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SILO 3 PROJECT
TRANSPORTATION AND DISPOSAL PLAN

40430-PL-0008, REV. 6

December 2005

APPROVED BY:

Mark Cherry, Operations Manager — 12-21-05 Date

Robert F. Schulten, Shipping and Receiving — 12-21-05 Date

Donna J. Allen, Shipping Manager — 12-21-2005 Date

FERNALD CLOSURE PROJECT
FERNALD, OHIO

7677

U.S. DEPARTMENT OF ENERGY

ORIGINAL

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RECORD OF ISSUE/REVISIONS

EFFECTIVE DATE	REV. NO.	DESCRIPTION
05/20/2004	0	New plan issued to describe transportation and disposal operations for Silo 3 material, comments by USEPA and OEPA incorporated.
07/07/2004	1	Section 2.3, 3rd paragraph, 2nd sentence, revised to add "actions to take in the event of severe weather." Third sentence of same section revised to indicate FCP access to the satellite tracking system. Section 4.2, deleted reference to IHASP. Section 5.3, 2nd paragraph revised to indicate notifications to state and tribal emergency response organizations and add reason for not providing individual shipment information.
2/15/2005	2	Revised plan issued to reflect disposal at Envirocare
2/23/2005	3	Revised to incorporate minor editorial revisions prior to USEPA / OEPA Review
3/4/05	4	Revision to Section 3 in response to comments from USEPA review
3/31/05	5	Revision to Section 2.3.1 to correct shipping route and to section 3.3 to reflect revised packaging configuration
12/21/05	6	Revision to 3.3 to reflect packaging for contingency option

ACRONYMS

ACEM	Activity Concentration for Exempt Material
AEA	Atomic Energy Act
AEDO	Assistant Emergency Duty Officer
ALEC	Activity Limit for Exempt Consignment
ASME	American Society of Mechanical Engineers
Bq	Becquerels
Bq/g	Becquerels per gram
CFR	Code of Federal Regulations
DOE	Department of Energy
DOT	Department of Transportation
EDO	Emergency Duty Officer
EMS	Emergency Management System
EOC	Emergency Operations Center
ERP	Emergency Response Plan
FCP	Fernald Closure Project
Fluor Fernald	Fluor Fernald, Inc.
HMR	Hazardous Material Regulations
IAEA	International Atomic Energy Agency
ILCR	Incremental Lifetime Cancer Risk
IP-2	Industrial Packaging-Type 2
ISMS	Integrated Safety Management System
ISO	International Standards Organization
LCF	Latent Cancer Fatalities
LSA	Low Specific Activity
MCEP	Motor Carrier Evaluation Program
MEF	Material Evaluation Form
NCP	National Contingency Plan
NHASP	Nuclear Health and Safety Plan
NRC	Nuclear Regulatory Commission
OU	Operable Unit
Ra-226	Radium 226
Ra-228	Radium 228
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RD/RA	Remedial Design/Remedial Action
RDP	Remedial Design Package
RI	Remedial Investigation
ROD	Record of Decision

RPP	Radiological Protection Program
RSPA	Research and Special Programs Administration
RWP	Radiological Work Permit
SPR	Safety Performance Requirement
SR	State Route
SRC	Safety Review Committee
TBq	Terabecquerels
TBq/g	Terabecquerels per gram
TEP	Transportation Emergency Plan
Th-230	Thorium 230
TSA	Trailer Staging Area
TSR	Transportation Safety Standards
US	United States
WAC	Waste Acceptance Criteria
WC	Waste Characterization

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This plan describes transportation and disposal operations that will ensure safe and successful staging and transportation of Operable Unit 4 (OU4) Silo 3 material from the Fernald Closure Project (FCP) to Envirocare of Utah (Envirocare), as well as operations for receipt and disposal of the Silo 3 material at Envirocare. The mode of transportation for this material will be motor carrier.

This plan serves to: (1) describe the transportation logistics associated with Silo 3 material; and (2) generally describe operational aspects of transportation plans to demonstrate that Silo 3 material can be transported to the designated disposal site safely, and in accordance with applicable regulations.

Submittal of this Transportation and Disposal Plan complies with the requirements put forth in the Silo 3 Project Remedial Design/Remedial Action (RD/RA) Package (40430-RDP-0001, Revision 2, December 2003), which requires an operational description of the transportation and disposal of Silo 3 material, including on-site staging, logistics, packaging configuration, and selected mode of transportation to the selected disposal facility.

The Record of Decision (ROD) Amendment for Operable Unit (OU) 4 Silo 3 Remedial Actions (40430-RP-0026, August 2003), requires treatment to the extent practical, by addition of a chemical stabilization reagent and a reagent to reduce dispersability.

