Description of Site Operations at the Low-Level Radioactive Waste Disposal Site

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ABSTRACT

The purpose of low-level waste disposal is to isolate the waste from both people and the environment. The radioactive particles in low-level waste emit the same types of radiation that everyone receives from nature. Most low-level waste fades away to natural background levels of radioactivity in months or years. Virtually all of it diminishes to natural levels in less than 300 years.

In Egypt, The Hot Laboratories and Waste Management Center has been established since 1983, as a waste management facility for LLW and ILW and the disposal site licensed for preoperational in 2005. This site accepts the low level waste generated on site and off site and unwanted radioactive sealed sources with half life less than 30 years for interim storage prior to the final disposal.
Operational requirements at the low-level (LLRW) disposal site are listed in the National Center for Nuclear Safety and Radiation Control NCNSRC guidelines. Additional procedures are listed in the Low-Level Radioactive Waste Disposal Facility Standards Manual. The following describes the current operations at the LLRW disposal site:

INTRODUCTION

The presence of an operational procedure for the disposal site is an important issue.
The following describes the current operations at the LLRW disposal site:

1.0 Waste Inspections

There are two types of waste inspections required for the LLRW disposal site. They are point-of-origin Inspections and onsite Inspections.

1.1 Point of-Origin Inspections

The Hot Laboratories Waste Facility, HLWF is going to begin the point-of-origin Inspection Program. The goal of the program is to identify any deficiencies at conditioning unit prior *to* waste being shipped for disposal. Identifying deficiencies before the waste is shipped will reduce subsequent packaging or waste form violations upon receipt at the LLRW disposal site. HLWF achieves this goal through random inspections of conditioning facility.

Point of origin inspection

1.2 Onsite Inspections

HLWF has a full-time onsite inspector at the LLRW disposal site. HLWF is required by their license to inspect the containers on each shipment for physical integrity, marking and labeling requirements, and correlation with the shipment manifest. A waste form confirmation program is also in place at the facility. This program requires HLWF to inspect a minimum of one shipment per week, or one shipment out of every ten, whichever is more frequent. Shipments that undergo this inspection are set aside and all packages are individually examined, using nondestructive testing. At least one of these packages is opened and/or punctured in the presence of a HLWF inspector to determine compliance with waste form requirements.

In addition to the inspections noted above, both HLWMC and HLWF inspect trucks entering the facility for compliance with NCNSRC and /or U.S. Department of Transportation (US DOT) regulations. The US DOT requirements address such things as shipment and package radiation levels, physical integrity of containers, and proper paperwork.

Onsite inspection

2.0 Waste Handling and Disposal

2.1 Packaging

Packaging refers to the types of containers the waste must be placed in for transport and disposal. Packaging requirements have changed over the past 30 years. In the past, cardboard and wood packages were allowed. Typical packaging today includes 200 L metal drums and steel boxes. There are packaging requirements for both waste stability and waste isolation. (Unstable waste must be placed in approved packaging such as high integrity containers (HICs) or engineered concrete barriers (ECBs).) Packaging requirements for waste isolation focus on package integrity. Containers received for disposal at the facility cannot show significant deformation, degradation, or any signs that radiation has dispersed through the container.

Old wood packages

2.2 Waste Forms

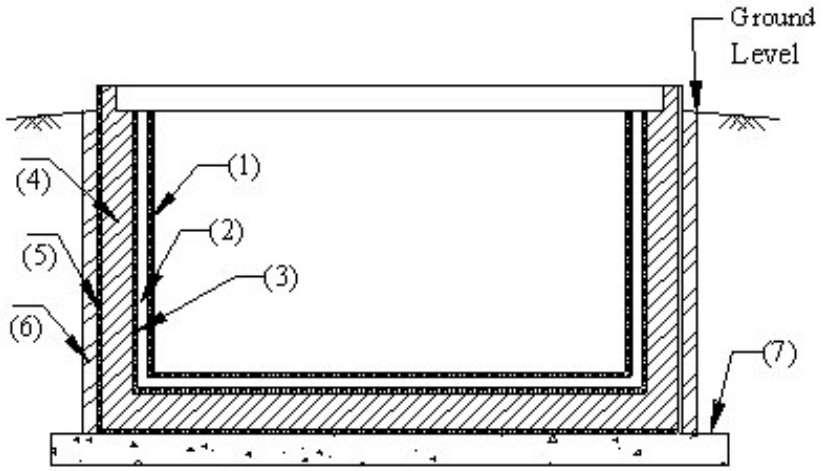
HLWF has specific requirements on the form in which waste must be in before it can be disposed of. For example, liquid wastes must be stabilized, or solidified. Absorbed liquids are not allowed. Liquids treated by stabilization must be processed to eliminate all freestanding liquid. Liquid wastes must also be rendered non-corrosive. Solid material containing incidental liquids is allowed, provided that the dry material contains less than 0.5% volume percent of liquid within the package.

