1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the management plan for 11e2 byproduct ("11e2") waste material and associated disposal procedures at the Lost Creek ISR Project. Waste material that is associated with in-situ uranium operations may be designated 11e2 byproduct if it is contaminated with natural uranium and associated decay products generated from the mining process. The 11e2 waste will be stored within the restricted area of the Processing Plant (Plant) until transported from the LC-ISR site to a licensed disposal facility. Waste management and disposal of 11e2 waste is pursuant to regulations in 10 CFR Part 20 Subpart K. To comply with NRC License Condition 9.9 the disposal agreement for LC-ISR shall have been provided to NRC and shall be maintained.

2.0 RESPONSIBILITIES

LC-ISR is responsible for:

- Disposing of 11e2 byproduct waste according to NRC regulation
- Ensuring the disposal facility is licensed to receive 11e2 byproducts
- Properly preparing material for shipment according to Department of Transportation (DOT) regulation
- Screening waste containers to ensure surface contamination and gamma levels are within set limits
- Providing proper training on handling and shipping 11e2 waste

The Radiation Safety Officer (RSO) and/or Health Physics Technician (HPT) are responsible for:

- Providing assistance in making decisions on the segregation of 11e2 material from non-11e2
- Performing screening and decontamination of material, if necessary
- Performing periodic surveys for assessment of potential gamma radiation from 11e2 containers
- Maintaining records of disposal

- Providing radiation safety and DOT training to persons involved with handling or preparing for shipping 11e2 waste

3.0 PREREQUISITES AND TRAINING

An agreement with an NRC-authorized disposal facility shall have been submitted to NRC and maintained in accordance with NRC License Condition 9.9. The facility shall be authorized to dispose of solid 11e2 byproduct material.

Training includes reading and understanding this SOP. Persons involved in handling or shipping 11e2 material must have general radiation safety training according to the LC-ISR Radiation Protection Program. Awareness training may be provided in-house from a qualified individual such as the Radiation Safety Officer or Health Physics Technician.

Individuals shall be trained on techniques to help identify and segregate 11e2 material that will be disposed.

Any personnel preparing waste shipments (i.e. packaging, labeling, documenting, etc.) must receive DOT-specific training on shipping radioactive materials.

4.0 DEFINITIONS

11e2 Waste: Any 11e2 byproduct material or equipment or other materials that have been in contact with 11e2 material that is to be disposed of at a licensed disposal facility.

Byproduct material: Material as defined by Section 11e.(2) of the Atomic Energy Act which is the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.

5.0 HAZARD ASSESSMENT AND PPE

Hazards associated with 11e2 waste handling include:

- Exposure to uranium and its daughters

Personal Protective Equipment (PPE) that shall be used when handling 11e2 waste includes:

- Standard site PPE including:
  - Safety toed boots
  - Hard hat
  - Safety eyewear
- Gloves, such as work gloves or disposable nitrile

6.0 PROCEDURE

The solid 11e2 byproduct materials generated during ISR operations likely include:

- Process wastes such as spent ion exchange resin, filter media, tank sludge, etc.;
- Materials or equipment that may become contaminated and cannot or will not be decontaminated;
- Materials for which decontamination is not practical such as tanks, vessels, process pipe, pumps, and other large equipment;
- Contaminated personal protective equipment; and/or
- Soils contaminated from spills.

Where possible, equipment and materials will be decontaminated for disposal as non-11e2 material or for re-use. Equipment and materials that cannot be decontaminated will be disposed.

The following sections describe procedures for storage, segregation and screening, preparing shipments, and empty containers for 11e2 material. The flow chart provided in the Appendix may aid in segregating and handling objects in question.

6.1 11e2 Storage and Handling

1. Material should be segregated as much as possible to minimize the amount of non-11e2 mixing in with 11e2 materials. See Section 6.2 for suggestions on how to segregate 11e2 material.

2. Potential 11e2 material may be screened to determine if it is contaminated as described in SOP_LC_HP-014: *Screening and Decontamination of Materials for Unrestricted Use*. See Section 6.3 for suggestions on screening 11e2 material.

3. Material should be handled with care according to the materials matrix. For example, spent resins will need to be containerized prior to placing into the 11e2 container.

4. Material must be dry or stabilized prior to placement in storage containers.

5. Bulk 11e2 byproduct material will likely be stored temporarily (until disposal) in the restricted area within the Plant in a weather resistant, strong, tight container that can be used as the transportation container such as a roll off, sea bin, or dump trailer. The storage container will be labeled clearly denoting radioactive material. Labels denoting radioactive material will be used to identify the container such as:

6. The storage/shipping container should prevent the release of dust or the 11e2 material during shipping. The container should also prevent moisture from coming in contact with the contents.

7. Suspected 11e2 material in the wellfield controlled area will be placed in buckets (e.g. 5-gallon plastic) in the header houses labeled with identifiers such as “contaminated material” or “radioactive material”. The buckets and labeling should be readily visible. Non-contaminated material should not be placed in the 11e2 buckets.

8. Material in the wellfield buckets will be initially screened and characterized by the RSO or HPT to demonstrate that contamination activity is below the exempt value for transportation (see Section 6.3). Full buckets of material from the wellfield will be taken to the Plant and consolidated in the Plant 11e2 storage bin. Once characterized, the buckets will be surveyed on an as necessary basis if the waste type changes from what is typically generated.

9. The buckets in the header houses will be frequently checked to see if they are full during either the radiation safety inspections or the daily wellfield inspections.

10. If it is determined or suspected that contamination activity on material is greater than the exempt value, the material will be transported across public roads by temporarily restricting access to that road until the material arrives at the Plant controlled area.

