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Date: DEC 2 1 2015
Symbol: ENV-DO-15-0356
LA-UR: 15-29237
Locates Action No.: N/A

Ms. Michelle Hunter, Chief
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Dear Ms. Hunter:

Subject: Closure Plan for Draft Discharge Permit DP-1132

Condition No. 42 of draft Discharge Permit DP-1132 (Version 09/18/2015) requires that the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) submit a Closure Plan to the New Mexico Environment Department (NMED) for the Technical Area (TA)-50 Radioactive Liquid Waste Treatment Facility (RLWTF) with 180 days from the effective date of a final Discharge Permit. At the NMED's recommendation, DOE/LANS committed in May 2015 (ENV-DO-15-0137) to prepare the required Closure Plan prior to NMED's issuance of a final Discharge Permit and before December 31, 2015. In keeping with that commitment, Enclosure 1 contains a comprehensive Closure Plan for the RLWTF that addresses all of the required elements of Condition No. 42.

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

Sincerely,

Alison M. Dorries
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Enclosures:

(1) Closure Plan for draft Discharge Permit DP-1132

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ENCLOSURE 1

Closure Plan for Draft Discharge Permit DP-1132

ENV-DO-15-0356

LA-UR-15-29237

Date: DEC 2 1 2015

Radioactive Liquid Waste Treatment Facility Closure Plan

Los Alamos National Laboratory

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List of Acronyms

DOE	U.S. Department of Energy
DOP	Detailed Operating Procedures
DOT	U.S. Department of Transportation
EDR	electrodialysis reversal
EPA	U.S. Environmental Protection Agency
IWD	Integrated Work Document
IX	ion exchange
LANL	Los Alamos National Laboratory
LDR	Land Disposal Restrictions
LLRLW	low-level radioactive liquid waste
LLRW	low-level radioactive waste
LLW	low-level waste
NE	northeast
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NW	northwest
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
RLWCS	Radioactive Liquid Waste Collection System
RLWTF	Radioactive Liquid Waste Treatment Facility
RO	reverse osmosis
RWP	Radiation Work Permit
SCADA	supervisory control and data acquisition
SE	southeast
SET	solar evaporator treatment
SW	southwest
TA	Technical Area
TRU	transuranic
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant

1. Introduction

This Closure Plan describes the future activities to close the Low-Level Radioactive Liquid Waste Treatment Facility (RLWTF) at Technical Area (TA)-50 at Los Alamos National Laboratory (LANL). The Plan describes actions necessary to close the existing RLWTF, and controls that will be implemented during and following closure activities to comply with the provisions specified in Conditions 42 and 43 in the Draft Discharge Permit DP-1132, issued by New Mexico Environment Department (NMED) (2015).

Closure activities include the removal of treatment units, support systems, and structures comprising the existing RLWTF, thereby removing potential sources of releases of contaminants to soil and groundwater. Following completion of closure activities, the footprint area occupied by the current RLWTF will be backfilled to conform to surrounding grades, and revegetated. Following completion of closure activities, a Closure Report will be submitted to the NMED for review and approval.

This Closure Plan assumes decommissioning of all RLWTF facilities at the same time. Another possibility, however, is that today's RLWTF may be closed piecemeal by major facility component in the years ahead, with closures separated in time for a variety of reasons (e.g., the timing of replacement facilities, mission need that outlives facilities, or the Federal funding process). In fact, a good example of this has already occurred. The original low-level collection system was installed in 1963, was replaced after ~20 years of service, and was subsequently decommissioned.

2. Overview of RLWTF

The RLWTF is located at TA-50 along Pecos Drive on the LANL facility. The treatment facility was designed, constructed and commissioned for processing/managing low-level radioactive liquid waste streams. The RLWTF has been in operation since 1963. The facility currently treats industrial wastewater, low-level wastewater, and, in a separate treatment system, transuranic (TRU) wastewater.

From a *process* perspective, the RLWTF can be viewed as having three treatment systems:

- The main treatment process for low-level radioactive wastes 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, solar evaporation, or evaporation using natural gas. Two secondary streams are generated by the main treatment process, sludge and reverse osmosis concentrate; they are sent to the secondary 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 is either sent to the secondary treatment process for additional treatment, 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.

- The secondary 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 RO concentrate from the main process and/or effluent from the transuranic process, and a bottoms storage and disposal step. Wastes from the secondary treatment process are disposed as low-level radioactive solid waste.

From a *facility* perspective, the RLWTF can be viewed as having the following major components:

- The low-level radioactive liquid waste collection system, or RLWCS, which is an underground pipeline system that connects the TA50 RLWTF to generator buildings in six Technical Areas. The collection system has approximately four miles of underground piping and 62 valve stations (also referred to as vaults). Piping is essentially a pipeline within a pipeline. Vaults are equipped with leak detection sensors that are linked electronically to the RLWTF control room.

- The WMRM facility (Waste Management and Risk Mitigation, Building 50-250), 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 influent tanks will be held in reserve for use in emergency situations; two will be used for day-to-day influent collection and storage. WMRM is a steel frame structure designed to withstand seismic, wind, and snow load criteria. The concrete basement houses the two influent and four emergency storage tanks, and acts as secondary containment..

- Building 50-001 and nearby support facilities, which house the primary and secondary processes for the treatment of low-level radioactive wastes, facility support functions (such as HVAC and compressed air), chemical laboratories, and personnel offices. Building 50-001 has a number of neighboring buildings and structures including:
    - Building TA-50-002, influent storage for low-level RLW;
    - Structure TA-50-090, influent storage for low-level RLW;
    - Building TA-50-248, storage for secondary low-level RLW; and
    - Structure TA-50-257, natural gas-fired boiler/evaporator.
- Facilities that house the transuranic treatment processes, including
    - the transuranic RLW collection system, an underground pipe system that conveys transuranic RLW from TA55 to TA50;
    - Structure TA-50-066, influent storage for transuranic RLW;
    - Rooms 60 and 60A in Building TA-50-001, for treatment of transuranic RLW
- The Solar Evaporation Tanks, or SET, which will be used to evaporate treated low-level radioactive liquid wastes. Two tanks are located on this approximately one-acre site, about two-thirds of a mile from the TA50 RLWTF within Technical Area 52 of LANL. Evaporation tanks have concrete walls approximately four feet high, and have a double liner with leak detection; each tank 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 TA50 RLWTF for storage and retreatment, if necessary. Approximately 3500 feet of high-density polyethylene (HDPE) transfer piping connect the SET and the TA50 RLWTF.

The facility perspective may be important from a closure perspective because today's RLWTF may be closed piecemeal by major component in the years ahead, with closures separated in time for a variety of reasons (e.g., the timing of replacement facilities, mission need that outlives some facilities, or the Federal funding process). As an example, the original low-level collection system installed in 1963, was replaced after ~20 years of service, and subsequently decommissioned.

An aerial view of the RLWTF structures is depicted on Figure 1.The location and generalized layout of buildings and structures, and RLWTF treatment units comprising the RLWTF are depicted on Figure 2. The inset on Figure 2 provides the general location plan. Building identification numbers shown on the figure are truncated; for example, Building 50-001 is labeled as 1, Building 50-002, is labeled 2 and so on.

2.1 History of RLWTF Operations

Construction of the current Radioactive Liquid Waste Treatment facility, at Technical Area 50, started in July 1961. It was a replacement for a treatment facility that had been located near the current intersection of Canyon Road and Central avenue in the Los Alamos townsite.

The original facility had just two buildings, 50-01 and 50-02. The process, with a capacity of 250 gallons per minute, consisted of influent storage, chemical precipitation, filtration, and effluent storage. The facility also included, laboratories for chemical and radioactive analysis of water samples, and offices. Treatment started in June 1963. In 1964, the first full year of operations, the facility treated 13.6 million gallons of radioactive liquid wastes. (For comparison, the RLWTF treated 0.8 million gallon in 2014.)

In the 52 RLW years since treatment began, a number of facility additions and process modifications and improvements have been installed at the facility. Table 1 presents a chronology of major RLWTF activities, facility and process additions, and modifications and improvements. All such modifications and improvements were completed in support of RLW treatment operations. Some of these are discussed in the following paragraphs.

- NPDES compliance (1978): The U.S. Environmental Protection Agency was created in 1970, and surface water regulations soon followed. LANL received its first NPDES Permit in 1974 from the Army Corps of Engineers; the permit included only sanitary outfalls. LANL received its second NPDES Permit four years later from the EPA; this permit created effluent limits for all LANL outfalls, including Outfall 051 from the RLWTF.

- Treatment of transuranic RLW (1979): Processing formerly performed at TA21 was relocated to TA55 beginning in 1977. In order to treat transuranic wastes from the new facility, underground transfer lines were installed between TA55 and the RLWTF, influent tanks were constructed (WM66), and treatment equipment was installed in Room 60. First Room 60 treatment of transuranic wastes occurred in July 1979.

- New collection system (1983): The original collection system for radioactive liquid waste was constructed under specifications for sanitary waste systems. Pipes were vitrified clay pipe with asphalted joints and, for road crossings, cast iron pipe. This original system was replaced by the current system in 1983. The current collection system is a double-walled, 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. The majority of these original collection system piping was decommissioned and removed in 1975, when excavated soils were characterized for radioactive constituents and remediated.

- Sanitary waste treatment: A septic system was installed at TA50 in 1964 at the south end of the RLWTF. The septic system consisted of a line from Building 50-1 that discharged to a manhole (structure 50-9) and then to a septic tank (structure 50-10). The effluent line from the tank tied to a distribution box (structure 50-11), which discharged to four parallel perforated pipes traversing a leach field. This septic system was removed in 1983 after the RLWTF had been connected to the sewage treatment facility constructed at TA46.

- Membrane treatment processes (1999): The two-step treatment process (chemical precipitation followed by filtration) was unable to meet new, reduced effluent DOE limits for radioactivity in treated water. In order to achieve compliance, major process modifications were installed beginning in1996 in treatment rooms at the east end of the RLWTF. Post-filtration treatment units that employed membrane separation technology were installed in these rooms. The additional treatment steps, ultrafiltration to remove smaller particles and reverse osmosis to remove much of the dissolved radioactivity, were placed into service in 1999.

- Improved and emergency influent storage (2010): 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. It is planned that two of these will be used as influent tanks, and that four will be held in reserve for use in emergency situations. The two daily-use influent tankswill replace existing in-ground tanks that have been in service since 1963.

- Solar Evaporation (2012): Open tanks for solar evaporation of treated water have been constructed on a site about two-thirds of a mile from the TA50 RLWTF within Technical Area 52 of LANL. The SET has two identical evaporation tanks and a pump house. Each tank has concrete walls approximately four feet high, and a double liner with leak detection. Each is approximately 70' x 250' in size, with a usable capacity of about 380,000 gallons. Approximately 3500 feet of high-density polyethylene (HDPE) transfer piping connect the SET and the TA50 RLWTF.

Continued use of the existing RLWTF for the collection, storage, and treatment of RLW is expected until replacement facilities are available. A new treatment facility for low-level RLW is currently under construction to the immediate west of the existing RLWTF. And new facility is being designed for the treatment of transuranic RLW, to replace the current Room 60 operations. The new transuranic facility will be located about 50 feet from the southeast edge of the existing RLWTF.

2.2 Existing Low-Level RLW Collection and Treatment System

2.2.1 Low-Level RLW Collection System

The RLWCS at LANL consists of approximately four miles of underground, double-walled piping. Primary piping consists of 6- or 8-inch-diameter polyethylene encased within 10- or 12-inch-diameter polyethylene secondary piping. Where the RLWCS piping passes under underground utilities, a minimum clearance (typically 24 inches) is maintained between RLWCS piping and other underground utilities. Where RLWCS piping passes under roadways, piping is installed inside a concrete pipe trench or encased in concrete at sufficient depth to protect the piping from damage from surface vehicle loads.

There are 62 underground valve stations (access vaults) along the four miles of piping. In each vault, primary piping transitions to stainless steel upon entering the vault, then transitions back to polyethylene piping when leaving the vault. Vaults are equipped with leak detection sensors that are linked electronically to the RLWTF control room. Figure depicts a typical low-level RLW collection system pipe trench and valve station.

2.2.2 Low-Level RLW Influent Storage

Influent low-level RLW streams currently flow from vault WM-72 through an underground, double-walled pipe, into influent storage tanks in Structure 50-002, an underground concrete structure. Four water storage tanks and a pumping station are associated with this structure. Two of the tanks, one with a capacity of 75,000 gal (75K Tank) and the other with a capacity of 17,000 gallons (17K Tank), are used to hold untreated low-level RLW influent streams. Influent is fed from these tanks to the low-level treatment process in Building 50-001 via another underground, double-walled pipe.

2.2.3 Low-Level RLW Treatment Process

The main treatment process includes clarification, filtration, ion exchange (IX), reverse osmosis (RO), and discharge or evaporation of treated water. Two secondary streams are generated by the main treatment process: sludge, and RO concentrate. Table 2 provides a summary of the principal structures, individual RLW treatment units, and associated components.