As documented in this Transportation and Disposal Plan, shipments of Silo 3 material to Envirocare will be performed exclusively by truck. The current transportation and disposal approach assumes the Silo 3 material will be conditioned and packaged in 96 ft3, soft-sided containers, loaded into International Standards Organization (ISO) containers, and transported by truck to Envirocare for disposal. If necessary, based upon the physical characteristics of the material sncountered inside Silo 3, an alternate contingency packaging configuration, described in section 3.3, will be utilized.

Since this plan is specific to transportation and disposal of Silo 3 material at Envirocare, disposal at any other government or commercial site will require a revision of this Transportation and Disposal Plan to reflect the receiving facility's license and permits.

1.2 PROJECT APPROACH

Fluor Fernald is responsible for material retrieval, conditioning, and packaging; selection of the disposal facility and mode of transportation; analysis of the Silo 3 material for compliance with the disposal facility's Waste Acceptance Criteria (WAC); loading Silo 3 material for shipment; and transporting the Silo 3 material to the disposal facility. Plans

and requirements for completing this scope are described in the Silo 3 Project Remedial Design/Remedial Action Package (40430-RDP-0001, Rev. 2, December 2003).

2.0 OFF-SITE TRANSPORTATION

2.1 INTRODUCTION

The FCP will conduct its operations in compliance with applicable federal, state, local, and tribal requirements governing materials transportation, unless exemptions or alternatives are approved in accordance with Department of Transportation (DOT) regulations.

2.2 DEPARTMENT OF TRANSPORTATION REQUIREMENTS

DOT regulations, under 49 Code of Federal Regulations (CFR) Part 173.403, categorize low specific activity (LSA) material into three classifications: LSA-I, LSA-II, and LSA-III. To be considered LSA material, the material need only meet criterion under one of the classifications. Evaluation of the radiological content of the Silo 3 material indicates this material meets one criterion for LSA-II material. Specifically, Silo 3 material is considered "other material in which the radioactive material is distributed throughout and the estimated average specific activity does not exceed 10-4 A2/g for solids..."

The results of the LSA-II determination on Silo 3 material are presented in Appendix A-1.

The LSA determination drives the container requirements for packaging the Silo 3 material for off-site shipment. Based on the evaluation performed, the minimum packaging requirement for the Silo 3 material is an Industrial Packaging – Type 2 (IP-2) container. Soft-sided IP-2 containers will be used to containerize the Silo 3 material for staging and subsequent shipment. The soft-sided containers will be placed on pallets to facilitate handling and loading into ISO containers and then loading onto flatbed trailers.

2.3 MATERIAL TRANSPORT

The carrier will be selected to meet the requirements of each shipment and provide safe, expeditious, and economical delivery to the final destination.

Only motor carriers with satisfactory ratings under the Department of Energy (DOE) Motor Carrier Evaluation Program (MCEP) will be considered.

The FCP provides a detailed briefing to every driver of radioactive material before the shipment departs the FCP. That briefing stresses emergency response actions to take in the unlikely event of an accident, actions to take in the event of severe weather, instructions for maintenance of exclusive use shipment controls, and the importance of remaining on the routes assigned by FCP. The FCP also requires motor carriers to utilize a satellite tracking system (e.g., Qualcomm and/or cell phone) for each shipment and has made arrangements with the motor carriers to access that data as necessary to randomly verify that the motor carrier is adhering to the assigned routes. Motor carrier drivers that

fail to adhere to the assigned routes are prohibited from hauling future shipments of material for the FCP.

2.3.1 Routes

The transportation risk evaluation conducted in support of the Revised Proposed Plan for Operable Unit 4 Silo 3 Remedial Action (April 2003) assumed the following route for direct truck shipments to Envirocare:

The proposed truck route to Envirocare of Utah consists of:

• South on Route 128 to West on I-74 to Indianapolis, IN.	95 miles
• Take I-70 Southwest to St. Louis, MO.	242 miles
• Continue on I-70 through Kansas into Colorado.	
• Follow I-70 to I-270 around Denver to I-25.	
• I-25 North to I-80 West (Cheyenne)	950 miles
• Take I-80 West to Exit 49 and proceed to Envirocare, Clive, UT.	512 miles
Total:	1799 miles

Loops around cities will be utilized when available This route would pass through or around the following major cities: Indianapolis, Indiana; St. Louis Missouri; Kansas City, Missouri; St. Joseph, Missouri;; Cheyenne, Wyoming; and Salt Lake City, Utah. Truck routes will use interstate bypasses, where such bypasses exist.