Other wastes subject to specific waste form requirements include all class B and C waste, radioactive consumer products, chelated wastes, biological wastes, and Class B tritium wastes. Void spaces within all classifications of waste must be reduced to the extent practicable. However, void spaces in Class A stable, Class B, or Class C waste may not exceed 15% of the total volume of the waste package, unless disposed of in a HIC.

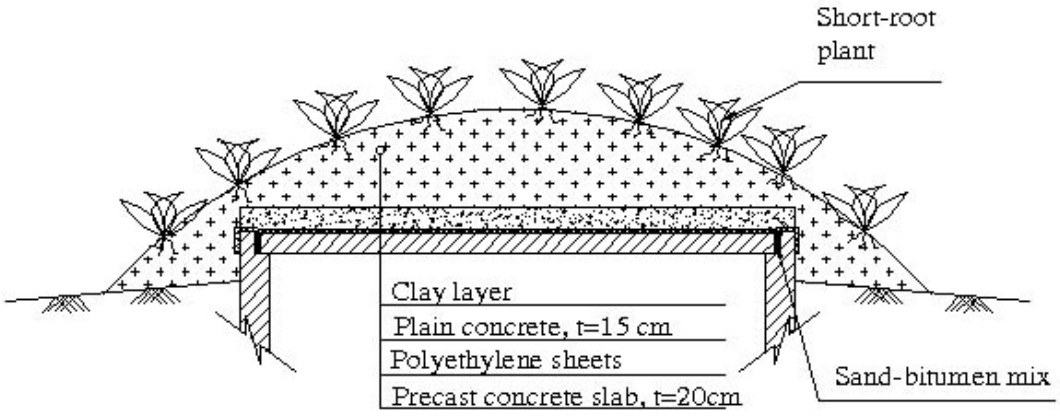
3.0 Vault Design

The LLRW site uses conventional shallow-land burial. In shallow-land burial, large, lined vaults are used for waste disposal. The vaults concrete walls are the primary method for containing the radioactive waste. The vaults are designed for long-term isolation and minimum active maintenance after site closure. The maximum dimensions allowed for any vault is 5 meters in width, 3 meters in depth, and 10 meters in length. Soils excavated during vault construction are used for backfilling. A registered professional land surveyor

documents the vault location, and a civil engineer performs a visual inspection of the vault walls, prior to waste emplacement.



(1) Cementitious base isolator
(2) Cement mortar paste
(3) Cementitious base isolator
(4) Vault's body
(5) Bitumen paint
(6) Brick wall



Vault design

4. Waste Emplacement and Backfilling

4.1 Emplacement

Waste placed in reinforcement concrete boxes is stacked in vaults in an orderly manner, while drums are placed in the vault more randomly. Waste must be emplaced in a manner that maintains the package integrity during emplacement, minimizes void spaces between packages, and permits the void spaces to be back filled with site soils or sand. Certain wastes must be segregated. Class A unstable waste is segregated from other waste by placing it into separate vaults. Class C waste is required to be disposed of in the bottom of vault. Waste with a surface radiation level greater than 2mSv/hr must also be disposed at a maximum depth of three meters below natural grade. Waste containing chelates in excess of 0.1% by weight must be segregated from other waste by placing it into ECBs. Packages containing gases must be placed in a manner that maintains package integrity, and with a minimum of 3 meters from other gas containers. Waste can only be held in storage for a maximum of 180 days. Storage of waste is monitored so that exposures are maintained as low as reasonably achievable and the dose limits are not exceeded.

4.2 Backfilling

Backfilling between waste containers must be done frequently enough that the radiation level at the vault edge does not exceed 0,05mSvhr. If possible, backfilling is to be performed concurrent as the waste is placed in the vault. For all types of wastes with specific package segregation requirements, backfilling is required so that each layer is covered prior to subsequent waste emplacement. More frequent backfilling may be performed to minimize radiation exposures.