Building TA-50-250, the Waste Management/Risk Mitigation (WMRM) facility, was completed in 2010. It houses two 50,000-gallon storage tanks to accommodate daily use for receipt and storage of influent that will be processed at RLWTF and includes four additional 50,000-gallon tanks to provide off-normal influent storage capability in the event of off-normal conditions, including unavailability of the RLWTF. This facility is not currently in use.

Primary RO-treated water is currently routed to one of the two 20,000-gallon effluent holding tanks (North and South Frac tanks) in Room 34B of Building 50-001. The two frac tanks are horizontal carbon steel tanks. At the present time, treated liquid waste from the frac tanks is conveyed to an effluent evaporator in Structure 50-257 where the liquid is evaporated using natural gas.

As an alternative to evaporation, treated water that meets NPDES and DOE discharge standards can be discharged to the environment through permitted Outfall 051 in Mortandad Canyon. Treated water is pumped to the outfall through approximately 1,400 feet of three-inch-diameter, carbon steel pipe.

A third discharge alternative has been constructed. Treated liquid waste streams from the Frac tanks can instead be routed/conveyed to either: the Solar Evaporator Treatment (SET) system. The SET system consists of two open, lined tanks located on a site of approximately 1 acre, about two-thirds of a mile from the TA-50 RLWTF within TA-52 of LANL. As with the WMRM Facility, the solar evaporation tanks are not currently in use.

Table 3 provides information on the historic waste streams handled in each of the LL RLW treatment units and the LL RLW collection system.

2.3 TRU RLW Collection and Treatment System

2.3.1 TRU RLW Collection System

The Transuranic Radioactive Liquid Waste Collection System (TRU RLWCS) is comprised of three underground, double-walled transfer piping systems: one for conveying acid waste, one for caustic waste, and one spare pipe.

Underground piping is double-wall construction with the interior pipe sizes ranging from 1½ inches to 2 inches, and the pipe materials consist of either stainless steel (for the acid waste stream) or thermoplastic material. The piping is encased where it passes below Pecos Drive and is positioned at sufficient depth to protect it from damage by surface vehicle loads. The outer pipe of each line is connected to a drip tray located inside the WM-201 vault such that a leak of the inner pipe drains to a sump inside the WM-201 vault.

The valve station structure located in vault WM-201 (structure TA-50-201) is used to isolate the downstream TRU Influent Storage System from the upstream discharge sources at TA-55. Piping inside the WM-201 vault is single-wall construction. Should there be a leak inside the WM-201 vault, it also drains into the sump in the vault. The WM-201 vault is approximately 1.5 meters (5 feet) below grade and serves as secondary confinement.

2.3.2 TRU Influent Storage System

The TRU Influent Storage System consists of an acid influent waste stream storage tank, caustic influent waste stream storage tank, and corresponding transfer/recirculation pumps and piping located in vault WM-66 (Structure TA-50-66). Piping components include double-walled transfer pipes, one for acid waste streams and one for caustic waste streams, which are used to transfer TRU-RLW influent streams from vault WM-66 to Tank TK-1 in Building TA-50-01, Room 60/60A, for treatment. Both the acid and caustic influent storage tanks are cylindrical in shape and have conical-shaped bottoms.

The initial TRU RLW influent storage tanks and conveyance piping systems to the TRU processing units in Building 50-001were installed in 1979. The caustic influent tank was replaced in 1983 and again in 2007; the acid influent tank was replaced in 1995.

2.3.3 Existing Transuranic RLW Treatment Process

The TRU RLW treatment process consists of 13 individual vessels having a combined total capacity of approximately 14,200 gallons. Table 4 provides a summary of the individual TRU RLW treatment units contained in the existing RLWTF.

Acid wastes are neutralized using sodium hydroxide; caustic wastes is treated with lime to adjust alkalinity. Sludge is generated by these treatment steps. Treated transuranic RLW is pumped from Room 60 to the low-level Secondary Treatment Plant for additional processing (e.g., secondary RO). TRU sludge is solidified in 55-gallon drums using cement. After curing, drums are stored to await shipment to and disposal at the Waste Isolation Pilot Plant (WIPP) as a solid TRU waste form (cement monolith).

Table 5 provides information on the historic waste streams handled in each of TRU RLW treatment unit and TRU RLW collection system.

2.4 Chemicals Used in RLWTF Treatment Processes

Various chemicals are used at the RLWTF:

- Bulk process chemicals used for the treatment of RLW;
- Laboratory chemicals used for analysis-related activities; and
- Ancillary chemicals used for maintenance and general facility operations.

Bulk chemicals include gases (e.g., argon and P-10, a methane-argon mixture), liquids, and powders/solids (e.g., cement used for the solidification of TRU RLW treatment-derived sludge, perlite, and magnesium sulfate heptahydrate [Epsom salt]). Liquid chemicals include sodium hydroxide for neutralization, sodium permanganate for influent oxidation, sodium silicate as cement wetting agent, and sulfuric acid for pH adjustment.

Most of the chemicals used at the RLWTF are found in the low-level treatment areas and processes. Depending on the type and form of chemical, bulk chemicals are stored in tanks, refrigerated tanks (argon), 55-gallon drums, bags (50-lb or 100-lb bulk),and cylinders (gases).

In addition to bulk chemicals, small quantities of chemicals, typically contained in 5-gallon or smaller containers, are used in the analytical chemistry laboratories that support the RLW treatment process. These chemicals are handled and used in accordance with consensus industry standards.

3. Closure Objectives and Approach

A principal objective of final closure of the RLWTF facility is to accomplish a clean closure wherein all RLWTF treatment units and ancillary components, facility and process systems, building structures, and other aboveground and underground structures associated with the current RLWTF will be removed and the site regraded and restored for unrestricted use.

Closure activities will be completed in accordance with requirements contained in the Compliance Order on Consent (March 1, 2005) (Consent Order) entered into between the New Mexico Environment Department and the Permittees pursuant to the New Mexico Hazardous Waste Act, NMSA 1978, §74-4-10 and the New Mexico Solid Waste Act, NMSA 1978,§74-9-36(D).

3.1 Closure Approach

Closure activities at the RLWTF will include the following:

- Remove process liquids and solids (sludge) from treatment and storage units;
- Remove unused chemicals;
- Decontaminate, demolish, and remove existing individual treatment units and ancillary components, including piping, pumps, and tanks;
- Remove balance of plant units such as air compressors, the heating system, and industrial water supply;
- Raze aboveground structures and exhume below-grade utilities (natural gas, water, sewage);
- Verify that the closure performance requirements have been achieved;
- and conduct post-closure monitoring until released by the NMED.

Final closure activities will be conducted in a manner that protects human health and the environment. Measures will be used to control, minimize, or eliminate release of radionuclide or chemical constituents and contaminated runoff to the ground or surface waters or to the atmosphere. Radioactive, non-radioactive, and debris/demolition wastes generated during closure activities will be managed and disposed in accordance with state, and federal regulatory requirements.

3.2 Closure Completion Standard

Closure of the RLWTF will be deemed complete when: 1) existing RLWTF treatment units, systems, structures, surfaces, and equipment have been removed and/or decontaminated and properly disposed; and 2) final documentation certifying closure of the RLWTF and ancillary associated components has been submitted to, and approved by, the NMED.

4. Closure of Individual Units and Systems

4.1 Closure Procedure for LL RLW and TRU RLW Collection and Treatment/Storage Units and Systems

The following sections describe the general procedures to be followed during closure of individual units, systems and structures present at the RLWTF. Table 6 provides a listing of the individual LL RLW treatment units and systems to be closed, along with a summary of the closure activities to be undertaken to close and remove each unit. Table 7 provides details pertaining to the treatment/storage capacity and construction of the individual treatment units in the RLWTF facility. Table 8 provides a listing of all the individual TRU RLW treatment units and systems to be closed, along with a summary of the closure activities applicable to each. Table 9 lists the remaining balance of plant features (process systems and utilities) that will be closed and removed.

4.1.1 Removal of Containerized Chemicals/Waste Materials

Containers holding process chemicals or miscellaneous waste materials (e.g., liquid or solid wastes) will be removed. Depending upon their size, the containers will be removed with a forklift, container dollies, air pallets, or manually. Containers will be placed on flatbed trucks, trailers, or other appropriate vehicles for transport from each structure/room. Approved containers holding radioactive waste will be moved to a permitted on-site storage unit or transported to a permitted off-site treatment, storage, or disposal facility. Appropriate shipping documentation will be prepared to accompany the waste containers during their transport and off-site disposal.

4.1.2 Structural Assessments

A structural assessment will be conducted to observe and document the starting physical conditions of the rooms or structures housing closed units. The assessment will include inspecting floors, walls and ceilings, and entrance/exit aprons or ramps for portions of above-ground structures. Photographs will be taken and archived to document existing conditions. The perimeter and the floor of each room will be examined for cracks or conditions that indicate a potential for, or evidence of an actual, prior release of constituents. The characterization program (e.g., radionuclide and chemical screening or sampling and analysis) may be modified as appropriate to reflect the results of the structural/visual assessment.

4.1.3 Preparatory Work

Each unit/system will be isolated and/or de-energized as appropriate prior to removal. Valves will be closed and, if not permanently sealed, a lock out/tag out system will be used as appropriate. Initial survey and sampling activities and radiological screening may be conducted to guide decontamination and closure activities and to identify potential waste dispositioning options.

4.1.4 Removal of Solids and Liquids from Individual Units

Removal of sludge and liquids from individual LL RLW and TRU RLW treatment units will be accomplished following the applicable LANL Detailed Operating Procedures (DOP) in effect at the time of final closure. An overview of the removal activities that will be undertaken, in the context of current LANL procedures, is summarized below.

- Liquids will be removed from the tanks or vessels either: (1) in accordance with the current unit DOPs or (2) using a portable pump and hoses to evacuate the liquids into a portable collection tank. Removed liquids will be routed to the replacement RLWTF for treatment;
- Solids (sludge), if present, will be removed from the tank or vessel either: (1) in accordance with current unit DOPs or (2) using one or more appropriate methods to evacuate the sludge materials into a portable collection tank. Removed sludge will be routed to the appropriate sludge treatment/process unit(s) in the replacement RLWTF for processing and/or packaged, labeled, and manifested for subsequent transport offsite for disposal;

Liquid and solid removal activities will be performed by personnel wearing personal protective equipment (PPE). Radiological data for the associated treatment units, piping, and other equipment will be used to select the appropriate PPE. A LANL Radiation Work Permit (RWP), if required, and a LANL Integrated Work Document (IWD) will be developed and used in combination with the applicable LANL DOP to guide these activities.

The actions required, and estimated durations, for completing removal of the various LL RLW and TRU RLW treatment units (including evacuation of liquids and solids from the individual treatment units) are presented in Table 6 and Table 8. Further details regarding the schedule for completing final closure of individual RLWTF treatment units, and the RLWTF as a whole, are provided in Section 0 below.

4.1.5 Decontamination

Equipment that may be used to decontaminate tanks and vessels, may include, but not be limited to:

- Remote insertable, rotatable mechanism, positioning/mast tool delivery arm, possibly including a high-pressure hose/nozzle system;
- Portable high-pressure washer;
- Sluicer unit, folding arm, sluicing end effectors, sluicer nozzle, and submersible pumps;
- Video cameras to monitor the effectiveness of washing;
- "Baker" tank(s);
- Concrete scabbling devices;
- Sponge media blasting equipment and blasting materials; and
- Radio decontamination solutions.

For emptying sludge and washing one or more larger size tanks (e.g., TK-8, TK-9, or a bottoms storage tank in Building 50-248), a remote mechanism containing a rotating, high-pressure water jet/nozzle system, a mast tool delivery system/arm, or other similar system may be deployed either through the top of the tank or through an access hole cut into the side of the tank. In such a case, a high-pressure hose, sluicer, and/or one or more submersible recirculation pumps may be used to complete removal of sludge materials from the tank bottom and adjacent floor/wall joint areas. Sluicer and pump systems employed in this fashion may use submersible pumps to supply excess, dilute tank liquids to wash the internal tank surfaces. This method recycles the tank liquid and avoids adding to the waste volume. Under such a tank decontamination scenario, the tank liquid level during most of the washing activities may be kept at a nominal minimal level (e.g., minimum depth of between approximately 30 cm (12 inches) to 61 cm (24 inches) to ensure uninterrupted sluicing/washing operations.

As discussed in Section 0, specific decontamination activities will be performed by personnel wearing appropriate PPE. Radiological data for the associated treatment units, piping, and other equipment will be used to select appropriate PPE. A LANL RWP, if required, and an IWD will be developed and used in combination with the applicable LANL DOP to guide these activities.

Table 6 and Table 8 summarize decontamination methods and procedures that may be used for decontaminating individual LL RLW and TRU RLW treatment units.

