumes. Describe how and where the monthly discharge volume at your facility will be. For all measuring devices, provide type, location, and units of measure including multipliers (e.g., gallons, gallons x 100, acre-ft, etc.) See Supplemental Instructions. Attach additional pages, if necessary.

Discharges of treated water to the environment are measured by the following methods:

- Low-level influent: ~~Low-level RLW influent volumes are determined by daily water balance. The levels of process vessels and tanks are continuously monitored with information transmitted electronically to the RLWTF control room. Level changes are converted to volume changes, which are summed daily. Influent is determined as the sum of tank volume changes plus volumes of water discharged to the environment and water removed as sludge. Tank level and other volume information is reviewed daily to assure activities and tank level changes agree with actual plant operations.~~
  Low-level RLW influent volumes will be determined by monitoring and recording the change in level of Tank 5 and Tank 6 in the Waste Management and Risk Mitigation (WMRM) Facility. While radioactive liquid waste (RLW) is being fed to the treatment process from one of these two influent tanks (e.g., Tank 5), fresh influent will be received in the other influent tank (e.g., Tank 6). In this illustration, the change in level of Tank 6 from one day to the next will reflect the volume of the influent received.
- Transuranic influent: Transuranic influent is received in batches from TA-55, with influent collected in either the acid tank or caustic tank in Building 50-66. Level probes for these tanks are linked electronically to the RLWTF control room. Operators monitor and record tank level changes during each influent batch transfer. Influent volumes are calculated from the difference between beginning and ending tank levels.

- Discharge to the environment by ~~mechanical~~ evaporation using natural gas at 50-257: Treated water is fed to the evaporator from the effluent Frac tanks in Room 34B; water is typically fed continuously during the normal work week, including overnight. Volumes are read in gallons from a water meter on the evaporator feed line.

- Discharge to the environment by solar evaporation: Treated water is discharged to the TA-52 Zero Liquid Discharge Solar Evaporation Tanks from either of the effluent Frac tanks in Room 34B, or from TK38 in Room 38. Discharges occur in batches. The volume, in gallons, of each discharge is calculated from the change in tank level. If discharges are from the effluent Frac tanks, which are horizontal tanks, before- and after-discharge tank volumes are determined from a table that correlates tank level and volume of water in the tank. If discharges are from TK38, pre and post discharge tank volumes are read directly from markings on this translucent vertical tank.

- Discharge to the environment via NPDES Outfall #051: Treated water is discharged from either of the effluent Frac tanks in Room 34B, or from TK38 in Room 38. Discharges occur in batches. The volume, in gallons, of each discharge is calculated from the change in tank level. If discharges are from the effluent Frac tanks, which are horizontal tanks, before- and after-discharge tank volumes are determined from a table that correlates tank level and volume of water in the tank. If discharges are from TK38, pre and post discharge tank volumes are read directly from markings on this translucent vertical tank.

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The RLWTF receives and treats radioactive liquid waste (RLW) from generators at Los Alamos National Laboratory. RLW includes small volumes, less than one percent of total influent, that are also characteristically hazardous for corrosivity, which are treated using elementary neutralization. The RLWTF has (1) a main treatment process for low-level RLW, (2) a process for treating transuranic RLW, and (3) a secondary treatment process for waste streams from both the low-level and transuranic processes.

1) The main treatment process consists of influent collection and storage, the treatment of low-level RLW, and the discharge of treated water to the environment. Process steps include treatment with chemicals in a reaction tank, filtration, ion exchange, and reverse osmosis. Discharge to the environment is via NPDES Outfall 051, solar evaporation at the TA-52 Zero Liquid Discharge (ZLD) Solar Evaporation Tanks or evaporation using natural gas at TA-50-257. Two secondary streams are generated by primary treatment, sludge and reverse osmosis concentrate; they are sent to the secondary treatment process.

2) Transuranic RLW treatment consists of influent collection and storage, treatment of the transuranic RLW, and sludge treatment. Treated water is not discharged; it either receives additional treatment (secondary reverse osmosis) or is sent to storage tanks in Building 50-248 for disposition as bottoms. Sludge from the treatment process is concentrated, solidified with cement, and shipped to the Waste Isolation Pilot Plant as a solid transuranic waste.

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TA-52 Zero Liquid Discharge Solar Evaporation Tanks (currently under construction)	19N	6E	22	35° 51' 36"	-106° 17' 12"

B-12. Discharge Volumes. Describe how and where the monthly discharge volume at your facility will be. For all measuring devices, provide type, location, and units of measure including multipliers (e.g., gallons, gallons x 100, acre-ft, etc.) See Supplemental Instructions. Attach additional pages, if necessary.

Discharges of treated water to the environment are measured by the following methods:

- **Low-level influent**: Low-level RLW influent volumes will be determined by monitoring and recording the change in level of Tank 5 and Tank 6 in the Waste Management and Risk Mitigation (WMRM) Facility. While radioactive liquid waste (RLW) is being fed to the treatment process from one of these two influent tanks (e.g., Tank 5), fresh influent will be received in the other influent tank (e.g., Tank 6). In this illustration, the change in level of Tank 6 from one day to the next will reflect the volume of the influent received

- **Transuranic influent:** Transuranic influent is received in batches from TA-55, with influent collected in either the acid tank or caustic tank in Building 50-66. Level probes for these tanks are linked electronically to the RLWTF control room. Operators monitor and record tank level changes during each influent batch transfer. Influent volumes are calculated from the difference between beginning and ending tank levels.

- **Discharge to the environment by evaporation using natural gas at 50-257**: Treated water is fed to the evaporator from the effluent Frac tanks in Room 34B; water is typically fed continuously during the normal work week, including overnight. Volumes are read in gallons from a water meter on the evaporator feed line.

- **Discharge to the environment by solar evaporation**: Treated water is discharged to the TA-52 Zero Liquid Discharge Solar Evaporation Tanks from either of the effluent Frac tanks in Room 34B, or from TK38 in Room 38. Discharges occur in batches. The volume, in gallons, of each discharge is calculated from the change in tank level. If discharges are from the effluent Frac tanks, which are horizontal tanks, before- and after-discharge tank volumes are determined from a table that correlates tank level and volume of water in the tank. If discharges are from TK38, pre and post discharge tank volumes are read directly from markings on this translucent vertical tank.

- **Discharge to the environment via NPDES Outfall #051:** Treated water is discharged from either of the effluent Frac tanks in Room 34B, or from TK38 in Room 38. Discharges occur in batches. The volume, in gallons, of each discharge is calculated from the change in tank level. If discharges are from the effluent Frac tanks, which are horizontal tanks, before- and after-discharge tank volumes are determined from a table that correlates tank level and volume of water in the tank. If discharges are from TK38, pre and post discharge tank volumes are read directly from markings on this translucent vertical tank.

ENCLOSURE 2

Supplemental Information, DP-1132 Application

Revised Section B-7 – Redline

Revised Section B-7 – Final

ENV-RCRA-12-0173

LAUR-12-21591

Date: AUG 1 0 2012

B-7. Operational Plan. Attach a detailed description of how you operate your processing, treatment, storage and/or disposal system.

Animal feeding operations: include stormwater management, nutrient management plans, method for mixing irrigation and wastewater.

Domestic wastewater treatment facilities: include pre-treatment, solids management, vegetation management for land application.

Facilities using reclaimed domestic wastewater above ground: include proposed water quality classification(s), effluent monitoring, setbacks, irrigation schedules, etc. that will result in protection of public health and the environment. Please refer to *NMED Ground Water Quality Bureau Guidance: Above-Ground Use of Reclaimed Domestic Wastewater* for further information. A copy of the guidance document is available on the NMED website www.nmenv.state.nm.us under "Ground Water Quality".

The process description and schematic of the Facility are located in Appendix B (February 16, 2012 Discharge Permit Application for the TA-50 RLWTF). Waste streams are characterized by RLW generators using acceptable EPA characterization methods (sampling and analysis, acceptable knowledge, or both); this characterization data is entered by the generator onto a Waste Profile Form (WPF). The WPF is reviewed by a Waste Management Coordinator, a RCRA subject-matter expert, and RLWTF staff. The waste stream is acceptable for discharge to and treatment at the RLWTF if reviewers approve the WPF.

Influent samples are periodically collected and analyzed at the RLWTF for inorganic and radioactive constituents, as a waste characterization overcheck. Samples of low-level RLW influent are also periodically submitted to an outside chemistry laboratory for analysis of organic constituents.

Generators of low-level RLW prepare and submit a WPF. Once the WPF is approved, the generator is approved to discharge the RLW as generated via the low-level collection system.

If the low-level RLW is to be sent to the RLWTF via truck, the generator must also prepare and submit a Waste Disposal Request form. The Waste Disposal Request is reviewed by a Waste Management Coordinator, transportation, and RLWTF personnel. The shipment is acceptable for transport to the RLWTF if reviewers approve the Waste Disposal Request.