11. The storage area of byproduct wastes shall be inspected on a routine basis (see SOP_LC_HP-003: *Radiation Safety Inspections*) to ensure integrity of storage methods and devices and documented on FORM_LC_HP-003A: *Radiation Safety Inspections*.

6.2 Segregation of 11e2 from Non-11e2

Segregation is the practice of minimizing the accumulation of 11e2 material by determining what waste material is actually contaminated.

1. If a question arises as to whether material is 11e2 or not, that person should refer to the RSO or HPT. If in doubt, dispose as 11e2.
2. Material is typically designated 11e2 by the material's association with or contact with uranium-bearing materials such as pregnant lixiviant or yellowcake product. Material that is in contact with such should be segregated as 11e2 and placed in an 11e2 waste bucket or bin.
3. Materials that are known to be free of contamination should not be placed in 11e2 storage but placed in regular trash.
4. An 11e2 object or suspected 11e2 object may be decontaminated following screening.

6.3 Screening and Surveying

If it is not known whether an object is contaminated, the object may be screened to determine if contamination is present:

1. Refer to the RSO or HPT to perform a screen of the material.
2. The material will be screened according to SOP_LC_HP-014: *Screening and Decontamination of Materials for Unrestricted Use*.
3. If disposal material is contaminated it will be placed in an 11e2 container.
4. If the material is not contaminated it may be disposed as non-11e2 trash.

5. If contaminated disposal material has been properly decontaminated, it may be disposed of as non-11e2 material.
6. If 11e2 material activity is low enough, it may be DOT exempt. Exempt amounts are not subject to DOT requirements as described in SOP_LC_TR-007. The exemption value for U-nat and Ra-226 is:

Nuclide	Exempt concentration	Exempt quantity
U-nat	2.7E-11 pCi/g (1.0 Bq/g)	2.7E-08 pCi (1.0E03 Bq)
Ra-226	2.7E-10 pCi/g (10 Bq/g)	2.7E-07 pCi (1.0E04 Bq)

Stored 11e2 material should be periodically surveyed using a gamma detector to determine if there is external radiation present at the surface of the container. If external radiation is present in excess of 5 mrem/hr, the area should be roped-off and designated a radiation area as described in SOP_LC_HP-006: *Gamma Surveys*.

6.4 Overview of Shipping

Byproduct material is shipped as radioactive material. A complete explanation of shipping radioactive material is provided in SOP_LC_TR-007: *Radioactive Materials Shipping and Transport*.

1. The total activity of the material should be estimated through characterization, and logged by activity (Ci, U-nat) and approximate weight prior to placing into disposal bin:
    a. Take a representative piece of each type of material and perform a screen to determine the activity present.
    b. For example, a piece of filter material may be cut off and placed in an alpha/beta counter or screened with a portable frisker.
    c. The quantity of material screened should be estimated as feasible. The total activity of the material will be the activity times the quantity of material.
    d. The total activity should be compared to the exempt quantity activity from 49 CFR 173.436 to determine if the shipment is exempt. The exempt quantity for U-nat is 2.7E-11 Ci/g and 2.7E-08 Ci per consignment.
2. A DOT trained person will check that the container is properly closed and secure.

3. Shipping papers will be prepared as necessary prior to shipment in accordance with disposal facility requirements.
4. The DOT trained person shall properly label and placard the container in accordance with DOT regulations.
5. The shipping container must be screened for radiation and removable radiological contamination by the RSO or HPT prior to release to the shipper.
6. An approved contractor or LC-ISR driver authorized to transport radioactive material will transport the containers of 11e2 material to the disposal site.
7. The RSO or HPT will contact the disposal facility within 24 hours of shipment to confirm the shipment was safely delivered.
8. Records of transport and disposal shall be collected and maintained in EHS-MS files.
9. Typically, the empty 11e2 container will not be released from the disposal site for unrestricted use but will instead be shipped back to Lost Creek as an empty contaminated container (see Section 6.5).

6.5 Empty Containers

Empty 11e2 byproduct containers used for transportation shall be returned to LC-ISR as an excepted package:

1. Return shipping paperwork is not required
2. The UN number for an empty radioactive material container (UN2908) is required to be placed on the container
3. Remove labels and place an “Empty” label(s) on the container
4. The internal contamination levels must not exceed:

Contaminant	Maximum permissible limits		
	Bq/cm^2	**uCi/cm^2**	**dpm/cm^2**
1. Beta and gamma emitters and low toxicity alpha emitters	400	10^{-2}	22000
2. All other alpha emitting radionuclides	40	10^{-3}	2200

5. Container shall be securely closed and covered for return

7.0 DOCUMENTS AND RECORDS

Records or documents that shall be retained for the 11e2 byproduct waste management program include:

- Waste manifests and other shipping documentation
- Screening and decontamination records
- Health physics inspection records

Records shall be maintained for at least three (3) years or for the life of the project.

8.0 REFERENCES

Code of Federal Regulation Title 10 Part 20 Subpart K: *Waste Disposal*

Code of Federal Regulation Title 10 Part 40 Appendix A *Criterion 2*

NRC License Technical Report Section 4.3.2: *Solid 11(e)(2) Byproduct Materials*, April 2010

NRC License Technical Report Section 5.7.1: *Effluent Control Techniques*, April 2010

SOP_LC_TR-007: *Radioactive Materials Shipping*

SOP_LC_HP-003: *Health Physics Inspections*

SOP_LC_HP-014: *Screening and Decontamination of Materials*

APPENDIX: 11e2 Waste Segregation Decision Chart