4.1.6 Radiological Surveys

Radiological surveying and sampling to support closure will be done in accordance with existing LANL facility radiation survey plans and procedures. Radiological Control Technicians will perform routine radiation surveys for release of personnel and equipment and general radiological oversight for closure activities. Additional radiological surveys (direct radiological surveying and dose measurements, and smear samples) will be performed following decontamination efforts, to evaluate the effectiveness of decontamination. The results of radiation surveys will be used to support the waste management practices. If practical, radiological release surveys may be conducted on items that may be made available for reuse. Any items or system that cannot be released for reuse will be packaged, labeled, properly manifested, and transported offsite for disposal at an appropriate facility.

4.1.7 Fixative or Paint

Following decontamination of a tank or a vessel, a radionuclide fixative or suitable (e.g., epoxy) paint may be applied to the interior walls and floor of those treatment units/vessels that: (1) were used to store influent; or (2) were used for main (primary) treatment of TRU RLW streams. Application of the fixative is intended to prevent or minimize potential airborne release of radionuclides during activities such as demolition/size-reduction required to assist in minimizing potential exposure to workers, the public, and the environment.

The condition of the fixatives applied to CL-1, CL-2, and the Gravity Filter during the prior stabilization activities (LANL 2015) will be visually inspected. If the fixative in those vessels is determined to have significantly deteriorated, additional fixative may be applied prior to removing the clarifiers and Gravity Filter during closure.

4.1.8 Removal of Conveyance Piping

Piping associated with the RLWTF units and interconnected piping extending between the units comprising the RLWTF facility will be removed, decontaminated if practical and appropriate, and disposed of offsite. Influent conveyance or discharge piping connected to each unit will be removed as part of closure of each unit; some sections of pipe between existing pipe joints may be removed in conjunction with removal of individual treatment vessels/units or may be removed if necessary by making a cut in the piping. In the latter case, valves in the pipe system encompassing the pipe section to be cut will first be closed to isolate the pipe section and any free liquid present in the pipe section will be drained and collected using a portable pump attached via tubing to an appropriate control valve system or by creating a small penetration in the bottom of the pipe section to allow the liquid to be drained and collected into a sealable collection vessel. Other sections of pipe may be temporarily left in place pending removal of other units. In all cases, ends of any pipe sections left in place (e.g., at pipe joints/pipe junctures) or at pipe cut locations will be capped or flanged using a blind flange, or, where necessary, a plug, molded rubber seal, and/or isolation gasket and fitted end cap. All sections of piping will be removed once all connected vessels/units have been removed.

Pipe removal/free liquid evacuation activities will be performed by personnel wearing appropriate PPE. Radiological data for the associated treatment units, piping, and other equipment will be used to determine approaches for piping/liquids removal and capping/flanging of pipe sections and for selecting appropriate PPE. A LANL RWP and IWD will be developed and used as appropriate to guide these activities.

4.1.9 Removal of Units and Associated Components

Following decontamination, units and their associated components will be removed. Depending on the size of the items (support pedestal, pan, palette, etc.) removal may include use of an excavator, forklift, container dollies, or other equipment. It is expected that removal methods will mimic those used to originally place them into each room. Section room walls or ceiling may be removed as necessary, however the integrity of the remaining structure must be maintained, or the entire structure will be removed, along with the unit.

Larger units may require size-reduction to meet transportation or disposal requirements. Specific methods used for size-reducing individual tanks or vessels, will depend on the composition and size of the item. Table 7 provides a summary of the characteristics of the various individual tanks and vessels comprising the LL RLW and TRU RLW treatment units. Equipment that might be used typically includes a diamond wire saw cutting system, metal saw, pipe cutter, or jackhammer.

The original (1963) clarifiers and gravity filter, which provide structural support for the RLWTF, will be size-reduced in place as will be other units. Additional measures may have to be taken for these units, however, in order to assure building structural safety while during cut-up and removal..

Removal of larger underground concrete structures such as the 75K Tank or the N25K and S25K Tanks in Structure 50-002 may involve partial demolition/segmentation of the tanks structures in place. In such instances, an excavator or backhoe with appropriate attachments (e.g., buckets, demolition shears) will be used to breakup and segregate material. If necessary, a Brokk® demolition/crusher unit or similar limited access demolition machine may be utilized to accomplish this task.

Removed tanks, vessels, components, and demolition debris will be segregated and placed into segregated waste staging areas. All waste material will be properly characterized, packaged, labeled, manifested, and transported offsite for disposal.

4.2 Grouping of Individual Units and Systems

4.2.1 LL RLW Units and Systems

The LL RLW collection system components, individual LL RLW treatment units, associated ancillary components to be closed are listed in Table 6. To facilitate closure and scheduling the individual units are grouped into categories or systems which will be closed together. For the LL RLW these categories or systems include:

- LLRLW Collection
- Influent Storage
- Main Treatment (Clarify)
- Main Treatment (IX\RO)
- Main Treatment (Filter)
- Main Treatment (Tanks)
- Secondary Reverse Osmosis
- Clean-in Place System
- Effluent Storage
- Effluent Mechanical Evaporation
- Tank Farm
- Solar evaporation tanks
- Canyon discharge piping and NPDES outfall 051

These groups may not necessarily be closed in sequence, but a basic objective will be to facilitate waste management for similar waste streams that are to be remediated together. A summary of the actions required to complete closure of the individual LL RLW treatment units, and closure duration estimates for completing closure of each group of units are presented in Table 6. Detailed descriptions of the capacity and construction of each individual a treatment unit (e.g., tank or vessel) are provided in Table 7.

4.2.2 TRU RLW Units and Systems

The TRU RLW collection system components, individual treatment units, and associated ancillary components to be closed are listed in Table 8. The individual units were grouped into categories which may be closed together to best facilitate closure. For the TRU RLW these categories include:

- TRU RLW Collection
- TRU Influent Storage
- TRU Treatment
- TRU Sludge
- TRU Effluent

These groups may not necessarily be closed in sequence, but a basic objective will be to facilitate waste management for similar waste streams that are to be remediated together. Description of the individual unit's capacity and construction material are included in Table 7. A summary of the actions required to complete closure of the individual TRU RLW treatment units, and closure duration estimates for completing closure of each group of units are presented in Table 8.

4.2.3 Removal of Balance of Plant Facilities and Structures

Following removal of the individual treatment system units remaining facility and process systems (e.g., infrastructure, SCADA systems, natural gas system components, utilities, etc.) will be closed and removed. Once all such systems have been removed, the principal building and other major structures (e.g., concrete vaults holding tanks) will be demolished and removed. Table 9 identifies the facilities and support systems addressed as part of these balance of plant closure activities and provides estimated durations for closing these systems and for subsequently demolishing and removing principal structures. The balance of plant systems are grouped into categories to better facilitate description of, and preliminary sequencing of activities for closing these various systems. The general categories of the balance of plant systems to be closed are as follows:

- Processing support
- Infrastructure
- Utilities
- Building components and structures (i.e., the principal structures to be removed following removal of facility-wide and process systems)
- Stormwater systems

The various facility-wide and process systems will be closed once individual treatment units are decontaminated and removed and a structural assessment completed of the structure that housed these units. The facility and process systems exist across the RLWTF and will be closed in a generally sequential order; however, the specific order of systems closed might be adjusted between categories or within a particular group. For example, the schedule (see Section 0) for closing and removing specific utilities might be staggered or delayed to allow for extended use for some utilities during a portion of the (subsequent) demolish/remove structures phase. It is projected that closure of all such systems and demolition and removal of all structures will be accomplished within about 420 days, with most of the removal of facility/process systems accomplished during the first 120 days and demolition and removal of principal structures completed within the last 300 days of that period.

Closure of these facility and process systems follows a similar approach as the individual treatment units. Systems will be isolated, drained or de energized as needed. Systems and equipment that may be reused or are sent for disposal as industrial waste would require radiological release surveys, and possibly decontamination. Material packaged and sent for disposal as LLRW or TRU waste, where applicable, may not require decontamination or radiological surveys.

Demolition and removal of principal building structures and other structures will be accomplished using excavators or backhoe fitted with appropriate attachments (e.g., buckets, demolition shears). As described previously, a Brokk® demolition/crusher unit or similar limited access demolition machine may be utilized to accomplish removal of some portions of building structures if necessary.

As above, these removal activities will be performed by personnel wearing appropriate PPE. Radiological data for the associated treatment units, piping, and other equipment will be used to select appropriate PPE. A LANL RWP and an IWD will be developed and used in combination with the applicable LANL DOP to guide these activities.

4.2.4 Processing of Demolition Materials/Debris

Removed sections of building structures and components will be placed into separate controlled staging areas onsite for subsequent processing. Waste will be segregated into the following:

- Uncontaminated bulk material or debris
- Potentially chemically impacted material or debris
- Radiologically contaminated material or debris
- TRU waste

The demolition materials will be segregated according to structure/material type site and based on the results of: (1) history of prior use of the portion of the structure demolished; and (2) results of radiological surveying/swipe samples collected for surfaces of the structures. As required, additional sampling will be conducted during processing of the removed demolition materials to confirm the most appropriate mode of final waste disposition.

Once the disposal requirements and modes are confirmed for materials, and debris, "clean" materials and debris will be loaded into bulk waste transport trucks fitted with proper tarp covers or following size reduction placed into DOT-approved waste shipping containers as required and the containers, labeled, manifested and loaded on flatbed trucks, trailers, or other appropriate vehicles for transport and off-site disposal. Low-level and TRU wastes will be packaged appropriately and staged for shipment to a facility licensed to dispose of such wastes following DOT and marking, labeling, manifesting, and shipping requirements.

4.2.5 Evaluation of Subgrade Conditions

After the removal of the major structures and units the foundation soils, surface or subsurface materials will be sampled to assess the possible residual chemical or radiological constituent concentrations above regulatory and risk-based limits and concentrations that are protective of ground water. NMED requirements for site assessment and verification and confirmation sampling will be followed. This activity is further described in Section 0 below.

5. Other Site Closure Activities

5.1 Surface Water and Groundwater Controls

During removal of treatment tanks and vessels and demolition of the principal structures, erosion control features will be installed around the perimeter of the working areas to contain runoff and migration of (potentially contaminated) sediments from the working areas and to minimize potential erosion of the ground surface from such runoff. Run-on controls will also be established as necessary to manage stormwater during closure.

Provisions will be taken during closure activities to prevent possible failures of temporarily stored waste containers (e.g., extreme weather changes). Such provisions will include management of the containers under a covered area or within an existing structure or the use of a temporary enclosure, or other appropriate controls as necessary.

Closure-generated wastes will be stored in appropriate containers within the facility. Storage vessels used to accumulate soil or liquid wastes will be appropriately containerized in accordance with regulatory requirements and applicable LANL procedures. Waste managed onsite will include the following controls as applicable:

- Wastes generated will be managed in containers within the facility;
- Containers will be compatible with the waste and the containers will remain closed unless being filled;
- Containers will be labeled to identifying the waste by type (e.g., radioactive or non-radioactive); and
- Spill control equipment will be provided adjacent to the container storage area(s).

5.2 Site Investigation/Characterization

The investigation, characterization, cleanup and corrective action requirements for potential releases of contaminants into soil, groundwater and other environmental media from "solid waste management units" (SWMUs) and "areas of concern" (AOCs) associated with the Facility and contained within the Consent Order entered into between the NMED and the Permittees pursuant to the New Mexico Hazardous Waste Act, NMSA 1978, §74-4-10 and the New Mexico Solid Waste Act, NMSA 1978,§74-9-36(D) shall be governed by the Consent Order. The investigation, characterization, cleanup and corrective action of any future SWMUs and AOCs associated with the Facility shall be conducted solely under the Consent Order and not under this Permit until termination of the Consent Order. No activities required under this Permit shall conflict with or duplicate activities required for SWMUs and AOCs identified under the Consent Order. Permittees shall provide information regarding which units and systems are covered by the Consent Order in the submittals required by Conditions VI.D.41 and VI.D.42 of this permit, along with a description of the investigation and characterization that will occur under the Consent Order for each unit and system.

5.3 Decontamination Methods

All equipment used during closure will be decontaminated and radiologically released in accordance with applicable LANL procedures. Where practical, volumetric release surveys as detailed in MARSAME may be used to support release. Any equipment, item or structure which cannot be decontaminated, or radiologically released will be packaged as waste and sent for disposal.

Portable berms or other such devices (e.g., membrane-wrapped hay bales, existing secondary containment) will be used to collect excess wash water derived from decontamination activities. Decontamination waste will be collected managed and segregated characterized in the same manner as closure waste. Based on the results of the analysis, the decontamination waste will be managed as low-level radioactive, non-hazardous, or TRU waste.