Generators of transuranic RLW also prepare and submit a WPF. In this case, the generator must sample and analyze each batch of transuranic RLW, then submit a request to the RLWTF to transfer that batch to the RLWTF. If analytical results are acceptable, a date and time for transfer is agreed upon. The transfer is controlled by RLWTF personnel who direct TA-55 personnel when to unlock and open the transfer valves; they monitor the level of the acid

waste or caustic waste tank as the transfer is in progress. The TA-55 personnel are directed when to close and lock transfer valves. Transfer valves remain closed and locked until authorized by RLWTF to be opened.

Detailed operating procedures are required for each treatment unit. Procedures are drafted by operators and engineers, then reviewed and approved by safety personnel and management. Before becoming effective, procedures must also be walked down and verified by operators (e.g., valve numbers and sequences). Approved procedures are controlled documents, available at a controlled document website.

Detailed operating procedures follow a mandatory outline, which currently has the following required topics:

- safety and controls
- prerequisite actions (prior to startup)
- detailed operating instructions
- administrative sections such as introduction, definitions, acronyms, references, and record keeping

Detailed operating sections provide step-by-step instructions for operating the treatment equipment, and identify valves by valve number (valves within the facility are labeled), electrical switches by number (electrical components are labeled), and the sequence for opening and closing valves and starting and stopping equipment (e.g., mixers, pumps).

The table below lists procedures currently used for treatment operations at the RLWTF. (The list varies over time, but procedures always exist for each unit operation.)

Operators also inspect equipment each operating day, both informally (as they operate equipment) and formally (as documented on daily inspection round sheets). Inspections include tank level checks, pump operability, alarm tests (horns and lights), leak inspections, levels of combustibles and wastes, and other items. Results of the formal inspections are reviewed with and signed off by management, and corrective maintenance work orders are initiated for deficiencies.

RLWTF Detailed Operating Procedures

Unit Operation	Detailed Operating Procedures
Main Treatment:	
M1 Collection System	Annual Inspection of the RLW Collection System Vaults
M2 Influent Storage	RLWTF Tank Management Sampling at the RLWTF
M3 Emergency Influent Storage	WMRM Facility Status Change WMRM System Alignment Checklist Sampling WMRM Tanks Transferring RLW Form WMRM to RLWTF
M4 Reaction Tanks ~~Clarifiers~~	TK71 Operations TK72 Operations System Alignment Checklist for Reaction Tanks ~~Clarifiers, Gravity Filter, and Gravity Filter Bypass~~ ~~Clarifier Chemicals and NaOH Operations~~
M5 Microfilter ~~Gravity Filter~~	Microfilter Operations System Alignment Checklist for the Microfilter ~~Clarifiers, Gravity Filter, and Gravity Filter Bypass~~
M6 Pressure Filters	Pressure Filter Operations System Alignment Checklist for Pressure Filter Operations
M7 Perchlorate Ion Exchange	Re-Configure Flow Path through the IX Columns in Room 16
M8 Primary Reverse Osmosis	Reverse Osmosis Clean-in-Place System Membrane Maintenance
M9 Polishing Ion Exchange	System Alignment Checklist for RLWTF Effluent Disposition Ion Exchange Treatment of RLWTF Effluent
M10 Effluent Storage	System Alignment Checklist for RLWTF Effluent Disposition
M11 Solar Evaporation at TA-52	ZLD Facility Status Change Transferring Effluent: RLW to ZLD Tanks Sampling ZLD Tanks Transferring Effluent: ZLD Tanks to WMRM

M11 Outfall #051	Frac Tank Operations and Discharge of TK38 TK38 Operations
Transuranic:	
T1 Collection System	WM-201/66/107 System Alignment Checklist Transuranic RLW Transfers from TA-55 to TA-50
T2 Influent Storage	Sampling of the WM66 Influent Tanks
T3 Treatment	Room 60/60A System Alignment Checklist Acid Waste Treatment Caustic Waste Treatment Operations Back flushing the Pressure Filter
T4 Drum Tumbling	Sampling TK-7A, Sludge Mixing, and Sludge Rinsing Water Addition to TK-7A Drum Tumbler Operations
T5 Effluent Storage	Transferring Material from TK3 to the 3K Tank
Secondary Treatment:	
S1 Secondary Reverse Osmosis	Secondary RO Operations Secondary RO Cleaning and Maintenance
S2 Rotary Vacuum Filter	Vacuum Filter System
S3 Bottoms Storage	Sampling TK-SE Loading Evaporator Bottoms into a Tanker

☐ Operational plan is attached.

☐ Operational plan was previously submitted. Submittal date(s): _____

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M4 Reaction Tanks	TK71 Operations TK72 Operations System Alignment Checklist for Reaction Tanks
M5 Microfilter	Microfilter Operations System Alignment Checklist for the Microfilter
M6 Pressure Filters	Pressure Filter Operations System Alignment Checklist for Pressure Filter Operations
M7 Perchlorate Ion Exchange	Re-Configure Flow Path through the IX Columns in Room 16
M8 Primary Reverse Osmosis	Reverse Osmosis Clean-in-Place System Membrane Maintenance
M9 Polishing Ion Exchange	System Alignment Checklist for RLWTF Effluent Disposition Ion Exchange Treatment of RLWTF Effluent
M10 Effluent Storage	System Alignment Checklist for RLWTF Effluent Disposition
M11 Solar Evaporation at TA-52	ZLD Facility Status Change Transferring Effluent: RLW to ZLD Tanks Sampling ZLD Tanks Transferring Effluent: ZLD Tanks to WMRM
M11 Outfall #051	Frac Tank Operations and Discharge of TK38 TK38 Operations

Transuranic:	
T1 Collection System	WM-201/66/107 System Alignment Checklist Transuranic RLW Transfers from TA-55 to TA-50
T2 Influent Storage	Sampling of the WM66 Influent Tanks
T3 Treatment	Room 60/60A System Alignment Checklist Acid Waste Treatment Caustic Waste Treatment Operations Back flushing the Pressure Filter
T4 Drum Tumbling	Sampling TK-7A, Sludge Mixing, and Sludge Rinsing Water Addition to TK-7A Drum Tumbler Operations
T5 Effluent Storage	Transferring Material from TK3 to the 3K Tank
Secondary Treatment:	
S1 Secondary Reverse Osmosis	Secondary RO Operations Secondary RO Cleaning and Maintenance
S2 Rotary Vacuum Filter	Vacuum Filter System
S3 Bottoms Storage	Sampling TK-SE Loading Evaporator Bottoms into a Tanker

☐ Operational plan is attached.

☐ Operational plan was previously submitted. Submittal date(s): _____

ENCLOSURE 3

Supplemental Information, DP-1132 Application

Revised RLWTF Processes and Units—Appendix B – Redline

Revised RLWTF Processes and Units—Appendix B – Final

ENV-RCRA-12-0173

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Date: AUG 1 0 2012

Appendix B – TA-50 RLWTF Processes and Units

The Radioactive Liquid Waste Treatment Facility (RLWTF) consists of: (a) an underground collection system that conveys water to Technical Area (TA) 50 from generators at LANL, (b) structures at TA-50, and (c) the Zero Liquid Discharge Solar Evaporation Tanks at TA-52. At TA- 50, Building 50-01 is the primary structure; it houses treatment equipment, process tanks, analytical laboratories, and offices. Adjacent TA-50 structures primarily provide for additional water storage: ~~50-02 (influent),~~ 50-66 (influent), ~~50-90 (influent)~~, 50-248 (secondary waters), and 50-250 (influent and emergency~~emergency~~).

The RLWTF receives and treats radioactive liquid waste (RLW) from generators at Los Alamos National Laboratory. RLW includes small volumes, less than one percent of total influent, that are also characteristically hazardous for corrosivity, which are treated using elementary neutralization. The RLWTF has (1) a main treatment process for low-level RLW, (2) a process for treating transuranic RLW, and (3) a secondary treatment process for waste streams from both the low-level and transuranic processes. The units within each of these process lines are summarized in Table 1 and described in the paragraphs that follow. Table 2 provides additional information for each unit operation, including location, treatment and storage vessels, construction materials, and sizes.

Table 1: Summary of RLWTF Treatment Units

Unit Operation	Location
Main Treatment:	
M1 Collection System	TA-03, 35, 48, 50, 55, 59
M2 Influent Storage	~~50-02, 50-90~~ TA-50-250
M3 Emergency Influent Storage	50-250
M4 Reaction Tanks ~~Clarifiers~~	50-01
M5 Microfilter ~~Gravity Filter~~	50-01
M6 Pressure Filters	50-01
M7 Perchlorate Ion Exchange	50-01
M8 Primary Reverse Osmosis	50-01
M9 ~~Polishing~~ Cu-Zn Ion Exchange	50-01
M10 Effluent Storage	50-01, ~~50-02~~
M11 Effluent Evaporator	50-257
M11 ~~Zero Liquid Discharge~~ Solar Evaporation ~~Tanks~~	TA-52
M11 NPDES Outfall #051	Mortandad Canyon
Transuranic:	
T1 Collection System	TA-50, TA-55
T2 Influent Storage	50-66
T3 Treatment	50-01
T4 Drum Tumbling	50-01
T5 Effluent Storage	50-01
Secondary Treatment:	
S1 Secondary Reverse Osmosis	50-01
S2 Rotary Vacuum Filter	50-01
S3 Bottoms Disposal	50-248

MAIN TREATMENT PROCESS

The main treatment process consists of influent collection and storage, the treatment of low-level RLW, and the discharge of treated water to the environment. ~~Treatment~~ Process steps include treatment with chemicals in a reaction tank ~~clarification~~, filtration, ion exchange, and reverse osmosis. Discharge to the environment is via NPDES Outfall #051, solar evaporation at the TA-52 Zero Liquid Discharge (ZLD) Solar Evaporation Tanks, or ~~mechanical~~ evaporation using natural gas at TA-50-257. Two secondary streams are generated by primary treatment, sludge and reverse osmosis concentrate; they are sent to the secondary treatment process.