2.3.2 Risk and Safety Requirements

A transportation risk assessment was conducted in support of the Revised Proposed Plan for Operable Unit 4 Silo 3 Remedial Action (April 2003) comparing the risks associated with potential alternatives for transportation of unconditioned Silo 3 material to disposal facilities, including direct truck transportation to Envirocare. The assessment was based on unconditioned material, and took no credit for the reduction in dispersability due to the additive, for the soft-sided disposal container nor for the ISO container as a conservative approach. The assessment evaluated both potential risks associated with accident-free waste transportation (direct radiation) and the risks associated with an accident scenario. The evaluation demonstrated that the calculated excess cancer risk to members of the general public for both scenarios meets the criteria specified by the Silo 3 ROD Amendment.

Per 49 CFR 397 Subpart D, Routing of Class 7 (Radioactive) Materials, the truck route selected for shipment of radioactive material to Envirocare shall ensure that the radiological risk is minimized. Accident rates, transit time, population density and activities, and the time of day and week in which transportation will occur are included in the radiological risk determination.

2.3.3 Shipping Requirements

2.3.3.1 Department of Transportation Requirements

The FCP shall comply with applicable federal, tribal, state, and local regulations. Each package and shipment of hazardous materials for off-site shipment shall be prepared in compliance with 49 CFR 171-180, Hazardous Materials Regulations and the applicable tribal, state, and local regulations.

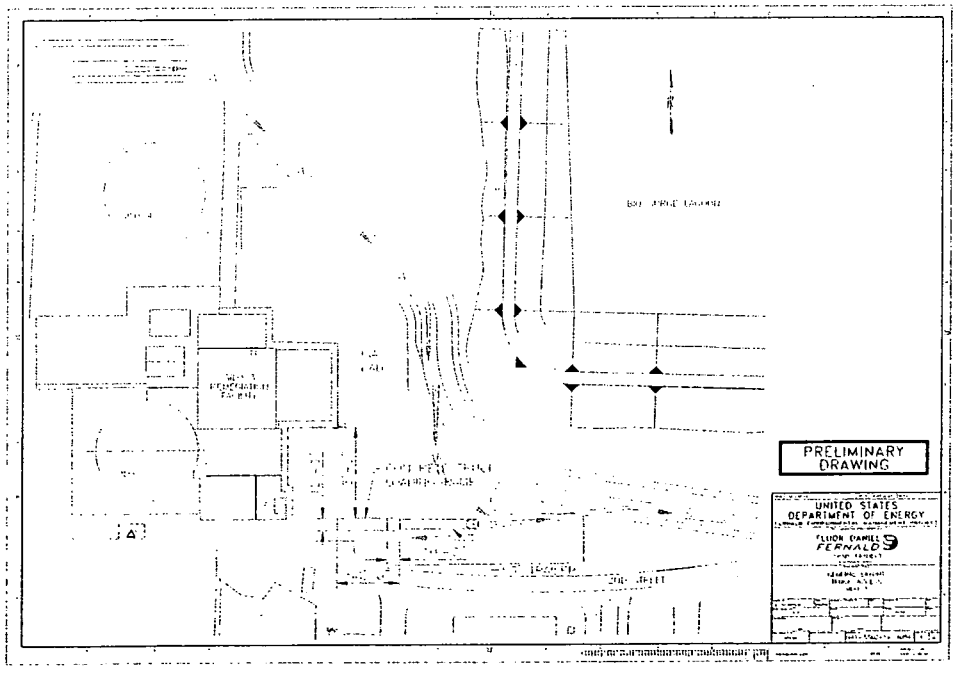
2.3.3.2 Motor Carrier Selection

Carrier selection will be performed consistent with DOE MCEP, DOE Orders, 41 CFR 101-40 and Transportation and Traffic Management. Shipments will be planned in order to maximize the quantity to the extent practicable whenever such arrangements will result in transportation or administrative economies but only within the limits of the transportation risk analysis.

3.0 ON-SITE WASTE MANAGEMENT

3.1 INTRODUCTION

This section addresses the on-site management of the Silo 3 material, including the characterization, packaging, staging, inspections, and Silo 3 material container movements. The following diagram is a representation of the layout of the Silo 3 Area:



3.2 WASTE CHARACTERIZATION

The Silos Project is responsible for characterizing the conditioned Silo 3 material to coordinate the appropriate waste disposal/storage, packaging and transportation options for this waste. As documented in the OU4 Remedial Investigation/Feasibility Study (RI/FS), the OU4 Record of Decision (ROD) and its subsequent modifications, and Material Evaluation File (MEF) 3851, the Silo 3 material is characterized as byproduct material in accordance with Section 11e.(2) of the Atomic Energy Act as amended. Additional characterization of the conditioned Silo 3, based upon process knowledge, process control data and/or sampling and analysis, will be documented to confirm that the packaged waste attains Envirocare's Waste Acceptance Criteria (WAC).