Decontamination of Equipment

Existing RLWTF equipment which is eligible for reuse may also be decontaminated and radiologically released. Operating machinery, equipment, tools and reusable sampling equipment, that is not sensitive to water intrusion, may be decontaminated by pressure washing or steam cleaning with a solution consisting of a surfactant detergent (e.g., Alconox®) or a decontamination solution (e.g., Radiacwash) and water mixed in accordance with the manufacturer's recommendations. Portable berms, or other such devices (e.g., absorbent socks, plastic sheeting, wading pools, existing secondary containment), will be used collect all wash water and provide containment during the decontamination process.

Equipment that is sensitive to water intrusion, e.g., electronic devices, some tools, will be decontaminated by washing using a wipe-down method with a solution consisting of a surfactant detergent or decontamination solution and water mixed in accordance with the manufacturer's recommendations. Quantities of wash solution used will be minimized by using buckets, spray bottles, or other types of containers. Cleaning cloths, or other absorbent cleaning devices, will not be reused to wipe down the equipment after being wetted in the wash solution or after spraying solution onto the equipment.

Decontamination of Structures

Decontaminating the interior structure may be accomplished using high-pressure washing, sponge media blasting, sluicing, scabbling (e.g., of a portion of the interior walls of a concrete treatment unit or secondary concrete containment structure), or similar processes. All decontamination waste, e.g., water and debris will be contained and properly characterized for disposal. Structures will be radiological surveyed and released in accordance with applicable LANL procedures. Structures and related equipment that are radiologically released will be considered industrial wastes. Any structure that is not radiologically released may be demolished and sent for disposal as LLRW or TRU waste.

Subgrade Conditions Assessment and Excavation

The foundation (subgrade) soils beneath the removed structures will be sampled to identify residual contamination in soils. Samples will be collected of the subgrade soils in accordance with requirements specified in a Sampling and Analysis Plan (See Section 0) and may include sampling in areas considered most susceptible for exhibiting residual contamination. If deemed appropriate at the time of the sampling assessment, soil samples may be collected from other locations exhibiting visible soil staining or at suspected or known locations of past spills (based on facility operational records) and submitted for laboratory analysis.

If soil is confirmed as being radiologically impacted or exhibiting hazardous constituent concentrations above regulatory or risk-based limits it will be removed and containerized, labeled, and properly manifested pending its final transport and disposal at an appropriate off-site disposal facility. The facility footprint will be radiological surveyed following removal of the identified residual contamination and be released in accordance with applicable DOE and LANL procedures.

5.4 Site Reclamation

Upon completion of the removal of systems, structures or contaminated subgrade soils, the footprint area formerly occupied by the current RLWTF will be regraded to conform with the surrounding natural site grade and conditions and minimize water run-on and run-off. Soil will be placed backfilled and compacted as engineered fill.

Depending on the desired end use, specific regraded areas will then either receive a layer of topsoil and the area will be reseeded with native plant species seeds to promote vegetation growth, or, the area may be regraded to appropriate engineered specifications to accommodate future facility use.

5.5 Post-Closure Monitoring, Maintenance and Repair, and Controls

Final closure of the RLWTF will result in the complete removal of all existing LL RLW and TRU RLW treatment units, process systems and structures comprising the existing RLWTF. Additionally, potential residual contamination in subgrade soils underlying the removed RLWTF structures will be characterized and assessed in accordance with requirements established under the Consent Order (See Section 5.2.) Corrective actions for soils exhibiting radiological and/or chemical constituents at concentrations above regulatory and risk-based limits and/or concentrations that are protective of ground water will be established in accordance with the consent Order and DOE Order 458.1.

Implementation of the final closure activities will effectively remove all sources of potential radiological or chemical constituents to air, soil and groundwater, and surface water. This should minimize the need for completing post-closure monitoring, maintenance and repairs, and implementation of active or administrative post-closure controls within the footprint area of the existing RLWTF.

5.6 Groundwater Monitoring Plan

Post-closure groundwater monitoring will be conducted at the same wells as that used for operational monitoring, specifically:

- a new alluvial well (currently unnamed) located hydrologically downgradient of Outfall 051;
- MCOI-6 - previously constructed and located within perched-intermediate groundwater beneath Mortandad Canyon;
- R-46 - located in the regional aquifer downgradient of the RLWTF;
- R-60 - located in the regional aquifer downgradient of the RLWTF;

- R-1 - located in the regional aquifer downgradient of the RLWTF; and
- R-14 - located in the regional aquifer downgradient of the RLWTF

The groundwater monitoring plan will focus on contaminants that were associated with RLWTF and have the potential to migrate to groundwater (e.g., nitrate, perchlorate, flouride). In the event that groundwater contaminants associated with operations conducted at RLWTF under this permit are detected in any of the wells, an assessment of the condition would be performed, and mitigation may be conducted. An important part of the assessment would be the evaluation of whether a new condition(s) arose in any of the wells associated with operations under the groundwater discharge permit. If mitigation is necessary, sampling will be conducted at applicable wells on a quarterly basis for a minimum of eight consecutive quarters after achieving the standards of NMSA 20.6.2.3103.

5.7 Characterization of Wastes Generated

For documentation purposes, wastes generated during final closure (e.g., treatment residues, contaminated demolition debris, contaminated soil, etc.) will be characterized through sampling and analysis of the wastes to verify waste constituents present and to identify appropriate disposal options for those wastes. Wastes generated during closure will be characterized as follows:

- Representative samples of water, sludge or bottoms, as appropriate, will be collected from tanks and vessels. These samples will be analyzed for appropriate indicator radionuclide constituents (alpha and beta emitters and tritium) and RCRA toxicity-characteristic metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver);
- Additional analyses may be included based on the tank or vessel being sampled and the historic waste streams handled; for example, following evacuation of liquid and/or sludge tanks and pipe sections that contained or conveyed acids (e.g., nitric acid used in treatment of TRU RLW acid influent treatment in Room 60 of Building 50-001; sulfuric acid used for pH adjustment in Room 34B of Building 50-001). Residual waste liquids or solids may be sampled and analyzed for: (1) RCRA toxicity-characteristic metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver); and (2) the RCRA corrosivity characteristic; and
- As warranted by observations and sample results obtained during decontamination activities, combined with consideration of knowledge or past processes, samples may be collected of solids/scale on the interior wall of selected sections of piping to verify the presence and concentrations of radionuclides, RCRA toxicity-characteristic metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver); and RCRA corrosivity characteristic.

Soil samples will also be collected at selected locations from the subgrade soils beneath the areas formerly occupied by the principal RLWTF principal structures to identify residual impacted soils. Excavated soils will be sampled to confirm concentrations of residual contaminants present and to confirm waste classification for disposal.

All liquid, sludge, debris, treatment residues, and soil samples will be analyzed in accordance with LANL waste analysis procedures and applicable local, State, and Federal regulations. Prior to initiating closure activities, a Sampling Analysis Plan will be generated to identify the

appropriate methods based on the historical LL RLW and TRU RLW streams treated in the existing RLWTF.

5.8 Dispositioning of Wastes Generated

Closure activities are likely to generate several different types of waste materials, including nonhazardous industrial wastes, LLRW and TRU wastes. Potential wastes that may be generated are listed in Table 10 along with potential disposal/treatment options. All waste generated during closure will be managed, controlled, handled, characterized, and disposed of in accordance with established LANL waste management procedures and applicable local, State, and Federal laws and regulations.

Waste generated from closure activities will be segregated based on the potential contaminates present in the waste. Particular attention will be focus on limiting the generation of TRU waste, and all waste material will be segregated based on the potential disposal options. The segregated waste will be sampled as necessary to properly characterize the waste, ensure proper waste packaging, labeling, manifesting and acceptance at the applicable disposal facility.

Waste material (liquids and sludge) present inside the individual treatment units and vessels will be removed and processed following existing DOPs. To the extent practicable, evacuated wastes will be processed on-site at the replacement RLWTF or may be otherwise treated onsite or off site to meet Land Disposal Restrictions (LDR). Waste material that may require additional treatment (solidification, etc.) prior to disposal will be manifested and transported to a licensed treatment facility (e.g., solidification and drumming of certain TRU residual wastes for subsequent shipment to WIPP). Waste will be packaged and transported in accordance with applicable DOT regulations.

Decontaminated equipment and structures may be reused or sent for recycling if they are radiologically released under applicable DOE and LANL procedures. Equipment that is volumetrically contaminated will be evaluated using DOE and LANL procedures for radiological release. Disposable equipment and other equipment that cannot be decontaminated will be containerized and managed as waste.

5.9 Closure Schedule

An integrated closure schedule has been developed that provides projected timetables and estimated durations for completing various steps (phases) required for closing the RLWTF. Figure presents a preliminary closure schedule and provides an anticipated sequence for completing the RLWTF closure activities. The schedule would be re-visited and revised prior to the start of Final Closure, which could be years into the future.

Key phases of the closure work included in the schedule are as follows:

- Prepare and receive approval of Closure Plan
- Procure closure contractor(s)
- Implement closure activities including:
  - Remove contaminants, decontaminate, decommission, and remove individual treatment units
  - Complete structural assessments of principal structures

  - Remove balance-of-plant facility-wide and process systems
  - Demolish and remove buildings/principal structures
  - Size-reduce, sample, package, manifest, and ship waste materials offsite for disposal
  - Perform verification sampling
  - Restore site
- Prepare and receive approval of Closure Report

Table 6, Table 8, and Table 9 provide descriptions of selected activities and additional details regarding estimated durations required for closing and removing each LL RLW and TRU RLW treatment unit and the "balance-of-plant" facility and process systems, respectively. Table 11 provides a tabular summary overall closure schedule identifying activities and their estimated durations for completing final closure of the RLWTF following the decision to close the RLWTF.

The estimated closure timetables presented in Table 6, Table 8, Table 9, and Table 11 for completing closure and removal of the various units and systems are intended to address requirements regarding closure timeframes contained in DP-1132, proposed Condition VI.D.42.k. This schedule reflects the estimated amount of time required for completing final closure activities and for submitting final documentation required for completing closure activities.

The estimated total duration for completing all closure activities (Table 11) and for preparation and approval of the final closure report is approximately 1,470 calendar days. This duration includes a number of assumptions, which are listed in the footnotes to Table 11. As an illustrative example, a total of 420 days (see also Table 6, Table 8, and Table 9) is estimated to be needed to complete the following activities (with the work assumed to generally proceed in a series-like fashion):

- Remove facility-wide systems and process systems; and
- Completed demolition and removal of principal building structures and other major structures

As an additional illustrative example, completion of removal of liquids and solids, decontaminating as needed, decommissioning, and removing all individual LL RLW and all TRU RLW treatment units (Table 6 and Table 8) is projected to fall within the 180-day period depicted on Figure . In this instance, this total duration is based on the following assumptions:

- Separate teams of workers are assumed to work simultaneously at closing the following facilities:
  - Influent tanks and main treatment facilities (Clarifiers, Gravity Filter, grit chamber, etc.);
  - Other main treatment system components in Building 50-001 and effluent and residuals storage tanks in Building 50-001 and Structures 50-002 and 50-248; and
  - Effluent evaporation facility and the Solar Evaporation Tanks facility.
- Separate crews work simultaneously to remove liquids and solids and to decontaminate, decommission, and remove individual LL RLW and TRU RLW treatment units.

The integrated schedule also allows flexibility to account for potential uncertainties; for example, the 300-day duration shown on Figure (and in Table 9) for demolishing and removing principal building structures and other major structures (vaults, etc.) might be less or greater than estimated, and more than 120 days might be required to remove all facility-wide and process

systems; however, it is expected that all such systems will be removed with 420 days of the completion of the required structural assessments.

Similarly, due to unanticipated delays or complexities that might be encountered, more than 180 days might be required to remove liquids and solids, decontaminating as needed, decommissioning, and removing all individual LL RLW and all TRU RLW treatment units; however, it is anticipated that all such units will be removed within approximately 690 days of the start of on-site closure work.

The schedule in Figure also includes estimated timeframes for undertaking and completing other activities related to closure of the RLWTF, including submittal and review of the Final Closure Plan, procurement of contractor(s) to perform the work, completing verification surveys and sampling and testing, completing site restoration, and submission and approval of the final closure report.

In the event that activities described in this Closure Plan cannot be completed within the projected timeline presented in Table 11 (e.g., due to unanticipated site conditions encountered during the course of the work; lack of availability of contractors/equipment, etc.) a time extension request for completing the final closure work may be submitted to NMED.

6. Final Closure Report

Consistent with DP-1132, proposed Condition VI.D.43 (Final Closure), once closure begins, and until all closure requirements (excluding post-closure ground water monitoring) are completed, LANL will submit quarterly status reports to NMED describing the closure actions taken during the previous reporting period and the actions scheduled for the next reporting period.

Within 90 days of completing closure activities, LANL will submit a final written report for approval on the actions taken to implement closure to NMED, in accordance with DP-1132, proposed Condition VI.D.43.