M1. Radioactive Liquid Waste Collection System

The majority of RLW is transferred by direct pipeline between generator facilities and the RLWTF. The remaining RLW, typically less than 1,000 gallons per month, is transferred from small generators via truck. The pipeline system, installed in 1982, connects the TA-50 RLWTF to buildings in six TAs using approximately four miles of underground piping. Piping is essentially an underground pipeline within a pipeline. Primary piping is six- or eight-inch-diameter polyethylene encased within 10- or 12-inch polyethylene secondary piping. The primary piping transitions to stainless steel in each of the 62 underground valve stations (also referred to as vaults), then back to polyethylene. ~~Underground v~~Vaults are equipped with leak detection sensors that are linked electronically to the RLWTF control room.

M2. Influent Storage

Influent flows from vault 50-72 through an underground, double-walled pipe, into two influent storage tanks in ~~the neutralization tank (TK-13) in Room 16 of TA-50-01, and then beneath the RLWTF into the influent tanks at~~ the basement of the Waste Management and Risk Mitigation (WMRM) Facility (50-250) ~~building 50-02~~. ~~There are two influent tanks, an in-ground concrete vessel with a capacity of 75,000 gallons, and a 17,000-galllon steel vessel set within a below-grade concrete containment vault.~~ Both are fiberglass, and each has a capacity of 50,000 gallons. ~~Influent may also be stored in Structure 50-90, which is an above-ground steel vessel with secondary containment and a capacity of 100,000 gallons. Low-level influent may be subjected to pH adjustment and/or oxidation. Typically, sodium hydroxide (25% solution) is used to adjust the influent pH; chemicals such as sodium permanganate may be used for oxidation. These two steps may be carried out in the neutralization tank, or the chemicals may be added directly to the influent tanks.~~ Influent is fed to the low-level treatment process in Building 50-01 via another underground, double-walled pipe.

M3. Emergency Influent Storage

Building 50-250, the Waste Management and Risk Mitigation (WMRM) facility, is located about 50 meters southeast of Building 50-01. WMRM houses six ~~emergency~~ influent storage tanks with a capacity of 50,000 gallons each; four of these are held in reserve for use in emergency situations. ~~Low-level influent can be shunted to these fiberglass tanks at vault 50-72, upstream of the 17K and 75K influent storage~~

~~tanks.~~ WMRM is a steel frame structure designed to withstand seismic, wind, and snow load criteria. The concrete basement houses the two influent and six emergency storage tanks, and acts as secondary containment. Tanks would receive influent by gravity flow from WM-72.

M4. Reaction Tanks ~~Clarifiers~~

Influent is mixed with treatment chemicals in the reaction tanks, TK71 and TK72, to remove insoluble constituents, including more than 90% of the radioactivity. There are two reaction tanks. Both are above-grade, carbon-steel vessels, ~10,000 gallons each. Influent and chemicals enter from above; the tank mixer brings the streams into contact. Chemicals such as sodium hydroxide, ferric sulfate, and magnesium sulfate are typically added to adjust pH, precipitate metals, and promote particle growth. Contaminants precipitate as sludge, which is kept in suspension by the tank mixer. The sludge-water mixture is fed to the next treatment step, the microfilter. ~~The clarifier acts as the workhorse of the Main Treatment Plant, removing insoluble constituents, including more than 90% of the radioactivity. There are two concrete clarifiers. Each is 20 feet in diameter with a working volume of about 20,000 gallons, and each is designed to operate at 120 gallons per minute. Influent and chemicals enter from above through a flash mixer into a center well. (Chemicals such as ferric sulfate and magnesium sulfate are added at the clarifier, to promote particle growth and to adjust pH.) Contaminants precipitate as sludge, which settles to the bottom of the clarifier. Treated waters flow to the bottom of the center well, rise in the outer portion of the clarifier, and overflow to the gravity filter. Sludge is periodically removed to TK8 for subsequent treatment in the rotary vacuum filter.~~

M5. Microfilter ~~Gravity~~ Filter

From the reaction tanks, treated influent is pumped to a microfilter to separate sludge from water. The microfilter employs polyvinylidene fluoride, or PVDF, membranes to separate solids from water. The membranes can withstand pH ranges from 0-14, are non-plugging, and are chlorine resistant; they remove particles as small as 0.1 micron, and can handle feed streams with up to 5% solids. A fully automatic backpulse of air periodically sends a reverse flow of filtrate across the membrane, dislodging contaminants and moving solids to the sludge tank. A clean-in-place system enables the periodic cleaning of membranes using acids, bases, or bleach.

Filtrate from the microfilter is fed to TK9, and from TK9 to either perchlorate ion exchange or~~f~~ the primary reverse osmosis unit. Sludge from the microfilter is periodically removed to TK8 for subsequent treatment in the rotary vacuum filter.

~~The dual media gravity filter is used to remove suspended solids in overflow water from the clarifier. The gravity filter contains two filtration cells of 45 square feet each. The filter bed consists of layers of anthracite, sand, and gravel resting on an underdrain grate. Water flows by gravity into the top and exits at the bottom of the bed. Backwashing is needed periodically to remove solids and to reconstitute the~~

~~bed. When properly maintained and operated, the gravity filter removes particles down to 10 microns in size. The gravity filter is sized to process up to 250 gallons of water per minute.~~

M6. Pressure Filters

Three pressure media filters, which operate in parallel or singly, can be used to remove suspended solids in water in the reaction tanks ~~from either the clarifier or the gravity filter~~. Water is pumped from either ~~two feed tanks,~~ TK71 or ~~and~~ TK72, through the media in an enclosed steel vessel at a pressure of about 30 psig. ~~Feed tanks are above-grade, carbon-steel vessels, ~10,000 gallons each~~. Pressure filters are 30 inches in diameter and ~five feet high, and are constructed of carbon steel lined with plasite (an epoxy). The media in the pressure filter consists of coarse and fine sized particles of sand, garnet, coal, and gravel. Backwashing is needed periodically to remove solids and to reconstitute the bed. Each filter can process up to 50 gallons per minute.

M7. Perchlorate Ion Exchange

Ion-exchange columns located in Room 16 are used to remove perchlorates. Six of the 12 fiberglass reinforced plastic (FRP) ion exchange vessels are typically in service. Vessels range in size to nine cubic feet of ion exchange resin, and can treat up to 60 gallons of water per minute. The columns are installed downstream of TK9, and prior to treatment by the Reverse Osmosis. TK9 is a 9000-gallon, carbon-steel, above-grade vessel located in Room 61. Resins are not re-generated. Instead, columns are drained of water, then disposed as solid radioactive waste.

M8. Primary Reverse Osmosis

The Reverse Osmosis unit removes soluble contaminants, and produces a high quality effluent that approaches and sometimes meets EPA primary drinking water standards. The Reverse Osmosis unit uses commercially available high-rejection membranes, typically rated at nominal NaCl rejection of 90-99%. The unit has three 8-inch-diameter pressure vessels, and operates at pressures of about 400 psig. Each pressure vessel contains four membranes in series; each membrane is 40 inches in length. The Reverse Osmosis is a two-stage membrane unit; the third pressure vessel receives reject from the first two. Feed may first be pH-adjusted at the perchlorate ion exchange feed tank, TK-9. Permeate is sent to storage tanks in Room 34B; concentrate is ~~either recycled to the 75K influent storage tank, or~~ is processed through the secondary Reverse Osmosis unit. The primary Reverse Osmosis has a capacity up to 60 gallons per minute.

M9. Copper-Zinc Ion Exchange

NPDES Permit effluent limits for the discharge of treated water to NPDES Outfall #051 in Mortandad Canyon became more restrictive on 08-01-2010. As a result of acute aquatic life water quality standards being applied to ephemeral streams, discharge limits for copper and zinc were decreased to levels more than 2,000 times lower than EPA's secondary drinking water standards. In order to meet these new effluent limits, an ion exchange system was installed to polish permeate from the primary Reverse

Osmosis unit. The system consists of two banks; each bank has five 3.5-cubic foot fiberglass. The ion exchange system draws water from one of the Frac tanks that holds Reverse Osmosis permeate, pumps the water through one, or if needed, both ion exchange banks, and then into TK38. Resins are not re-generated. Instead, columns are drained of water, then disposed as solid radioactive waste.