5.0 Manifest Tracking and Record Keeping

Each shipment of LLRW and disused radioactive sealed sources SRSS arriving at the LLRW disposal site is required to have shipping documents properly completed by the shipper. Each generator using the HLWF must also have a valid site use permit issued by the NCNSRC or EORP prior to shipping any waste for conditioning, storage and disposal.

NCNSRC's license requires that waste shipments arriving at the disposal facility be accompanied by a shipment manifest approved by HLWMC and civil defense Department, HLWF requires that each manifest contain a detailed physical and chemical description of the waste, including the identity and quantity of radionuclides. The shipper must certify that the material is properly classified, packaged, and labeled for onsite transport and disposal.

The onsite inspector reviews all shipping papers prior to acceptance of the shipment for disposal. No shipment may be offloaded unless the inspector has stamped and initialed the paperwork. A copy of the manifest accompanies the load to the vault for offloading. During the disposal process, a HLWF operator records which vault the load was placed in, depth of waste burial, three-dimensional location of Class B and C waste, and the date of disposal. Detailed reports on waste disposal are required monthly, annually, and whenever a vault is closed.

6.0 Interim Closure

As vaults are filled to within 2 meters of natural grade, filling the void space using sand and gravel are placed over the vault. The interim vault cover is not considered a low-permeability cover. Interim vault markers are installed at each end of the vault and are inscribed with total activity, vault number, dates of operation, the volume of waste in the vault, and the coordinates of the disposal unit. Each quarter, visual inspections and radiation surveys of completed disposal units are performed to determine the condition of vault caps, changes in radiation levels, general condition of the disposal facility, and status of security measures.

7.0 Rain or Flooding Management

The LLRW disposal site has a water management diversion channel designed to control surface water drainage. The channel was built in response to any water flooding, which resulted in run-on at the site. The drainage channel is engineered to accommodate heavy rain. The drainage channel is designed to minimize surface erosion, prevent run-on onto vault, and limit contamination resulting from run-on and run-off.

8.0 Institutional Controls

Institutional controls are used to secure and control the LLRW disposal site. In addition to the security provided by the EAEA, the LLRW disposal site is surrounded with a continuous three meters chain link fence that is topped with barbed wire. The entire fence is posted for radiation areas. The entrance gate to this area is under direct surveillance during working hours and is locked after working hours.

9.0 Environmental Monitoring

Beginning in 1956, soil, groundwater, and vegetation monitoring have been performed periodically. Air quality monitoring began in 1969. Ambient air and other experimental monitoring began in the mid-1980s. In 1987, a comprehensive environmental monitoring plan was initiated. Today there are nine permanent environmental monitoring stations surrounding the LLRW disposal site, and several other stations throughout the site. Table 1 lists monitoring requirements included in the NCNSRC. Reporting levels, established in the license for each of the monitoring requirements, are based on the protection of public health. NCNSRC publishes an annual environmental report documenting results of the previous year's monitoring.

Table 1: NCNRSC Environmental Monitoring Requirements

Media Sampled	Sample Sites	Sample Frequency
Groundwater	Eight wells	Monthly
Air Quality	One station	Continuous, weekly, and monthly
Vegetation	many	Quarterly

10.0 Personnel Training

The LLRW disposal site has a formalized written training program developed by HLWF and approved by NCNSRC. The training program is reviewed and updated at least every two years. The program includes specific hours of classroom study, on-the-job training, and testing requirements for radiological workers, management, and unescorted visitors.

11.0 Emergency Response

HLWF *Radiological Emergency Group* (REG) outlines the actions to be taken if there is a significant release of radioactive materials to the environment at the LLRW disposal site. The REG contains detailed procedures for notification and response in case of a radiation emergency. A radiation emergency is defined as:

- fire
- major release of radioactive materials to the air, soil, or ground water transportation accident
- any event requiring evacuation
- any other hazardous materials event involving radioactive materials

To ensure readiness in case of an emergency, REG performs periodic emergency drills at the LLRW disposal site. The drills are unannounced and number at least three drills a year. The drills cover areas such as fire, release of radioactive material, and care of a contaminated injured person.

REFERENCES

1. 10 CFR 835, Occupational Radiation Protection
2. NCRP 116, Limitation of Exposure to Ionizing Radiation, 1993
3. PNL-6577, Health Physics Manual of Good Practices for Reducing Radiation Exposures to Levels that are As Low As Reasonably Achievable (ALARA), 1988
4. MN471016, Radiological Protection Procedures Manual, Chapter 12, "Radiation Instrumentation"
5. Abdel Salam Elreefy, MSc, Cairo University, 2007 (Under Publication)