7. References

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Appendix A-
Tables

TABLES

Table 1. Timeline of Facility Operations and Facility/Process Modifications- RLWTF

Table 2. Principal Structures, Units, and Components to be Closed – LLW System

Table 3. Historic Waste Streams Handled: Low-Level RLW Treatment Units

Table 4. Principal Structures and Individual Units to be Closed – TRU System

Table 5. Historic Waste Streams Handled: Transuranic RLW Treatment Units

Table 6. Closure Actions and Estimated Durations for Low-Level RLW Treatment Units

Table 7. Characteristics of Individual Treatment Units

Table 8. Closure Actions and Estimated Durations for TRU RLW Treatment Units

Table 9. Closure Actions and Estimated Durations for Balance of Plant Systems

Table 10. Potential Waste Material Types Generated and Disposal Options

Table 11. Closure Schedule for RLWTF

Table 1. Timeline of Facility Operations and Facility/Process Modifications– RLWTF

Year/Date of Operation	Aspect of Facility Operation/Facility or Process Addition or Modification
1961 – 1963	Construction of the TA-50 RLWTF
June 27, 1963	TA-50 RLWTF receives first RLW influent
1978	Obtained NPDES Discharge Permit for Discharge Outfall 051 in Mortandad Canyon
1979	Constructed transuranic collection system, structure TA-50-066 to provide transuranic influent storage, and treatment equipment in Room 60. .
July 1979	Created first drum of cemented transuranic sludge
1983	Completed the new low-level RLW Collection System, with double-walled piping and leak detection capability at 62 access vaults along the four miles of piping. Majority of the original collection system was decommissioned and removed.
1983	Sanitary wastes sent to the TA46 sewage plant instead of to a septic system with leach field at TA50. Septic system was removed.
1982	Constructed TA-50-090 to provide additional influent storage capacity for low-level RLW waste streams.
1983 – 1984	Enclosed the Room 60 drum tumbler, and began exhausting enclosure emissions through HEPA filters.
1994	Added an emergency power generator in northeast corner of TA-50-001 and replaced main power transformer for TA-50-001.
1995	Replaced TRU RLW acid tank in WM-66
1996	Installed steel 17K Tank in underground concrete tank south of the 75K Tank.
1997	De-scaled internal surfaces of clarifiers then applied epoxy-based paint to cleaned surfaces.
1997	Installed four 20,000-gal above-ground storage tanks in concrete basin in Building 50-248 to provide secondary containment with leak detection capability.
1996-1999	Installation of advanced membrane treatment units (ultrafilter and reverse osmosis) in treatment rooms on the east side of Building 50-01 in response to reduced discharge limits for radioactivity in treated water released to the environment.
2000	Sandblasted interior walls of N25K and S25K Tanks clean and applied impermeable epoxy paint to cleaned walls.
2001	Began use of gravity filter effluent for clarifier chemicals, thereby reducing secondary waste generation rates.
2002	Added perchlorate ion exchange columns per anticipated EPA regulations.
2003	Removed sludge from 25,000-gal in-ground, single-walled concrete tank located southwest of N25K and S25K Tanks in Building 50-02.

Table 1. Timeline of Facility Operations and Facility/Process Modifications– RLWTF

Year/Date of Operation	Aspect of Facility Operation/Facility or Process Addition or Modification
2010	Added Cu-Zn ion exchange columns to polish permeate from the primary RO unit.
2010	Installed structure TA-50-257 including natural-gas fired boiler/evaporator for evaporation of treated low-level RLW.
Jan 2, 2011	First evaporation of treated water.
2010	Completed construction of Building TA-50-250 (Waste Management/Risk Mitigation Facility) housing six new 50,000-gal storage tanks.
2012	Completed construction of lined Solar Evaporation Tanks (SETs) at TA52 to create an alternative to evaporation using natural gas.
2012	Completed facility modifications and process upgrades per anticipated requirements of a Ground Water Permit.

Table 2. Principal Structures, Units, and Components to be Closed – LLW System

Structure	Year Built	Description of Structure	Associated LLW Treatment Units *[and other components]*	No. in Permit Application/ Room No. in Structure
50-001 50-002	**1963**	**RLWTF**	• **N.A.**	• **N.A./N.A.**
N.A	**1982**	**RLWCS**	• **Low-level RLW collection system, including Piping and access vaults and vault alarms.**	• **N.A. / N.A.**
50-001	**1963**	**Influent Storage**	• **Neutralization Chamber (Tank TK-13) and associated piping**	• **M2 / Rm 16**
50-002	**1963**	**Influent Storage: Below-grade concrete storage tanks structure**	• **17K Tank (untreated RLW storage)**	• **N.A. / 50-002 structure**
50-002	**1963**	**Influent Storage: Below-grade concrete storage tanks structure**	• **75K Tank (untreated RLW storage)**	• **TK-3 / 50-002 structure**
50-090	**1986**	**Influent Storage: Above-ground 100K LL RLW influent storage tank (Tank WM2-N)**	• **100K Tank (untreated LL RLW Influent storage tank)**	• **N.A. / Structure 50-090**
50-250 (WMRM facility)	2010	Influent and Emergency Influent storage facility	• Influent Storage Tanks TK5 and TK6	• M2 / 50-250 Building
50-250 (WMRM facility)	2010	Emergency Influent storage facility	• Emergency influent storage tank TK-1,2,3,4	• M3 / 50-250 Building
50-001	1963	Main treatment process	• Clarifier #1 and Clarifier #2 and Grit Chamber (idle)	• N.A. / Rm 16
50-001	1963	Main treatment process	• Gravity Filter	• N.A. / Rm 16
50-001	2011	Main treatment process	• Pressure Filters	• M6 / Rm 63
50-001	2012	Main treatment process	• Microfilter	• M5 / Rm 70A
50-001	1963	Main treatment process	• Reaction tanks TK-71 and TK-72	• M4 / Rm 70
50-001	1963	Secondary treatment process	• Tank TK-73	• S1 / Rm 70

Table 2. Principal Structures, Units, and Components to be Closed – LLW System

Structure	Year Built	Description of Structure	Associated LLW Treatment Units *[and other components]*	No. in Permit Application/ Room No. in Structure
50-002	**1963**	**Main treatment process**	• **Centrifugal Ultrafilter (idle)**	• **N.A. / Rm 71**
50-001	**1963**	**Main treatment process**	• **5,000-gallon storage tank (idle)**	• **N.A./Outside TA-50-001, Rm 59**
50-002	**1963**	**Main treatment process**	• **Former Low Level Sludge Tank (TK-7)**	• **N.A./ TA-50-002**
50-001	**1963**	**Main treatment process**	• **IX vessels (Cu-Zn)**	• **M9 / Rm 34B**
50-001	**1963**	**Main treatment process**	• **IX vessels (12) (Perchlorate)**	• **M7 / Rm 16**
50-001	**1963**	**Main treatment process**	• **Tank TK-9**	• **S2 / Rm 62**
50-001	**1963**	**Secondary treatment process**	• **Rotary Vacuum Filter (Secondary Treatment)**	• **S2/ Rm 116B**
50-001	**1963**	**Secondary treatment process**	• **Tank TK-8 (Secondary RO)**	• **S2 / Rm 61**
50-001	**1963**	**Secondary treatment process**	• **Tank TK-25/Secondary RO units SRO-1; SRO-2 (Secondary RO)**	• **S1 / Rm 24**
50-001	**1963**	**Main treatment process**	• **Membrane Clean-in-Place System**	• **N.A.**
50-001	**1963**	**Clean-in-Place System**	• **TK-74**	• **N.A.**
50-001	**1963**	**LLW Effluent Storage**	• **North and South Frac Tanks**	• **M10 / Rm 34B**
50-257	2011	Effluent Evaporator	• Natural Gas-Fired Evaporator	• M11 / Structure 50-257
50-002	1997	Secondary treatment process	• 3K tank	• S3 / Structure 50-002
50-002	1963	Secondary treatment process	• North Tank (N25K) and South Tank (S25K)	• WM2-N and WM2-S/ Structure 50-002
50-248	1963	Secondary treatment process	• Tanks TK-NE, TK-SE, TK-SW, and TK-NW	• S3/ Structure 50-248
52-181 52-182 52-183	2010	Solar Evaporation Treatment (SET)	• Effluent evaporation basins, pump house, and associated cross-site below-grade piping	• M11 / Located in TA- 52

Table 2. Principal Structures, Units, and Components to be Closed – LLW System

Structure	Year Built	Description of Structure	Associated LLW Treatment Units *[and other components]*	No. in Permit Application/ Room No. in Structure
50-250	2010	Piping	• Return line from WMRM Facility (Structure 20-250) to Structure 50-001	• N.A.
Outfall #051	N.A.	NPDES Discharge outfall	• Discharge Pipe	• N.A.
50-002	1963	Below-grade concrete storage tanks structure	• Main wastewater treatment system pumps, and effluent pumps for discharging treated water to Mortandad Canyon	• N.A./ Structure 50-002
50-002	1963	Below-grade concrete storage tanks structure	• Overflow piping from 75K and 17K Tanks to a sump equipped with sump pumps and piping to the 100K Tank in Structure TA-50-90	• N.A./ Structure 50-002
50-090	1986	Above-ground 100K LL RLW influent storage tank (Tank WM2-N)	• Secondary containment system including dike wall and connective piping to the 17K Tank in Structure 50-002	• N.A./ Structure 50-090

Table 3. Historic Waste Streams Handled: Low-Level RLW Treatment Units

Structure	Description	LL RLW Treatment Unit	Historic Waste Streams Handled
50-001	Main treatment plant structure housing LLW treatment equipment, process tanks, analytical labs, utilities, and offices	Clarifiers (CLI-1 and CL-2)[1, 2]	Low-level RLW influent; lime (calcium hydroxide), caustic soda (sodium hydroxide), and iron sulfate additives to precipitate impurities, including radionuclides.
		Gravity Filter[1,2]	Chemically treated low-level RLW influent from clarifiers. Radioactive concentrations in feed to the Gravity Filter were 85% - 95% reduced from influent concentrations, except for tritium.
		Reaction Tanks TK-71; TK-72	Low-level RLW influent mixed with chemicals such as lime, sodium hydroxide, ferric sulfate, and magnesium sulfate added to adjust pH, precipitate metals, and promote particle growth.
		Microfilter	Treated influent sludge/water mixtures from reaction tanks TK-71, TK-72 are filtered to separate solids from water.
		Pressure Filters	Treated influent from the clarifiers, the gravity filter, and TK-71 or TK-72 are run through media consisting of coarse- and fine-sized particles of sand, garnet, coal, and gravel.
		Perchlorate Ion Exchange Unit	Filtrate from TK-9 for perchlorate removal prior to treatment in Primary RO Unit.
		Primary RO Unit	Filtrate from Tank TK-9.
		Primary RO Unit	Feed water from Tank TK-9
		Influent Storage Tank TK-13 (Neutralization Chamber)	LL RLW influent is mixed with a neutralizing agent as required.
		Rotary Vacuum Filter	Sludge from TK-8 (rotary vacuum filter).
		Sludge Storage Tank TK-8	Sludge from microfilter or pressure filters (TK-8).
		Sludge Storage Tank TK-9	• Filtrate from microfilter (TK-9) • Permeate from Secondary RO for subsequent retreatment through perchlorate ion exchange unit • Additives for pH adjustment
		Cu-Zn Ion Exchange Unit	Permeate from Primary RO Unit in Room 72 run through ion exchange resin bank(s) using makeup water drawn from one of the two Frac Tanks.