M10. Effluent Storage

~~Five~~Three tanks are available for the storage of treated water. Two Frac tanks (north tank and south tank) receive permeate from the primary reverse osmosis unit. Frac tanks are horizontal carbon steel tanks located in Room 34B; each has a capacity of ~20,000 gallons. Water that receives post-Reverse Osmosis treatment (i.e., copper-zinc ion exchange) is collected in a 1000-gallon tank, TK38 in Room 38.~~,~~ TK38 is constructed of high-density polyethylene. ~~Two additional storage tanks (WM2-N and WM2-S) are located in Building 50-02. These are below-grade concrete tanks with a nominal capacity of 25,000 gallons each.~~

M11. Discharge of Treated Water to the Environment

11a. Discharge Via ~~Mechanical~~ Effluent Evaporator ~~at TA-50-257~~ Using Natural Gas

Treated water may be discharged to the environment via an effluent ~~thermal~~ evaporator located outside Room 34 of Building 50-01. Water is heated using natural gas in a 4.5 million Btu/hr low NOx gas burner that can evaporate up to 400 gallons of water per hour. The unit is constructed of stainless steel, and has received a No Permit Required Determination from the NMED Air Quality Bureau.

11b. Discharge Via ~~Zero Liquid Discharge~~ Solar Evaporation ~~Tanks at TA52~~

Zero-Liquid-Discharge Solar Evaporation Tanks for solar evaporation of treated water are currently being constructed. The tanks are located on a site of approximately one acre, about two-thirds of a mile from the TA-50 RLWTF within TA-52 at LANL. The Zero Liquid Discharge Solar Evaporation Tanks have concrete walls approximately four feet high, and have a double liner with leak detection; each is approximately 70' x 250' in size, with a usable capacity of about 380,000 gallons. The pump house has the capability of returning the contents of the tanks to the TA-50 RLWTF for storage and retreatment, if necessary. Approximately 3500 feet of high-density polyethylene (HDPE) transfer piping connect the Zero Liquid Discharge Solar Evaporation Tanks and the TA-50 RLWTF.

11c. Discharge Via NPDES Outfall #051

Treated water that meets NPDES and DOE discharge standards can be discharged to the environment via NPDES Permitted Outfall #051 in Mortandad Canyon. Water is pumped to the outfall through approximately 1400 feet of three-inch-diameter, carbon steel pipe. NPDES samples are collected at TA-50 while water is discharging to the canyon.

TRANSURANIC TREATMENT PROCESS

Transuranic RLW treatment consists of influent collection and storage, treatment of the transuranic RLW, and sludge treatment. Treated water is not discharged; it either receives additional treatment (secondary reverse osmosis) or is sent to storage tanks in Building 50-248 for disposition as bottoms. Sludge from the treatment process is concentrated, solidified with cement, and shipped to the Waste Isolation Pilot Plant (WIPP) as a solid transuranic waste.

T1. Transuranic Collection System

The transuranic collection system runs from Building 55-04 through below-grade, double-contained transfer lines, through a valve pit ~~and vault~~ at 50-201, and into influent storage tanks at Building 50-66. One transfer line is dedicated for acid waste, and a second for caustic waste. Both are two-inch-diameter pipes. The acid waste lines are constructed of polyvinylidene fluoride (PVDF); the caustic lines are constructed of polypropylene (PP).

~~TRU wastewater is not freely drained to the RLWTF. Instead,~~ TA55 and RLWTF personnel coordinate batch wastewater transfers in advance. Once a transfer is coordinated, a batch of known volume, typically less than 100 gallons, is discharged through the system by gravity to the TRU influent storage tanks in Building 50-66. Transuranic influent is not trucked.

T2. Transuranic Influent Storage

Two influent storage tanks are located in Building 50-66, one for acid waste (~3900 gallons) and the other for caustic waste (~3000 gallons). Each tank has enough capacity to hold more than ~~two~~ one year~~s~~ of transuranic influent. Both tanks are cylindrical, cone-bottomed tanks, and each has a mixer~~,~~ and a HEPA-filtered vent. The sump in Building 50-66 has a leak detector that is linked to the RLWTF control room.

T3. Transuranic Treatment

Acid waste is pumped from Building 50-66 into TK1 in Room 60. The acid waste is neutralized by mixing it with liquid sodium hydroxide (nominal 25%). ~~C~~Other chemicals (ferric sulfate or polymer) may be added to promote particle growth. Solids that form in the neutralized waste settle, and are then pumped to the sludge tank, TK-7A. Clear liquid is pumped through a pressure filter into a receiving tank, TK3.

Caustic waste is pumped from Building 50-66 to Tank TK1 in Room 60, and then into the sludge-settling tank, TK-7A. The treated caustic waste is allowed to stand in the tank, which allows most of the solid particles to deposit on the bottom of the tank as sludge. In order to facilitate particle growth, TK-7A may be seeded with sludge left over from the previous treatment campaign. Chemicals (lime, ferric sulfate, or polymer) may also be added to TK-7A for this purpose.

T4. Transuranic Sludge

Sludge collects in TK-7A, a 900-gallon carbon-steel tank in Room 60. Excess water is decanted from TK-7A, then transferred to the effluent storage tank, TK3. The sludge itself is added to cement and sodium silicate, then tumbled and allowed to cure. After curing, drums of cemented sludge are transported to TA-54 to await shipment to and disposal at the Waste Isolation Pilot Plant as a solid transuranic waste.

T5. Transuranic Effluent

Effluent from the transuranic treatment process is collected in TK3 in Room 60, a 1000-gallon, horizontal fiberglass tank. Having been treated, effluent is no longer transuranic waste. The effluent either receives additional treatment (secondary reverse osmosis) or is sent to storage tanks in Building 50-248 for disposition as bottoms.

SECONDARY TREATMENT PROCESSES

The secondary treatment process treats wastes from the primary and transuranic treatment lines. It consists of a rotary vacuum filter to treat sludge from main process, secondary reverse osmosis to treat reverse osmosis concentrate from the main process and/or effluent from the transuranic process, and a bottoms disposal step. Wastes from the secondary treatment process are disposed as low-level radioactive solid waste.

S1. Secondary Reverse Osmosis

These two Reverse Osmosis units, each with a capacity of up to five gallons per minute, recover much of the concentrate from the primary Reverse Osmosis unit, thereby reducing the volume of bottoms that must be disposed of. Effluent from the transuranic process may also be treated. Secondary Reverse Osmosis units use commercially available high-rejection membranes, typically rated at nominal NaCl rejection of 90-99%. The units have two 4-inch-diameter pressure vessels, and operate at pressures of about ~~3~~200 psig. Each pressure vessel has a single membrane 40 inches in length. They are two-stage membrane units; the second pressure vessel receives reject from the first. Concentrate from the primary Reverse Osmosis unit is collected in TK73 (3700 gallons, lined steel), then fed to a smaller feed tank (300 gallons, polyethylene) in Room 24, adjacent to the secondary Reverse Osmosis (SRO) units. Permeate from the SRO is sent to the feed tank for the perchlorate ion exchange system (TK9), for re-treatment through the MTP. Reject is sent to storage tanks in Building 50-248 to await shipment as bottoms.

S2. Rotary Vacuum Filter

Solids ~~that settle to the bottom of the MTP clarifier~~ frm the microfilter (or pressure filters) are separated from water and then disposed as low-level radioactive solid waste. This sludge treatment operation includes the TK8 storage tank (capacity of 8,000 gallons) in Room 61 and the rotary vacuum filter in

Room 116. Low-level sludge contains more than 90% of the radioactivity present in low-level influent; it does not contain hazardous chemical constituents above RCRA limits, and is not a mixed waste.

S3. Bottoms ~~Disposal~~Storage

RLWTF bottoms are stored in tanks in Building 50-248 until shipped to a commercial waste treatment facility using a commercial tanker truck; shipments typically range from 4,000 to 5,000 gallons each. The commercial waste treatment facility processes bottoms to a solid form, and disposes of the solids as low-level radioactive waste at a Department of Energy or commercial disposal site.

Table 2: Vessel Information for RLWTF Treatment Units

Unit Operation	Vessel	Capacity (gallons)	Material	Above (A) Below (B)	Secondary Containment	Note
Main Treatment:						
M1 Collection System	Piping	----	Polyethylene	B	Polyethylene	
	Vaults (62)	----	Concrete	B	----	x
M2 Influent Storage	~~W5~~WMRM Tanks (2)	50,000	Fiberglass	B	Concrete	z
	~~TK13~~	~~400~~	~~Stainless Steel~~			
	~~W6~~	~~50,000~~	~~Fiberglass~~	~~B~~	~~Concrete~~	
	~~17K tank~~	~~17,000~~	~~Steel~~			
	~~75K tank~~	~~75,000~~	~~Concrete~~	B	----	
	~~100K tank~~	~~100,000~~	~~Steel~~	A	Concrete	
M3 Emergency Influent Storage	WMRM tanks (4 ~~6~~)	50,000	Fiberglass	B	Concrete	z
M4 Reaction Tanks	TK71, TK72	10,000	Steel	A	Concrete-w	~~v,~~ z
~~Clarifiers~~	~~Clarifiers (2)~~	~~26,000~~	~~Concrete~~			
M5 Microfilter	Filter	40	Steel	A	Concrete-w	
~~Gravity Filter~~	Sludge tank	500	Polyethylene	A	Concrete-w	
	Cleaning tanks	200	Polyethylene	A	Concrete-w	z,
	~~Gravity Filter~~	~~7,000~~	~~Concrete~~	~~A~~	~~Concrete~~	v
M6 Pressure Filters	Filters (3)	100	Lined Steel	A	Concrete-w	z
	TK71, TK72	10,000	Steel	A	Concrete-w	z
M7 Perchlorate Ion Exchange	Ion Exchange Vessels(12)	50	Fiberglass	A	Concrete-w	z
	TK09	10,000	Steel	A	Concrete-w	
M8 Primary Reverse Osmosis	RO Vessel	40	Steel	A	Concrete-w	
M9 ~~Polishing~~ Cu-Zn Ion Exchange	Ion Exchange Columns (10)	200	Fiberglass	A	Concrete-w	
M10 Effluent Storage	N. Frac, S. Frac	20,000	Steel	A	Concrete-w	z
	TK-38	1,000	HDPE	A	Concrete-w	
	~~WM2-N, WM2-S~~	~~25,000~~	~~Concrete~~	~~B~~	~~----~~	~~z~~
M11 Effluent Evaporator	----	1,200	Stainless Steel	A	Hypalon, Asphalt	
M11 Solar Evaporation ~~at TA-52~~	E. Tank, W. Tank	380,000	HDPE	A	HDPE, Concrete	z
M12 NPDES Outfall #051	----	----	----	B	----	y