Table 3. Historic Waste Streams Handled: Low-Level RLW Treatment Units

Structure	Description	LL RLW Treatment Unit	Historic Waste Streams Handled
		Effluent Storage (North and South Frac) Tanks in Room 34B	Permeate from Primary RO Unit.
		Tank TK-73 (Secondary RO) 3,700-gal tank in Room 70A	Concentrate from the Primary RO Unit.
		Tank TK-25 (Secondary RO) 300-gal tank and SRO-1 and SRO-2 in Room 24	Concentrate from Tank TK-73.
		5,000-gal storage tank (idle)located outside of Room 59.	Nitric acid.
50-002	Below-grade concrete storage tanks structures	N25K and S25K Tanks (treated LL RLW storage)[1]	1963-2000: Storage of treated water from main treatment process having alpha-emitting radionuclide concentrations <1 nCi/L. 2000–Present: • Storage of overheads from waste evaporator containing trace radionuclides and no solids (2000–2014) • Storage of drain waters from the effluent evaporator having concentrations of alpha-emitting radionuclides <10 nCi/L and no solids (2011–Present)
		75K Tank[1]	• Storage of LL RLW influent from LL RLW collection system • Storage of xxx (info to be provided by LANL)
		17K Tank	• Storage of LL RLW influent from LL RLW collection system • Storage of RLW bottoms
		3K Tank (mixing/transfer tank)	• Storage of LL RLW influent from LL RLW collection system • Storage of RLW bottoms
		Emptied/abandoned concrete sludge storage tank (25,000 gallon) located southwest of N25K and S25K Tanks.	Storage of LL RLW sludge *(Additional information to be provided when available)*

Table 3. Historic Waste Streams Handled: Low-Level RLW Treatment Units

Structure	Description	LL RLW Treatment Unit	Historic Waste Streams Handled
50-090	Above-ground 100K Storage Tank	100K Tank	1996–Present: Storage of LL RLW influent on as-needed basis 2008–Present: Storage of RLW bottoms
50-248	Secondary low-level RLW and Bottoms Storage Facility	Storage Tanks (4) – NE, SE, SW, and NW Tanks	Storage of residuals from (former) Interim Evaporator System: • NE, SW, and NW Tanks: Storage of evaporator feed (Electrodialysis reversal [EDR] concentrate [reject] from EDR unit) • SE Tank: Storage of evaporator bottoms (distillate)
50-250	Influent and emergency influent storage facility	• Influent Storage Tank TK-5 • Influent Storage Tank TK-6 • Emergency Influent Storage Tank TK-1 • Emergency Influent Storage Tank TK-2 • Emergency Influent Storage Tank TK-3 • Emergency Influent Storage Tank TK-4	• Storage of low-level RLW influent • Storage of low-level RLW influent • Emergency storage of low-level RLW influent • Emergency storage of low-level RLW influent • Emergency storage of low-level RLW influent • Emergency storage of low-level RLW influent
N.A	LL RLW collection system	LL RLW collection system components, including WM-72 collection vault	• Collection/temporary storage/conveyance of LL RLW influent from LL RLW collection system
52-181 52-182 52-183	Solar Evaporation Treatment (SET)	Geomembrane-Lined concrete effluent evaporation basins and pump house	• Treated water received from main RLW treatment process

[1] Low-Level RLW liquids and sludge will be removed from each of these tanks/vessels and the interior walls and floor of these tanks/vessels decontaminated during stabilization activities completed prior to closure.
[2] Radionuclide fixative or epoxy-type paint will be applied to the interior walls and floor of these tanks/vessels following decontamination during prior stabilization activities.

Table 4. Principal Structures and Individual Units to be Closed – TRU System

Structure	Year Built	Description of Structure	Associated TRU LLW Treatment Units [and other components]	No. in Permit Application/ Room No. in Structure
TA-50, TA-55, 50-201	**1979**	**TRU RLW collection system**	**TRU RLW collection system components**	**T1 / N.A.**
50-066, 50-107	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Acid waste tank (original tank replaced in 1995)**	• **T2/ Structure TA-50-66 (Vault WM-66)**
50-001	**1979**	**TRU treatment equipment, process tanks, and utilities**	• **Treatment tanks TK-1 and TK-2**	• **T3 / Rm 60**
50-001	**1979**	**TRU treatment equipment, process tanks, and utilities**	• **TK-4 (idle)**	• **Rm 60A**
50-001	**1979**	**TRU treatment equipment, process tanks, and utilities**	• **Clarifier CL-1 (idle)**	• **Rm 60**
50-001	**1979**	**TRU treatment equipment, process tanks, and utilities**	• **Tank TK-6**	• **Rm 60A**
50-001	1979	TRU treatment equipment, process tanks, and utilities	• Tank TK-7 (idle)	• Rm 60A
50-001	1979	TRU treatment equipment, process tanks, and utilities	• Pressure filter	• Rm 60
50-001	1979	TRU treatment equipment, process tanks, and utilities	• Decant filter (idle)	• Rm 60A
50-001	1979	TRU treatment equipment, process tanks, and utilities	• Piping	• Rms 60 and 60A

Table 4. Principal Structures and Individual Units to be Closed – TRU System

Structure	Year Built	Description of Structure	Associated TRU LLW Treatment Units [and other components]	No. in Permit Application/ Room No. in Structure
50-001	**1979**	**TRU treatment equipment, process tanks, and utilities**	• **Drum tumbler (original tumbler was replaced in 2007)** •	• **T4 / Rm 60A**
50-001	**2007**	**TRU treatment equipment, process tanks, and utilities**	• **TK-7A**	• **T4 / Rm 60A**
50-001	**1979**	**TRU treatment equipment, process tanks, and utilities**	• **TK-3**	• **T5 / Rm 60**
50-066, 50-107	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Caustic waste tank (replaced in 1983 and again in 2007)**	• **T2/ Structure TA-50-66 (Vault WM-66)**
50-066, 50-107/50-001	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Piping *[two double-wall transfer pipes connecting Acid and Caustic waste tanks to Tank TK-1 in Rm 60 of Building 50-001]***	• **T2/Multiple**
50-066, 50-107/50-001	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Valves**	• **T2/Multiple**
50-066	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Sump with transfer/ recirculation sump pump**	• **N.A./ Structure TA-50-66**
50-066	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Ventilation system with exhaust through pre-filter and two stage high efficiency particulate air (HEPA) filter**	• **N.A./ Structure TA-50-66**
50-066	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Fabric and metal frame cover enclosure**	• **N.A./ Structure TA-50-66**
50-066	**1979**	**Below-grade TRU RLW influent storage tanks**	• **Structure TA-50-107 - A sampling shed for obtaining liquid samples from the acid and caustic RLW storage tanks**	• **SN.A./ Structure TA-50-66**

Table 4. Principal Structures and Individual Units to be Closed – TRU System

Structure	Year Built	Description of Structure	Associated TRU LLW Treatment Units [and other components]	No. in Permit Application/ Room No. in Structure
50-201	1979	Below-grade reinforced concrete TRU RLW valve pit/valve station in Vault WM-201	• Vault with sump and valve station	• N.A./Structure 50-201 (Vault WM-201)
50-201	1979	Below-grade reinforced concrete TRU RLW valve pit/valve station in Vault WM-201	• Double-wall and single-walled piping	• N.A./Structure 50-201
50-201	1979	Below-grade reinforced concrete TRU RLW valve pit/valve station in Vault WM-201	• Steel frame building with sheet metal sides and roof covering valve pit	• N.A./Structure 50-201 N.A./Structure 50-201

Table 5. Historic Waste Streams Handled: Transuranic RLW Treatment Units

Structure	Description	TRU RLW Treatment Unit	Historic Waste Streams Handled
50-001	TRU treatment equipment, process tanks, and utilities	Treatment Tank TK-1	Acid and caustic TRU RLW influent from Tanks AWT-001 and CWT-001. Acid influent is neutralized by mixing with liquid sodium hydroxide; other chemicals (ferric sulfate or polymer) may be added to promote particle growth
		Treatment Tank TK-2	Neutralized acid TRU RLW or un-neutralized liquids from Tank TK-1
		Sludge Tank TK-7A	Settled-out solids formed in the neutralized waste and caustic waste influent from Tank TK-1; TK-7A may be seeded with sludge left over from the previous treatment campaign and/or chemicals (lime, ferric sulfate, or polymer) to facilitate particle growth
		Effluent Tank TK-3	Water decanted from Tank TK-7A and treated liquid from Tank TK-1 following neutralization
		(Metering) Tank TK-6 (20-gal)	Sludge from Tank TK-7
		Drum Tumbler	Sludge from TK-7A and Tank TK-6 is mixed in cement and sodium silicate then tumbled to form solidified waste form in drums for off-site disposal (at WIPP)
		Tanks TK-4; TK-7; decant pressure filter – Rooms 60 and 60A	Tank TK-4 and decant pressure filter are installed and available for use if needed. Tank TK-7 has experienced wall corrosion from previous service and is not used for treatment. Tank TK-7 is believed to contain negligible quantity of radioactive material.
50-066	Below-grade TRU RLW influent storage tanks	Acid TRU RLW influent storage tank (AWT-001; 3,900-gal) Caustic TRU RLW influent storage tank (CWT-001; 3,000-gal)	TRU RLW influent received in discrete batches from valve pit/valve station in Vault WM-201.
50-201	Below-grade reinforced concrete TRU RLW valve pit/valve station in Vault WM-201	Vault with sump and valve station	TRU RLW influent received from Building 55-04 (via TRU RLW Collection System)

Table 5. Historic Waste Streams Handled: Transuranic RLW Treatment Units

Structure	Description	TRU RLW Treatment Unit	Historic Waste Streams Handled
50-248	Treated secondary TRU RLW and bottoms storage facility	Storage tanks (4) – NE, SE, SW, and NW tanks	Storage of treated water from the TRU RLW treatment system units for disposition as bottoms.
N.A	TRU RLW collection system	TRU RLW collection system components	Collection/temporary storage/conveyance of TRU RLW influent from TRU RLW collection system.

Table 6. Closure Actions and Estimated Durations for Low-Level RLW Treatment Units

LL RLW Category	Closure Duration Estimate[1]	Permit Application No.	Vessel/ Item	Room # in 50-001	Other Buildings	Isolate unit	Collect liquid &/or sludge sample for analysis	Evacuate (pump or drain) free liquid &/or sludge	Dilute removed liquids/sludge to acceptance RLWTF for treatment	Decontaminate unit (wash, scabble)	Dismantle and remove secondary containment systems	Radiological Survey	Apply Fixative or Paint	Remove treatment unit or vessel & associated components	Size reduce/segment larger removed items/vessels if required	Perform Structural Assessments[1]	Demolish and remove structure(s)[1]	Collect subgrade soil sample(s) after removal of structure/unit[1]	Package and ship off-site for processing (e.g. solidification) or disposal off-site
LL RLW Collection System (RLWCS)	NA		Cross Country Line	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
		M1	Various piping	NA	TA-03, TA-35, TA-48, TA-50, TA-55, TA-59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
		M1	Vaults (62), incl. WM-72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
			Floor Drains and Sumps	Multiple	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
Influent Storage	120 days		Piping	Multiple	NA	X	X	X	X	X		X		X	X		X		X
		M2	Neutralization Chamber (TK-13)	16	50-002	X	X	X	X	X	X	X		X	X		X		X
			17,000-gal Tank	NA	50-002	X	X	X	X	X	X	X	X	X	X		X		X
			75,000-gal Tank	NA	50-002							X	X	X	X		X	X	X
			100,000-gal Tank	NA	50-090							X	X	X	X		X	X	X
		M2	WMRM tanks (2)	NA	50-250	X	X	X	X	X		X		X	X		X		X
		M3	WMRM tanks (4)	NA	50-250	X	X	X	X	X		X		X	X		X		X
		M2/M3	Return line: WMRM to 50-001	NA	50-250	X	X	X	X	X		X		X	X		X		X
Main Treatment (Clarify)	60 days		Clarifier #1	16	NA							X		X	X		X	X	X
			Clarifier #2	16	NA							X		X	X		X	X	X
			Piping	16/116	NA	X	X	X	X	X		X		X	X		X		X
			Gravity Filter	16A	NA							X		X	X		X	X	X
		Idle	Grit Chamber	16	NA	X	NA	NA	NA	NA		X		X	X		X		X
			Storage Tank (TK-8)	61	NA	X	X	X	X	X		X		X	X		X		X
		Idle	RP Filter	61	NA	X						X		X			X		X
		M6	Pressure Filters	63	NA	X					X	X		X			X		X
		Idle	Pilot Ultrafiltration Units	61	NA	X					X	X		X			X		X
			TK-73	70	NA	X	X	X	X	X	X	X		X	X		X		X
			Centrifugal Ultrafilter	71	NA	X						X		X			X		X
Main Treatment (IX/RO)[2]	10 days	M9	IX vessels (Cu-Zn)	34B	NA	X					X	X		X			X		X
		M7	IX vessels (12) (Perchl)	16	NA	X					X	X		X			X		X
		M7	TK-9	62	NA	X					X	X		X	X		X		X
		M8	Primary RO[3] Unit	72	NA	X					X	X		X	X		X		X
Main Treatment (Filter)	30 days	M5	Microfilter	70A	NA	X					X	X		X			X		X
			Piping	70A	NA	X	NA	NA	NA	NA		X		X	X		X		X
			Sludge Tank	70A	NA	X	X	X	X	X	X	X		X	X		X		X
			Cleaning Tanks	70A	NA	X	X	X	X	X	X	X		X			X		X
		M4	TK-71	70	NA	X	X	X	X	X	X	X		X	X		X		X
		M4	TK-72	70	NA	X	X	X	X	X	X	X		X	X		X		X
Main Treatment (Tanks)	20 days	*Idle*	Low-level Sludge Tank	NA	50-002	X	X	X	X	X		X		X	X		X	X	X
		Idle	Underground tank	62	TA-50-077	X	X	X	X	X		X		X	X		X	X	X

Table 6. Closure Actions and Estimated Durations for Low-Level RLW Treatment Units