Notes:

v: Two concrete bottom slabs, with compacted tuff between.

w: Floor of Building 50-01, with floor drains, provides secondary containment.

x: Vaults provide secondary containment.

y: Pipe is below grade; the outfall is at the surface.

z: Capacity is for each vessel.

Table 2: Vessel Information for RLWTF Treatment Units (Continued)

Unit Operation	Vessel	Capacity (gallons)	Material	Above (A) Below (B)	Secondary Containment	Note
Transuranic:						
T1 Collection System	Piping	----	PVDF , PP	B	PVDF, PP	
T2 Influent Storage	Acid Tank	3,900	Steel	B	Concrete	
	Caustic Tank	3,000	Steel	B	Concrete	
T3 Treatment	TK1	900	Steel	A	Concrete-w	
	TK2	800	Fiberglass	A	Concrete-w	
T4 Drum Tumbling	TK-7A	900	Steel	A	Concrete-w	
T5 Effluent Storage	TK3	1,000	Fiberglass	A	Concrete-w	
Secondary Treatment:						
S1 Secondary Reverse Osmosis	RO Vessel	10	Fiberglass	A	Concrete-w	
	~~TK2401~~ TK25	300	Polyethylene	A	Concrete-w	
	TK73	3,700	Steel	A	Concrete-w	
S2 Rotary Vacuum Filter	Rotary Vacuum Filter	900	Stainless Steel	A	Concrete-w	
	TK8	8,000	Steel	A	Concrete-w	
S3 Bottoms Storage	TK-NE, SE, SW, NW	20,000	Steel	A	Concrete	z
	3K tank	3,000	Steel	A	Concrete	
	17k tank	17,000	Steel	A	Concrete	

Notes:

w: Floor of Building 50-01, with floor drains, provides secondary containment.

Z: Capacity is for each vessel.

Appendix B – TA-50 RLWTF Processes and Units

The Radioactive Liquid Waste Treatment Facility (RLWTF) consists of: (a) an underground collection system that conveys water to Technical Area (TA) 50 from generators at LANL, (b) structures at TA-50, and (c) the Zero Liquid Discharge Solar Evaporation Tanks at TA-52. At TA- 50, Building 50-01 is the primary structure; it houses treatment equipment, process tanks, analytical laboratories, and offices. Adjacent TA-50 structures primarily provide for additional water storage: 50-66 (influent), 50-248 (secondary waters), and 50-250 (influent and emergency).

The RLWTF receives and treats radioactive liquid waste (RLW) from generators at Los Alamos National Laboratory. RLW includes small volumes, less than one percent of total influent, that are also characteristically hazardous for corrosivity, which are treated using elementary neutralization. The RLWTF has (1) a main treatment process for low-level RLW, (2) a process for treating transuranic RLW, and (3) a secondary treatment process for waste streams from both the low-level and transuranic processes. The units within each of these process lines are summarized in Table 1 and described in the paragraphs that follow. Table 2 provides additional information for each unit operation, including location, treatment and storage vessels, construction materials, and sizes.

Table 1: Summary of RLWTF Treatment Units

Unit Operation	Location
Main Treatment:	
M1 Collection System	TA-03, 35, 48, 50, 55, 59
M2 Influent Storage	TA-50-250
M3 Emergency Influent Storage	50-250
M4 Reaction Tanks	50-01
M5 Microfilter	50-01
M6 Pressure Filters	50-01
M7 Perchlorate Ion Exchange	50-01
M8 Primary Reverse Osmosis	50-01
M9 Cu-Zn Ion Exchange	50-01
M10 Effluent Storage	50-01,
M11 Effluent Evaporator	50-257
M11 Solar Evaporation	TA-52
M11 NPDES Outfall #051	Mortandad Canyon
Transuranic:	
T1 Collection System	TA-50, TA-55
T2 Influent Storage	50-66
T3 Treatment	50-01
T4 Drum Tumbling	50-01
T5 Effluent Storage	50-01
Secondary Treatment:	
S1 Secondary Reverse Osmosis	50-01
S2 Rotary Vacuum Filter	50-01
S3 Bottoms Disposal	50-248

MAIN TREATMENT PROCESS

The main treatment process consists of influent collection and storage, the treatment of low-level RLW, and the discharge of treated water to the environment. Process steps include treatment with chemicals in a reaction tank, filtration, ion exchange, and reverse osmosis. Discharge to the environment is via NPDES Outfall #051, solar evaporation at the TA-52 Zero Liquid Discharge (ZLD) Solar Evaporation Tanks, or evaporation using natural gas at TA-50-257. Two secondary streams are generated by primary treatment, sludge and reverse osmosis concentrate; they are sent to the secondary treatment process.

M1. Radioactive Liquid Waste Collection System

The majority of RLW is transferred by direct pipeline between generator facilities and the RLWTF. The remaining RLW, typically less than 1,000 gallons per month, is transferred from small generators via truck. The pipeline system, installed in 1982, connects the TA-50 RLWTF to buildings in six TAs using approximately four miles of underground piping. Piping is essentially an underground pipeline within a pipeline. Primary piping is six- or eight-inch-diameter polyethylene encased within 10- or 12-inch polyethylene secondary piping. The primary piping transitions to stainless steel in each of the 62 underground valve stations (also referred to as vaults), then back to polyethylene. Vaults are equipped with leak detection sensors that are linked electronically to the RLWTF control room.

M2. Influent Storage

Influent flows from vault 50-72 through an underground, double-walled pipe, into two influent storage tanks in the basement of the Waste Management and Risk Mitigation (WMRM) Facility (50-250). Both are fiberglass, and each has a capacity of 50,000 gallons. Influent is fed to the low-level treatment process in Building 50-01 via another underground, double-walled pipe.

M3. Emergency Influent Storage

Building 50-250, the Waste Management and Risk Mitigation (WMRM) facility, is located about 50 meters southeast of Building 50-01. WMRM houses six influent storage tanks with a capacity of 50,000 gallons each; four of these are held in reserve for use in emergency situations. WMRM is a steel frame structure designed to withstand seismic, wind, and snow load criteria. The concrete basement houses the two influent and six emergency storage tanks, and acts as secondary containment. Tanks would receive influent by gravity flow from WM-72.

M4. Reaction Tanks

Influent is mixed with treatment chemicals in the reaction tanks, TK71 and TK72, to remove insoluble constituents, including more than 90% of the radioactivity. There are two reaction tanks. Both are above-grade, carbon-steel vessels, ~10,000 gallons each. Influent and chemicals enter from above; the tank mixer brings the streams into contact. Chemicals such as sodium hydroxide, ferric sulfate, and magnesium sulfate are typically added to adjust pH, precipitate metals, and promote particle growth. Contaminants precipitate as sludge, which is kept in suspension by the tank mixer. The sludge-water mixture is fed to the next treatment step, the microfilter.

M5. Microfilter Filter

From the reaction tanks, treated influent is pumped to a microfilter to separate sludge from water. The microfilter employs polyvinylidene fluoride, or PVDF, membranes to separate solids from water. The membranes can withstand pH ranges from 0-14, are non-plugging, and are chlorine resistant; they remove particles as small as 0.1 micron, and can handle feed streams with up to 5% solids. A fully automatic backpulse of air periodically sends a reverse flow of filtrate across the membrane, dislodging contaminants and moving solids to the sludge tank. A clean-in-place system enables the periodic cleaning of membranes using acids, bases, or bleach.

Filtrate from the microfilter is fed to TK9, and then from TK9 to either perchlorate ion exchange or the primary reverse osmosis unit. Sludge from the microfilter is periodically removed to TK8 for subsequent treatment in the rotary vacuum filter.