LL RLW Category	Closure Duration Estimate[1]	Permit Application No.	Vessel/ Item	Room # in 50-001	Other Buildings	[redacted] unit	Collect liquid &/or sludge sample for analysis	Evacuate (pump or drain) free liquid &/or sludge	Route removed liquids/sludge to [redacted] RLWTF for treatment	Decontaminate unit (wash, scabble)	Demolish and remove secondary containment systems	Radiological Survey	Apply Fixative or Paint	Remove treatment unit or vessel & [redacted] components	Size reduce/segment larger [redacted] tank [redacted] if required	Complete Structural Assessments	Demolish and remove structure(s)[1]	Collect subgrade soil sample(s) after removal of structure[redacted][1]	Ship [redacted] off-site for processing (e.g. solidification) or disposal off-site
Secondary Reverse Osmosis	20 days	S1	Secondary RO[3] Vessels	24	NA	X	X	X	X	X	X	X		X			X		X
		S1	TK-25 (Storage of concentrate from TK-73)	24	NA	X	X	X	X	X	X	X					X		X
		S2	Rotary vacuum filter	16	NA	X		X	X		X	X		X	X		X		X
		S2	TK-8	24	NA	X	X	X	X	X				X	X		X		X
Clean-in-Place System	10 days		Membrane Clean-in-Place System		NA	X	X	X	X	X		X		X			X		X
			TK-74		NA	X	X	X	X	X		X		X	X		X		X
Effluent Storage	90 days	M10	North FRAC tank	34B	NA	X	X	X	X	X	X	X		X	X		X		X
		M10	South FRAC tank	34B	NA	X	X	X	X	X	X	X		X	X		X		X
		M10	TK-38 (1,000-gal)	38	NA	X	X	X	X	X	X	X		X			X		X
		S3	TK-NE	NA	50-248	X		X				X		X	X		X	X	X
		S3	TK-SE	NA	50-248	X		X				X		X	X		X		X
		S3	TK-SW	NA	50-248	X		X				X		X	X		X	X	X
		S3	TK-NW	NA	50-248	X		X				X		X	X		X		X
		S3	3K Tank	NA	50-248	X	X				X	X		X	X		X	X	X
			N. Overhead Tank (N 25K) (TK-5)	NA	50-002							X		X	X		X	X	X
			S. Overhead Tank (S 25K) (TK-6)	NA	50-002							X		X	X		X	X	X
			Former Underground concrete sludge storage tank (TK-7)	NA	50-002							X		X	X		X	X	X
Mechanical Evaporation	60 days	M11	Effluent Evaporator	NA	TA-50-257	X	X	X	X	X		X			X		X	X	X
			Piping	NA	NA	X		X	X	X		X		X	X		X		X
			Pumps, pipes, valves, lines, sinks	NA	NA	X		X	X	X		X		X	X		X		X
Solar Evaporation Tanks	60 days	M11	Solar Evaporation Basins (TA-52)	NA	NA	X	X	X	X	X	X	X		X	X		X	X	X
		M11	Pump house & underground piping	NA	NA	X	X	X	X	X		X		X	X		X		X
NPDES Discharge Outfall #051	NA	M11	Discharge Pipe (Mortandad Canyon)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA

[1] The estimated durations shown in the second column do not include the time required for completing the activities listed in the last four columns (covered elsewhere)

Table 7. Characteristics of Individual Treatment Units

Unit Operation	Vessel	Capacity (gals.)	Material	Above Below	Secondary Containment	
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
M7 Perchlorate ion exchange	**IX 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	**IX 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 Mechanical evaporator	-	1,200	S. Steel	A	Hypalon, Asphalt	
M11 Solar evaporation	E. Tank, W. Tank	380,000	HDPE	A	HDPE, Concrete	z
M11 NPDES Outfall #051	-	-	-	B	-	y

Table 7. Characteristics of Individual Treatment Units

Unit Operation	Vessel	Capacity (gals.)	Material	Above Below	Secondary Containment	
Transuranic:						
T1 TRU Collection system	-	-	**PVDF, PP**	**B**	**PVDF, PP**	
T2 TRU Influent storage	**Acid tank**	**3,900**	**Steel**	**B**	**Concrete**	
	Caustic tank	**3,000**	**Steel**	**B**	**Concrete**	
T3 TRU Treatment	**TK1**	**900**	**Steel**	**A**	**Concrete-w**	
	TK2	**800**	**Fiberglass**	**A**	**Concrete-w**	
T4 TRU Sludge	**TK-7A**	**900**	**Steel**	**A**	**Concrete-w**	
Drum Tumbler	**T4**	**55**	**Fiberglass**	**A**	**Concrete-w**	
T5 TRU Effluent	**TK3**	**1,000**	**Fiberglass**	**A**	**Concrete-w**	
Secondary Treatment:						
	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**	**S. 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	B	Concrete	
	17K Tank	17,000	Steel	B	Concrete	

w: Floor of Building 50-001, with sumps or 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 8. Closure Actions and Estimated Durations for TRU RLW Treatment Units

TRU Category	Closure Duration Estimate [1]	Permit Application No.	Vessel /item description	Room # in 50-001	Other Buildings	Isolate Unit	Collect liquid &/or Sludge Sample for Analysis Sample	Evacuate (Pump or Drain) Free Liquid and/or Sludge	Route Removed Liquids/Sludge to New RLVTF for Treatment	Decontaminate Unit (Wash, scabble)	Demolish/Remove secondary containment system components	Radiological Survey	Apply Fixative or Paint	Remove Treatment Unit or vessel and Associated Structural Components	Size Reduce/Segment Larger removed Tanks/Vessels if Required	Complete Structural Assessments [1]	Dismantle and Remove Structure(s) [1]	Collect Subgrade Soil Sample(s) [1] After Removal of Structure/Unit	Packaged/Ship Off-Site for Processing (e.g., Solidification) or Disposal Off-Site [1]	Route Drummed Solidified Waste Forms To TA-54 At LANL For Off-Site Transport and Disposal [1]
TRU Collection System		T1	TRU Collection system	NA	TA-50, TA-55, 50-201	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRU Influent Storage	60 days	T2	Acid Waste Tank	NA	50-066, 50-107	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		T2	Caustic waste tank	NA	50-066, 50-107	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		T2	Piping	NA	50-066, 50-107	X	X	X	X	X		X		X		X	X		X	
		T2	Valves	NA	50-066, 50-107	X	X	X	X	X		X		X		X	X		X	
		T3	TK-1	60	NA	X	X	X	X	X	X	X	X	X		X	X	X	X	
		T3	TK-2	60	NA	X	X	X	X	X	X	X	X	X		X	X	X	X	
TRU Treatment	60 days	*Idle*	TK-4	60A	NA	X	X	X	X	X		X		X			X		X	
			TK-6	60A	NA	X	X	X	X	X		X		X		X	X		X	
			TK-73	70A	NA	X	X	X	X	X	X	X		X	X	X	X		X	
		Idle	TK-7	60A	NA	X	X	X	X	X	X	X	X	X		X	X	X	X	
			Pressure Filter	60	NA	X	X	X	X	X		X		X		X	X		X	
		Idle	Decant filter	60A	NA	X	X	X	X	X		X		X		X	X		X	
			Piping	60 & 70A	NA	X	X	X	X	X		X		X	X	X	X		X	
			Drum tumbler	60A	NA	X	X	X		X		X		X	X	X	X		X	X
TRU Sludge	30 days	T4	TK-7A	60A	NA	X	X	X	X	X	X	X	X	X		X	X	X	X	
TRU Effluent	30 days	T5	TK-3	60	NA	X	X	X	X	X	X	X		X	X	X	X		X	

[1] The estimated durations shown in the second column do not include the time required for completing the activities listed in the last five columns (covered elsewhere)

Table 9. Closure Actions and Estimated Durations for Balance of Plant Systems

Category	Closure Duration Estimate	Feature Description	Typical Components	Actions to be Taken					
				Isolate	Drain/De-energize	Decon	Rad Survey	Remove	Disposal
Processing Support	20 days[1]	Chemical Supply, Compressed Gas	Argon tank and associated piping.		X			X	X
			CO2 tank and associated piping.	X	X			X	X
			P-10 gas rack and associated piping.	X	X			X	X
		Vacuum	Vacuum pumps, piping, gages, etc.	X	X			X	X
		Compressed Air	Compressors, piping, instrumentation, etc.	X	X			X	X
		Chemical Supply, Sodium Hydroxide	Wet chemical feed, HCl, NaOH, lime, etc.	X	X			X	X
		Chemical Supply Caustic	Caustic chemical supply, CST-1, CST-2, CST-3, etc.	X	X			X	X
		Water, Non-Potable	Process cooling tower, industrial water, laboratory water (DI),	X	X			X	
		Chemistry Labs		X	X	X	X	X	X
Infrastructure	40 days[1]	SCADA System	SCADA components	X	X	X	X	X	X
		Security	Badge readers	X		X	X	X	
		Instrumentation and Control	Servers, PLCs, logix integrators, conduit, instrumentation, calibration activities etc.	X	X	X	X	X	
		Telecommunications	Telecommunications and computing installations	X			X	X	
		Public Address	PA system	X			X	X	

Table 9. Closure Actions and Estimated Durations for Balance of Plant Systems

Category	Closure Duration Estimate	Feature Description	Typical Components	Actions to be Taken					
				Isolate	Drain/De-energize	Decon	Rad Survey	Remove	Disposal
		HVAC	Fans, ductwork, filters, housings, manometers, samplers, etc.	X	X	X	X	X	
		HVAC, Contaminated	Fans, ductwork, filters, housings, manometers, samplers, etc.	X	X	X	X	X	X
		Industrial Safety	Safety showers, eye washes, oxygen, CO2 and NG sensors	X	X			X	X
		Radiation Monitoring	CAMs, PCMs, hand/foot monitors, fixed head samplers, etc.	X		X	X	X	
		Fire Protection	Fire Suppression System, Fire Alarm, fire extinguishers, Standpipes	X	X		X	X	
		Lightning Protection	Rods, grounding cables, surge suppression, etc.	X	X		X	X	
Utilities	100 days[1]	Hoists and Cranes	Cranes, rescue tripod, hoists, winches, rigging, mobile equipment, etc.	X	X		X	X	
		Diesel Generators	Diesel generators, fuel system, cooling water, instrumentation, starting battery, distribution panel, circuit breakers, ATS	X	X		X	X	
		Water, Heating	Boilers, piping, radiators, etc.	X	X		X	X	
		Natural Gas	Piping, valves,	X	X		X	X	

Table 9. Closure Actions and Estimated Durations for Balance of Plant Systems

Category	Closure Duration Estimate	Feature Description	Typical Components	Actions to be Taken					
				Isolate	Drain/De-energize	Decon	Rad Survey	Remove	Disposal
			gauges, etc.						
		Water, Potable	Potable water, utility feed, fire water supply	X	X		X	X	
		Sanitary Waste	Piping, sinks, floor drain fixtures, sump pumps	X	X		X	X	
		Elevator	Elevator and dumbwaiter, lifting cage, doors, hydraulic pump, motor, cable, lifting ram, controls, etc.	X	X		X	X	
		Lighting	Fixtures, conduit, bulbs, emergency lighting, etc.	X	X		X	X	
		Electrical Power	MCCs, transformers, switchgear, breakers, etc.	X	X		X	X	
Building Components and Structures (Demolition/ Removal)	300 days	Offices		X		X	X		X
		Non-Rad Storage		X		X	X		X
		Building Structures	Walls, floors, roof, doors, ceilings, structure, perimeter fence, etc.				X	X	X
Stormwater	15 days	Storm Sewer	Piping, manholes, French drains	X				X	X
		Water, Storm	Gutters and downspouts, roof drains and piping	X				X	X

[1] The duration required to completely remove some systems (e.g., utilities) may extend into, but occur within, the building components and structure demolition and removal phase

Table 10. Potential Waste Material Types Generated and Disposal Options

Potential Waste Materials	Waste Types	Disposal or Treatment Options
PPE	Solid waste Low-level radioactive solid waste	Subtitle D landfill LLRW disposal facility (DOE Nevada, and/or commercial)
Decontamination wash water	Non-regulated liquid waste Radioactive liquid waste	Sanitary sewer On-site replacement RLWTF or licensed facility LLRW treatment and disposal
LL RLW and TRU RLW liquids and sludge materials removed from RLWTF treatment units	Radioactive liquid waste TRU waste	On-site replacement RLWTF or licensed facility LLRW treatment and disposal Facility licensed to treat TRU waste and after stabilization WIPP
Tanks, vessels, piping, and other ancillary components and equipment removed from the RLWTF during final closure activities	TRU waste Low-level radioactive solid waste	WIPP LLRW disposal facility (DOE Nevada, and/or commercial)
Discarded waste management equipment	Solid waste Low-level radioactive solid waste	Subtitle D landfill LLRW disposal facility (DOE Nevada, and/or commercial)
Sampling equipment	Solid waste Low-level radioactive solid waste	Subtitle D landfill LLRW disposal facility (DOE Nevada, and/or commercial)
Non-radiological Storage structures	Solid waste	Re-use, recycle, or Subtitle D landfill
Asphalt and concrete demolition debris	Solid waste	Recycle or Subtitle D landfill