M6. Pressure Filters

Three pressure media filters, which operate in parallel or singly, can be used to remove suspended solids in water in the reaction tanks. Water is pumped from either TK71 or TK72, through the media in an enclosed steel vessel at a pressure of about 30 psig. Pressure filters are 30 inches in diameter and ~five feet high, and are constructed of carbon steel lined with plasite (an epoxy). The media in the pressure filter consists of coarse and fine sized particles of sand, garnet, coal, and gravel. Backwashing is needed periodically to remove solids and to reconstitute the bed. Each filter can process up to 50 gallons per minute.

M7. Perchlorate Ion Exchange

Ion-exchange columns located in Room 16 are used to remove perchlorates. Six of the 12 fiberglass reinforced plastic (FRP) ion exchange vessels are typically in service. Vessels range in size to nine cubic feet of ion exchange resin, and can treat up to 60 gallons of water per minute. The columns are installed downstream of TK9, and prior to treatment by the Reverse Osmosis. TK9 is a 9000-gallon, carbon-steel, above-grade vessel located in Room 61. Resins are not re-generated. Instead, columns are drained of water, then disposed as solid radioactive waste.

M8. Primary Reverse Osmosis

The Reverse Osmosis unit removes soluble contaminants, and produces a high quality effluent that approaches and sometimes meets EPA primary drinking water standards. The Reverse Osmosis unit uses commercially available high-rejection membranes, typically rated at nominal NaCl rejection of 90-99%. The unit has three 8-inch-diameter pressure vessels, and operates at pressures of about 400 psig. Each pressure vessel contains four membranes in series; each membrane is 40 inches in length. The Reverse Osmosis is a two-stage membrane unit; the third pressure vessel receives reject from the first two. Feed may first be pH-adjusted at the perchlorate ion exchange feed tank, TK-9. Permeate is sent to storage tanks in Room 34B; concentrate is processed through the secondary Reverse Osmosis (SRO) unit. The primary Reverse Osmosis has a capacity up to 60 gallons per minute.

M9. Copper-Zinc Ion Exchange

NPDES Permit effluent limits for the discharge of treated water to NPDES Outfall #051 in Mortandad Canyon became more restrictive on 08-01-2010. As a result of acute aquatic life water quality standards being applied to ephemeral streams, discharge limits for copper and zinc were decreased to levels more than 2,000 times lower than EPA's secondary drinking water standards. In order to meet these new effluent limits, an ion exchange system was installed to polish permeate from the primary Reverse Osmosis unit. The system consists of two banks; each bank has five 3.5-cubic foot fiberglass. The ion exchange system draws water from one of the Frac tanks that holds Reverse Osmosis permeate, pumps the water through one, or if needed, both ion exchange banks, and then into TK38. Resins are not re-generated. Instead, columns are drained of water, then disposed as solid radioactive waste.

M10. Effluent Storage

Three tanks are available for the storage of treated water. Two Frac tanks (north tank and south tank) receive permeate from the primary reverse osmosis unit. Frac tanks are horizontal carbon steel tanks located in Room 34B; each has a capacity of ~20,000 gallons. Water that receives post-Reverse Osmosis treatment (i.e., copper-zinc ion exchange) is collected in a 1000-gallon tank, TK38 in Room 38. TK38 is constructed of high-density polyethylene.

M11. Discharge of Treated Water to the Environment

11a. Discharge Via Effluent Evaporator Using Natural Gas

Treated water may be discharged to the environment via an effluent evaporator located outside Room 34 of Building 50-01. Water is heated using natural gas in a 4.5 million Btu/hr low NOx gas burner that can evaporate up to 400 gallons of water per hour. The unit is constructed of stainless steel, and has received a No Permit Required Determination from the NMED Air Quality Bureau.

11b. Discharge Via Solar Evaporation

Zero-Liquid-Discharge Solar Evaporation Tanks for solar evaporation of treated water are currently being constructed. The tanks are located on a site of approximately one acre, about two-thirds of a mile from the TA-50 RLWTF within TA-52 at LANL. The Zero Liquid Discharge Solar Evaporation Tanks have concrete walls approximately four feet high, and have a double liner with leak detection; each is approximately 70' x 250' in size, with a usable capacity of about 380,000 gallons. The pump house has the capability of returning the contents of the tanks to the TA-50 RLWTF for storage and retreatment, if necessary. Approximately 3500 feet of high-density polyethylene (HDPE) transfer piping connect the Zero Liquid Discharge Solar Evaporation Tanks and the TA-50 RLWTF.

11c. Discharge Via NPDES Outfall #051

Treated water that meets NPDES and DOE discharge standards can be discharged to the environment via NPDES Permitted Outfall #051 in Mortandad Canyon. Water is pumped to the outfall through approximately 1400 feet of three-inch-diameter, carbon steel pipe. NPDES samples are collected at TA-50 while water is discharging to the canyon.

TRANSURANIC TREATMENT PROCESS

Transuranic RLW treatment consists of influent collection and storage, treatment of the transuranic RLW, and sludge treatment. Treated water is not discharged; it either receives additional treatment (secondary reverse osmosis) or is sent to storage tanks in Building 50-248 for disposition as bottoms. Sludge from the treatment process is concentrated, solidified with cement, and shipped to the Waste Isolation Pilot Plant (WIPP) as a solid transuranic waste.

T1. Transuranic Collection System

The transuranic collection system runs from Building 55-04 through below-grade, double-contained transfer lines, through a valve pit at 50-201, and into influent storage tanks at Building 50-66. One transfer line is dedicated for acid waste, and a second for caustic waste. Both are two-inch-diameter pipes. The acid waste lines are constructed of polyvinylidene fluoride (PVDF); the caustic lines are constructed of polypropylene (PP).

TA55 and RLWTF personnel coordinate batch wastewater transfers in advance. Once a transfer is coordinated, a batch of known volume, typically less than 100 gallons, is discharged through the system by gravity to the TRU influent storage tanks in Building 50-66. Transuranic influent is not trucked.

T2. Transuranic Influent Storage

Two influent storage tanks are located in Building 50-66, one for acid waste (~3900 gallons) and the other for caustic waste (~3000 gallons). Each tank has enough capacity to hold more than one year of transuranic influent. Both tanks are cylindrical, cone-bottomed tanks, and each has a mixer and a HEPA-filtered vent. The sump in Building 50-66 has a leak detector that is linked to the RLWTF control room.

T3. Transuranic Treatment

Acid waste is pumped from Building 50-66 into TK1 in Room 60. The acid waste is neutralized by mixing it with liquid sodium hydroxide (nominal 25%). Other chemicals (ferric sulfate or polymer) may be added to promote particle growth. Solids that form in the neutralized waste settle, and are then pumped to the sludge tank, TK-7A. Clear liquid is pumped through a pressure filter into a receiving tank, TK3.

Caustic waste is pumped from Building 50-66 to Tank TK1 in Room 60, and then into the sludge-settling tank, TK-7A. The treated caustic waste is allowed to stand in the tank, which allows most of the solid particles to deposit on the bottom of the tank as sludge. In order to facilitate particle growth, TK-7A may

be seeded with sludge left over from the previous treatment campaign. Chemicals (lime, ferric sulfate, or polymer) may also be added to TK-7A for this purpose.

T4. Transuranic Sludge

Sludge collects in TK-7A, a 900-gallon carbon-steel tank in Room 60. Excess water is decanted from TK-7A, then transferred to the effluent storage tank, TK3. The sludge itself is added to cement and sodium silicate, then tumbled and allowed to cure. After curing, drums of cemented sludge are transported to TA-54 to await shipment to and disposal at the Waste Isolation Pilot Plant as a solid transuranic waste.

T5. Transuranic Effluent

Effluent from the transuranic treatment process is collected in TK3 in Room 60, a 1000-gallon, horizontal fiberglass tank. Having been treated, effluent is no longer transuranic waste. The effluent either receives additional treatment (secondary reverse osmosis) or is sent to storage tanks in Building 50-248 for disposition as bottoms.

SECONDARY TREATMENT PROCESSES

The secondary treatment process treats wastes from the primary and transuranic treatment lines. It consists of a rotary vacuum filter to treat sludge from main process, secondary reverse osmosis to treat reverse osmosis concentrate from the main process and/or effluent from the transuranic process, and a bottoms disposal step. Wastes from the secondary treatment process are disposed as low-level radioactive solid waste.

S1. Secondary Reverse Osmosis

These two Reverse Osmosis units, each with a capacity of up to five gallons per minute, recover much of the concentrate from the primary Reverse Osmosis unit, thereby reducing the volume of bottoms that must be disposed of. Effluent from the transuranic process may also be treated. Secondary Reverse Osmosis units use commercially available high-rejection membranes, typically rated at nominal NaCl rejection of 90-99%. The units have two 4-inch-diameter pressure vessels, and operate at pressures of about 200 psig. Each pressure vessel has a single membrane 40 inches in length. They are two-stage membrane units; the second pressure vessel receives reject from the first. Concentrate from the primary Reverse Osmosis unit is collected in TK73 (3700 gallons, lined steel), then fed to a smaller feed tank (300 gallons, polyethylene) in Room 24, adjacent to the secondary Reverse Osmosis (SRO) units. Permeate

from the SRO is sent to the feed tank for the perchlorate ion exchange system (TK9), for re-treatment through the MTP. Reject is sent to storage tanks in Building 50-248 to await shipment as bottoms.