Table 11. Closure Schedule for RLWTF

Stabilization Activity	Schedule[1]	Basis
NMED Issues Discharge Permit	**Day "0"**	**N.A.**
Submit Closure Plan to NMED identifying steps necessary to perform final closure of the RLWTF	**+180 days**	**DP-1132, Condition VI.D.42– Submit Closure Plan within 180 days of issuance of Discharge Permit**
NMED review Closure Plan, LANL address comments, and NMED approve Closure Plan	**+240 days.**	**Estimated 60 days duration[2]**
Begin closure activities	**+420 days Within 180 days of NMED approval of Closure Plan**	**Assumes an estimated 180 days to procure a final closure contractor[3]**
Complete removal of liquids and solids from individual LL RLW and TRU RLW treatment units, and decontamination and decommissioning, and removal of all such units	**+600 days**	**Estimated total amount of time to complete liquids and solids removal, to decommission, and to remove individual treatment units and associated components and piping[4]**
Complete structural assessments of principal structures	**+690 days**	**Estimated 90-day duration of structural assessment activities following completion of removal of treatment units**
Complete removal of facility-wide and process systems	**+810 days**	**Includes an estimated 120-day duration for de-energization and removal facility and process systems[4, 5]**
Completion demolition and removal of principal building structures, buried piping, and remaining infrastructure components	+1,110 days	Estimated 300- day total duration for demolition and removal of principal structures[4, 5]
Completion of size reduction, sampling, packaging, manifesting, and shipping generated waste materials for off-site processing or disposal	+1,200 days	Estimated additional 90-day duration to complete following demolition/removal all structures, pipes, and other hard components[4]
Complete additional verification sampling in soils in building debris/component size reduction area and/or removal and packaging, manifesting and transport of residual soil contamination for disposal offsite	+1,260 days	Estimated 60-day duration to complete
Complete site restoration activities	+1,290 days	Estimated 30-day duration to complete

Table 11. Closure Schedule for RLWTF

Stabilization Activity	Schedule[1]	Basis
Submit Draft Closure Report to NMED	+1,380 days	DP-1132, Condition VI.D.43: report submitted within 90 days of closure completion
NMED complete review of Closure Report, LANL address NMED comments, and NMED approval of Final Closure Report	1,470 days	Estimated 90 days duration[6]

1 The number of days entered for each activity represents the total cumulative number of days from the date of issuance of the Discharge Permit to either reach startup ("begin closure activities") or to accomplish completion of each listed activity.

2 The estimated duration assumes 30 days for NMED to complete review of the document, 30 days for LANL to respond to review comments and transmit final document to NMED, and that the final document will be approved by NMED without further comments.

3 The schedule for commencing final closure activities may change based on the timing and amount of funding available at the time procurement of a contractor would be pursued.

4 The schedule for completing final closure activities may change based on the availability of suitably qualified contractors and/or specialized equipment required at the time the work would be performed.

5 The duration for closing some facility/process systems (e.g., utilities) may extend into, but occur within, the 300-day building demolition/removal phase of work.

6 The estimated duration assumes 60 days for NMED to complete review of the document, 30 days for LANL to respond to review comments and transmit final document to NMED, and that the final document will be approved by NMED without further comments.

Appendix B.
Figures

Figure 1. Aerial View Radioactive Liquid Waste Treatment Facility (2011)

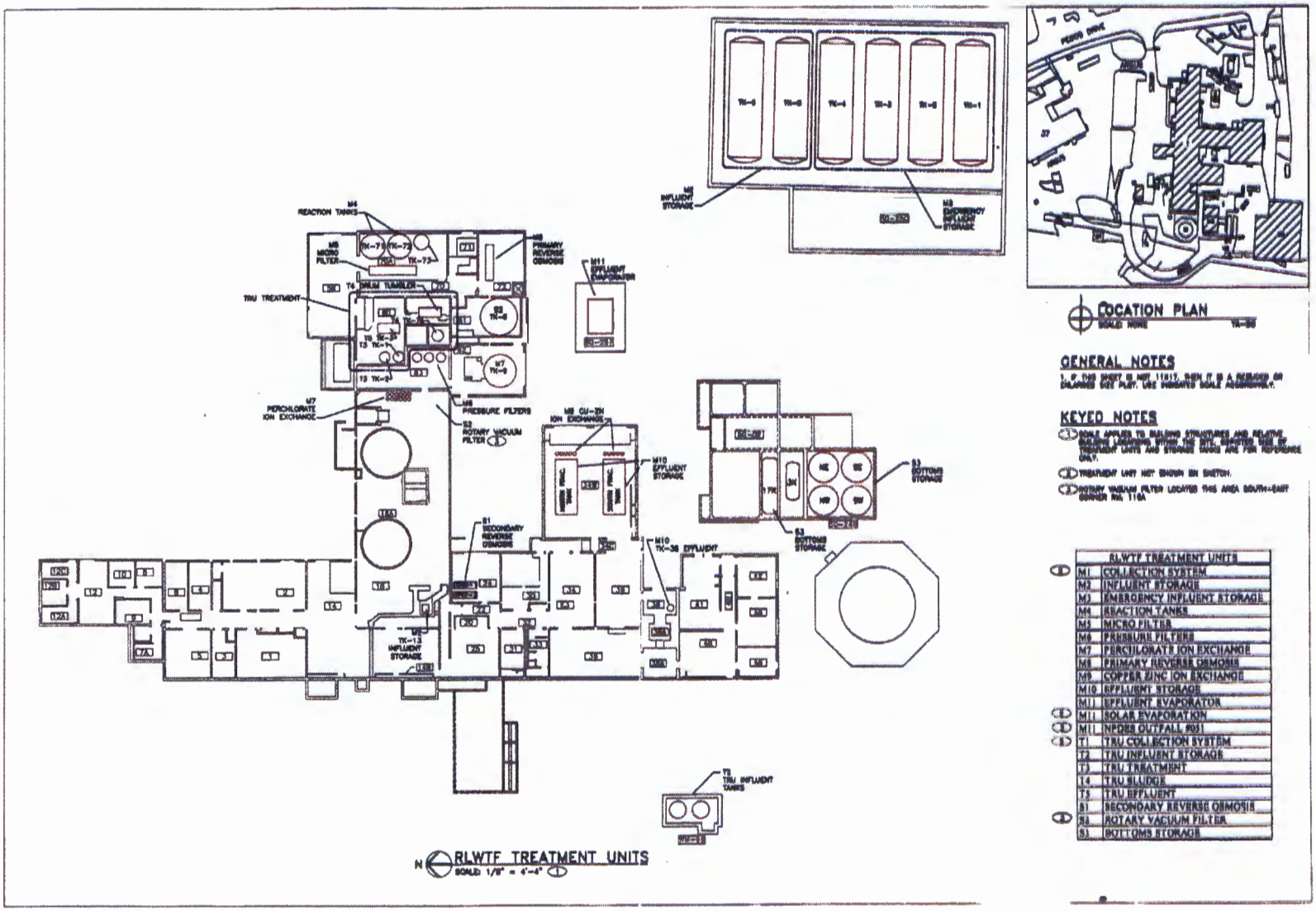


Figure 2. RLWTF Location and Treatment Units

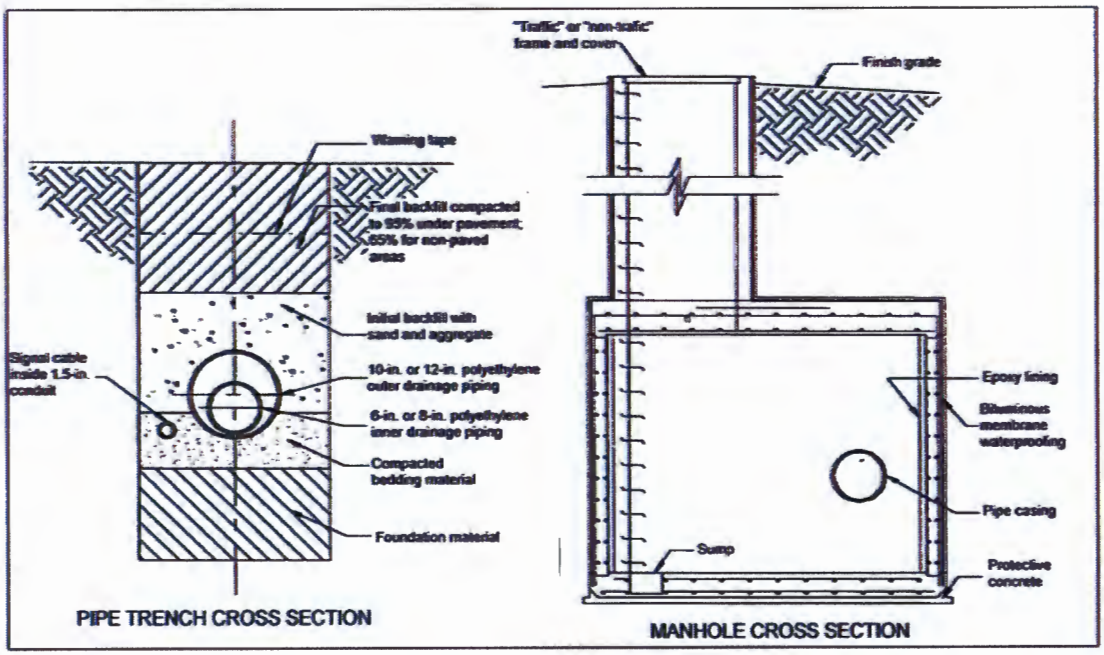
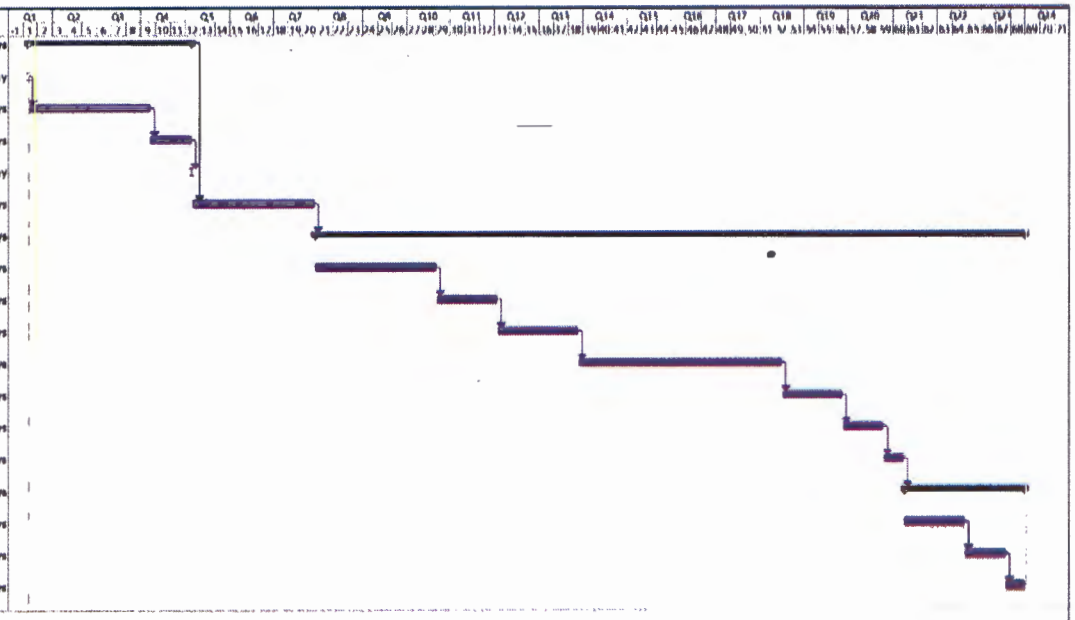


Figure 3. Example of Low-Level Radioactive Liquid Waste Collection System Piping and Valve Station

ID	Task Name	Duration
1	**Closure Plan**	**242 days**
2	NMED Issues Discharge Permit	1 day
3	Submit Closure Plan to NMED for Review	180 days
4	NMED Review and LANL Receive /Respond to Comments	60 days
5	NMED Closure Plan Approval	1 day
6	Procurement	180 days
7	**Closure Activities**	**1050 days**
8	Remove Contaminants, Decontaminate, Decomission, and Remove Units	180 days
9	Perform Structural Assessments of Principal Structures	90 days
10	Remove BOP Facility-wide and Process Systems	120 days
11	Demolish and Remove Buildings	300 days
12	Size Reduce, Sample, Package, Manifest, and Ship Waste Materials	90 days
13	Verify Sampling in Soils	60 days
14	Site Restoration Activities	30 days
15	Reporting	180 days
16	Submit Draft Closure Report to NMED	90 days
17	LANL Receive/Respond to Comments	60 days
18	NMED Final Closure Report Approval	30 days



Project: LANL Closure Plan 11241
Date: Wed 11/25/15

Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline | Progress

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Figure 4. Integrated Closure Schedule–RLWTF