S2. Rotary Vacuum Filter

Solids from the microfilter (or pressure filters) are separated from water and then disposed as low-level radioactive solid waste. This sludge treatment operation includes the TK8 storage tank (capacity of 8,000 gallons) in Room 61 and the rotary vacuum filter in Room 116. Low-level sludge contains more than 90% of the radioactivity present in low-level influent; it does not contain hazardous chemical constituents above RCRA limits, and is not a mixed waste.

S3. Bottoms Storage

RLWTF bottoms are stored in tanks in Building 50-248 until shipped to a commercial waste treatment facility using a commercial tanker truck; shipments typically range from 4,000 to 5,000 gallons each. The commercial waste treatment facility processes bottoms to a solid form, and disposes of the solids as low-level radioactive waste at a Department of Energy or commercial disposal site.

Table 2: Vessel Information for RLWTF Treatment Units

Unit Operation	Vessel	Capacity (gallons)	Material	Above (A) Below (B)	Secondary Containment	Note
Main Treatment:						
M1 Collection System	Piping	----	Polyethylene	B	Polyethylene	
	Vaults (62)	----	Concrete	B	----	x
M2 Influent Storage	WMRM Tanks (2)	50,000	Fiberglass	B	Concrete	z
M3 Emergency Influent Storage	WMRM tanks (4)	50,000	Fiberglass	B	Concrete	z
M4 Reaction Tanks	TK71, TK72	10,000	Steel	A	Concrete-w	z
M5 Microfilter	Filter	40	Steel	A	Concrete-w	
	Sludge tank	500	Polyethylene	A	Concrete-w	
	Cleaning tanks	200	Polyethylene	A	Concrete-w	z
M6 Pressure Filters	Filters (3)	100	Lined Steel	A	Concrete-w	z
	TK71, TK72	10,000	Steel	A	Concrete-w	z
M7 Perchlorate Ion Exchange	Ion Exchange Vessels (12)	50	Fiberglass	A	Concrete-w	z
	TK09	10,000	Steel	A	Concrete-w	
M8 Primary Reverse Osmosis	RO Vessel	40	Steel	A	Concrete-w	
M9 Cu-Zn Ion Exchange	Ion Exchange Columns (10)	200	Fiberglass	A	Concrete-w	
M10 Effluent Storage	N. Frac, S. Frac	20,000	Steel	A	Concrete-w	z
	TK-38	1,000	HDPE	A	Concrete-w	
M11 Effluent Evaporator	----	1,200	Stainless Steel	A	Hypalon, Asphalt	
M11 Solar Evaporation	E. Tank, W. Tank	380,000	HDPE	A	HDPE, Concrete	z
M12 NPDES Outfall #051	----	----	----	B	----	y

Notes:

v: Two concrete bottom slabs, with compacted tuff between.
w: Floor of Building 50-01, with floor drains, provides secondary containment.
x: Vaults provide secondary containment.
y: Pipe is below grade; the outfall is at the surface.
z: Capacity is for each vessel.

Table 2: Vessel Information for RLWTF Treatment Units (Continued)

Unit Operation	Vessel	Capacity (gallons)	Material	Above (A) Below (B)	Secondary Containment	Note
Transuranic:						
T1 Collection System	Piping	----	PVDF , PP	B	PVDF, PP	
T2 Influent Storage	Acid Tank	3,900	Steel	B	Concrete	
	Caustic Tank	3,000	Steel	B	Concrete	
T3 Treatment	TK1	900	Steel	A	Concrete-w	
	TK2	800	Fiberglass	A	Concrete-w	
T4 Drum Tumbling	TK-7A	900	Steel	A	Concrete-w	
T5 Effluent Storage	TK3	1,000	Fiberglass	A	Concrete-w	
Secondary Treatment:						
S1 Secondary Reverse Osmosis	RO Vessel	10	Fiberglass	A	Concrete-w	
	TK25	300	Polyethylene	A	Concrete-w	
	TK73	3,700	Steel	A	Concrete-w	
S2 Rotary Vacuum Filter	Rotary Vacuum Filter	900	Stainless Steel	A	Concrete-w	
	TK8	8,000	Steel	A	Concrete-w	
S3 Bottoms Storage	TK-NE, SE, SW, NW	20,000	Steel	A	Concrete	z
	3K tank	3,000	Steel	A	Concrete	
	17k tank	17,000	Steel	A	Concrete	

Notes:

w: Floor of Building 50-01, with floor drains, provides secondary containment.

Z: Capacity is for each vessel.

ENCLOSURE 4

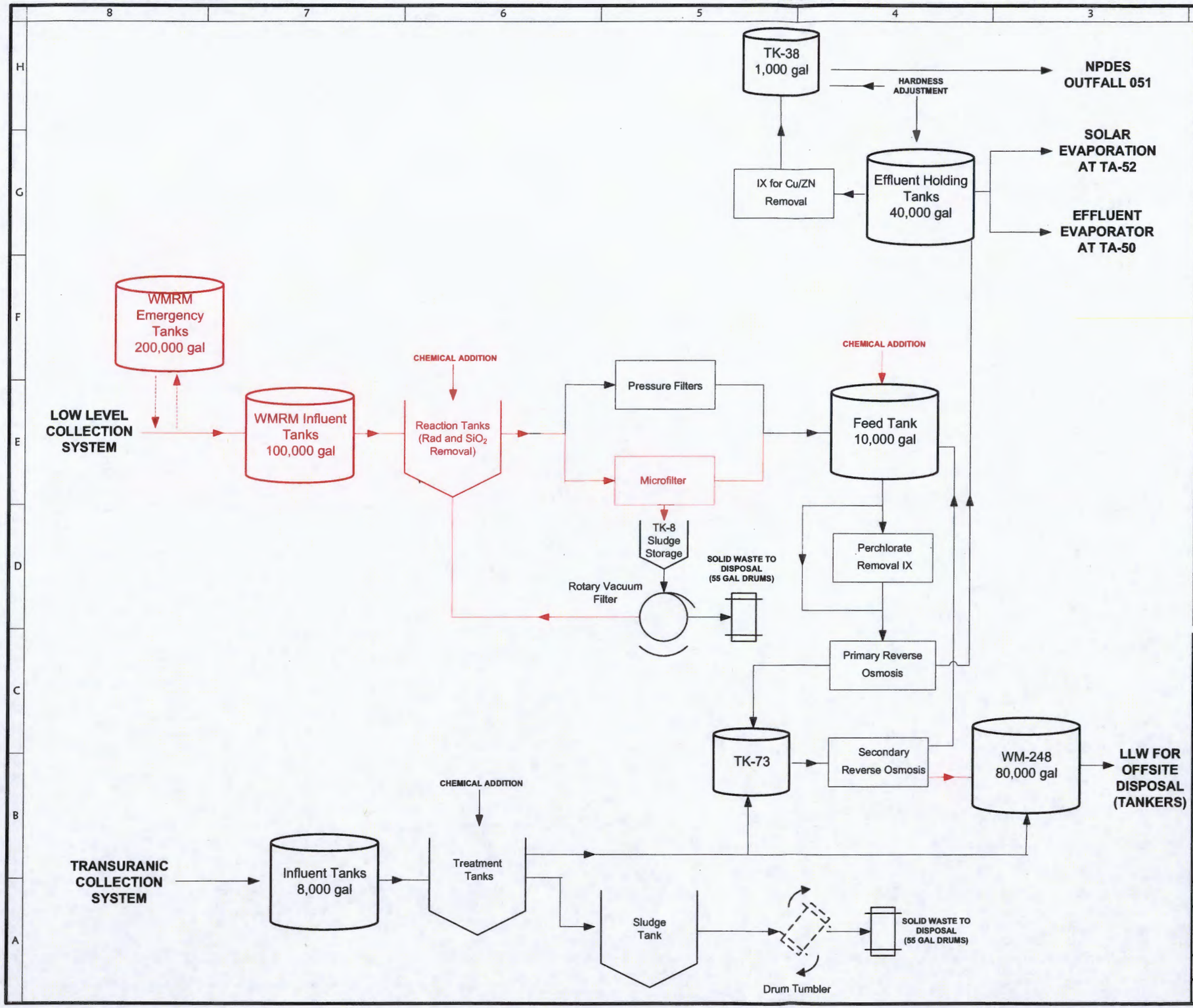
Supplemental Information, DP-1132 Application

Revised Process Schematic—Appendix B

ENV-RCRA-12-0173

LAUR-12-21591

Date: AUG 1 0 2012



General Notes

NOTES:

THIS PROCESS SCHEMATIC DEPICTS TYPICAL FLOW PATHS WHEN TREATING WATER AT THE TA50 RLWTF. ACTUAL TREATMENT MAY VARY DEPENDING UPON WATER QUALITY. FOR EXAMPLE, WATER FROM THE CLARIFIER MAY BE SENT TO EITHER THE GRAVITY FILTER OR THE PRESSURE FILTERS, THUS BYPASSING A SET OF FILTERS. OR PERMEATE FROM THE SECONDARY RO UNIT MAY BE SENT TO EFFLUENT HOLDING TANKS RATHER THAN TO THE PERCHLORATE FEED TANK.

No.	Date	Class Rev	ADC	Description	DFT	CHK	CSE SME	APP
3	05/15/2012	3	U	CHANGES FOR BRIDGING PROJECT	JCR	JCDS	RLS	RLS
2	01/11/2012	2	U	CHANGES FROM DISCHARGE PERMIT MTNG	JCR	JCDS	RLS	RLS
1	10/31/2011	1	U	CHANGES FROM WQH – RLW MEETING	JCR	JCDS	RLS	RLS

ENGINEERING STANDARDS PROGRAM
Radioactive Liquid Waste Treatment Facility (RLWTF)

PROCESS SCHEMATIC
NPDES OUTFALL 051
POST GROUND WATER
PERMIT MODS

DRAFTER	J. Ruiznavarro
CHECKER	J.C Del Signore
CSE / SME	R. Swickley
Date	10/31/2011

SUBMITTED RLWTF EM R. Swickley
APPROVED FOR RELEASE RLWTF DAR R. Swickley

Los Alamos National Laboratory
Los Alamos, NM 87545

RLWTF-SD-PFD-001
1 OF 1

CLASSIFICATION UNCLASSIFIED
ADC
DATE 10/31/2011
PROJECT ID. N/A
REV. 3

ENCLOSURE 5

Supplemental Information, DP-1132 Application

Revised Scaled Floor Plan—Appendix B

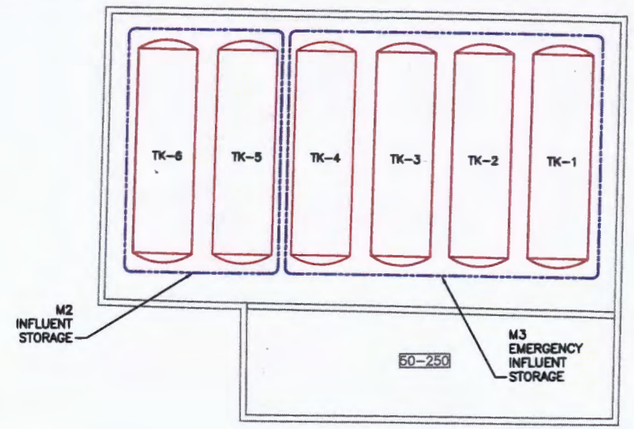
ENV-RCRA-12-0173

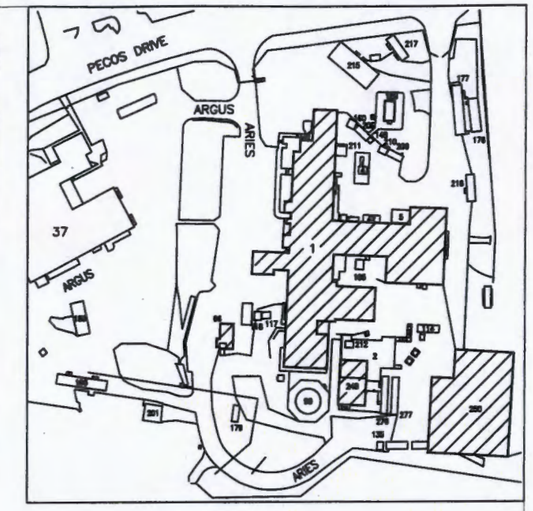
LAUR-12-21591

Date: AUG 1 0 2012

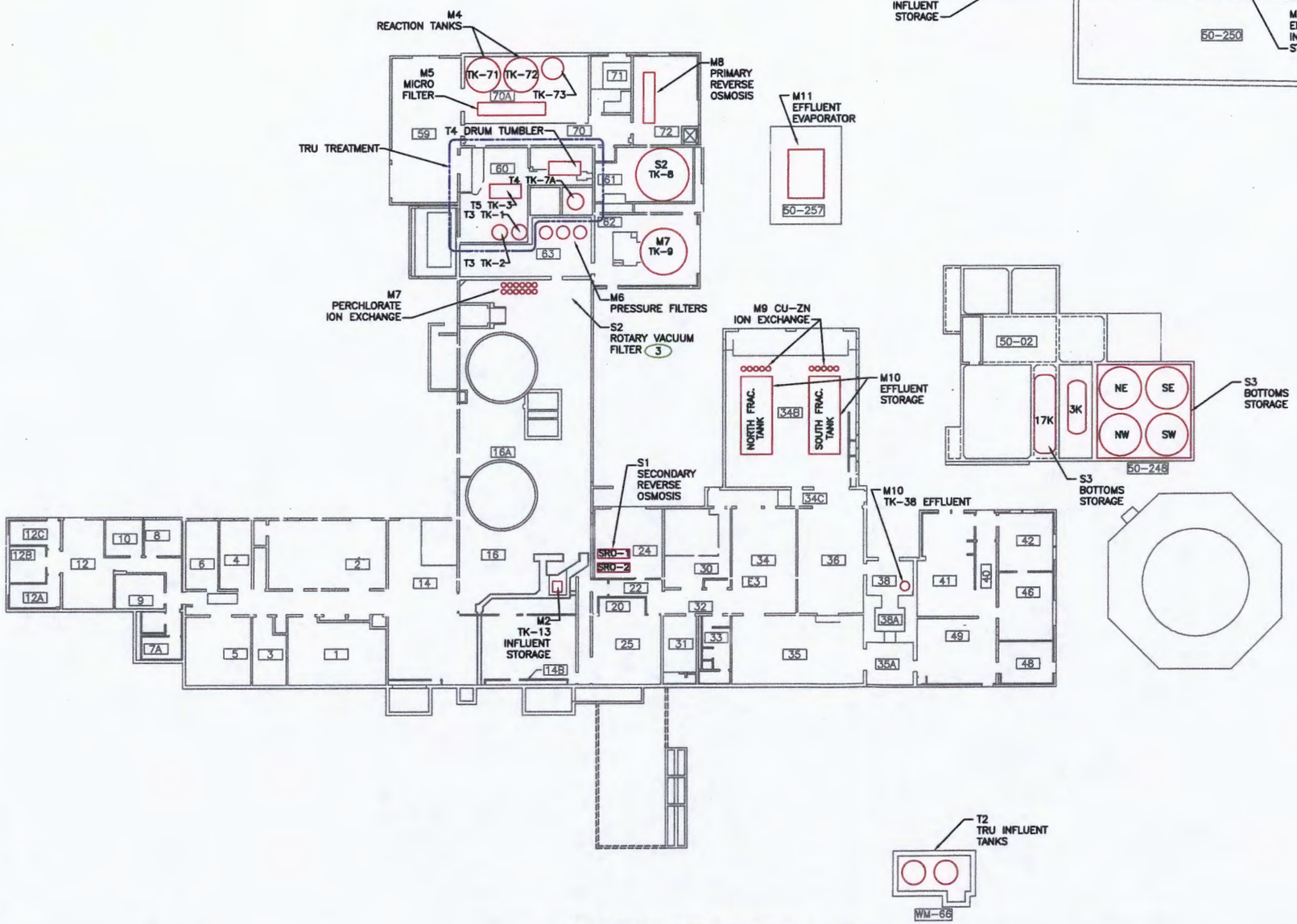
ENV-RCRA-12-0173
LAUR-12-21591

ENCLOSURE 5





LOCATION PLAN
SCALE: NONE
TA-50



N RLWTF TREATMENT UNITS
SCALE: 1/8" = 4'-4" 1

GENERAL NOTES

1. IF THIS SHEET IS NOT 11X17, THEN IT IS A REDUCED OR ENLARGED SIZE PLOT. USE INDICATED SCALE ACCORDINGLY.

KEYED NOTES

1. SCALE APPLIES TO BUILDING STRUCTURES AND RELATIVE BUILDING LOCATIONS WITHIN THE SITE. DEPICTED SIZE OF TREATMENT UNITS AND STORAGE TANKS ARE FOR REFERENCE ONLY.
2. TREATMENT UNIT NOT SHOWN ON SKETCH.
3. ROTARY VACUUM FILTER LOCATED THIS AREA SOUTH-EAST CORNER RM. 116A

	RLWTF TREATMENT UNITS	
2	M1	COLLECTION SYSTEM
	M2	INFLUENT STORAGE
	M3	EMERGENCY INFLUENT STORAGE
	M4	REACTION TANKS
	M5	MICRO FILTER
	M6	PRESSURE FILTERS
	M7	PERCHLORATE ION EXCHANGE
	M8	PRIMARY REVERSE OSMOSIS
	M9	COPPER ZINC ION EXCHANGE
	M10	EFFLUENT STORAGE
	M11	EFFLUENT EVAPORATOR
2	M11	SOLAR EVAPORATION
2	M11	NPDES OUTFALL #051
2	T1	TRU COLLECTION SYSTEM
	T2	TRU INFLUENT STORAGE
	T3	TRU TREATMENT
	T4	TRU SLUDGE
	T5	TRU EFFLUENT
	S1	SECONDARY REVERSE OSMOSIS
3	S2	ROTARY VACUUM FILTER
	S3	BOTTOMS STORAGE

Plotted By:119873 Plot Date:July 17, 2012
RLWTF MAJOR EQUIPMENT 7-17-12.DWG