3.3 PACKAGING

The current Silo 3 packaging approach assumes conditioned Silo 3 material is packaged in 96 ft3 Industrial Packaging- Type 2 (IP-2) soft-sided containers with 30-mil PVC liners, placed on pallets, loaded into ISOs (4 to 8 soft-sided containers per ISO), placed on flat bed trailers and staged for shipment to the Envirocare. Either one or two ISOs will be loaded on each trailer and anchored in accordance with DOT requirements. The ISOs are approximately 8 feet wide by 8.5 feet high by 20 feet long (exterior) and are all-steel construction, end-opening containers. The tare weight of an ISO varies between 5000 and 5,200 pounds. Although, they are rated to an approximate gross of 68,000 pounds, the maximum anticipated gross is 40,000 pounds.

If necessary, based upon the physical characteristics of the material cncountered in the silo, a contingency retrieval and packaging approach will be utilized to facilitate effective retrieval and packaging of the material. The contingency approach will consist of:

1. A manned, enclosed cab, front-end loader will be utilized to retrieve material from Silo 3 and load it directly into a disposal container in the excavator room.
2. No liquid additive solution will be added to the material.
3. The package would consist of a 96ft^3 double layer, coated woven polypropylene soft-sided package, with a 6-mil poly liner rather than the sealed 30-mil PVC inner liner. The new soft-sided package configuration will be tested (drop and stacking tests) to verify compliance with Department of transportation (DOT) IP-2 requirements.

   The soft-sided packages would be closed as currently done, loaded into an overpack container (4-8 packaged per overpack), and loaded onto a flatbed truck for transportation to Envirocare.

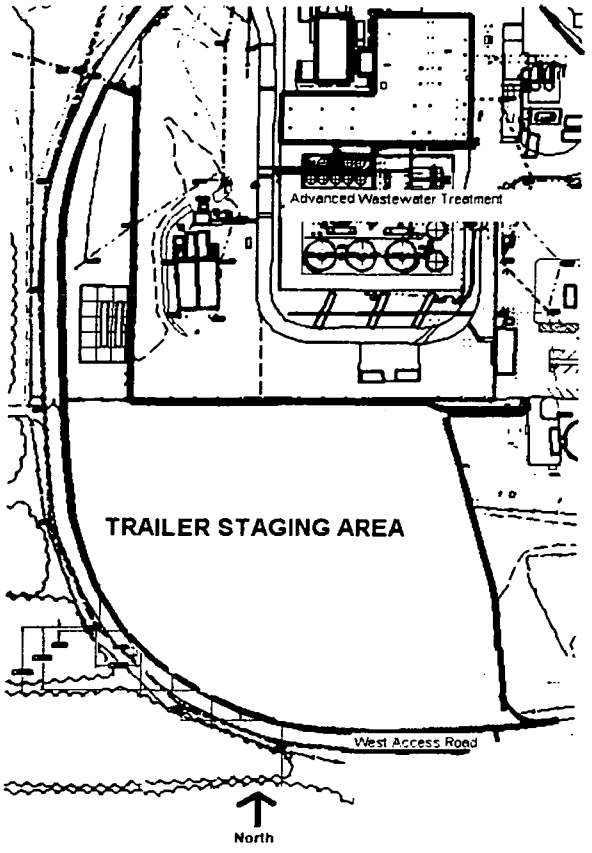
   An alternate package configuration, consisting of a 96ft^3 soft-sided package with a single inner liner may also potentially be used. These packages would be closed and loaded into an IP-2 certified Sea/Land container for shipment to Envirocare.

This information will be communicated to appropriate state and local authorities along the transportation route.

The containers will be filled with Silo 3 material, weighed, labeled, and surveyed before being prepared for shipment to Envirocare. When ready for shipment, the containers will be loaded into the ISO in accordance with procedure 11-C-344, "Loading of Silo 3 Soft-sided Shipping Containers for Offsite Shipment", and will be braced as required (e.g. with lumber), before closing the ISO. The Package Loading Stand is equipped with a scale to allow weighing of the filled soft-sided container prior to being placed on pallets.

3.4 STAGING AND INSPECTIONS

Inbound trailers will be inspected and surveyed before being moved to the Trailer Staging Area (TSA), using a yard tractor. The TSA will serve as a place for staging of empty and loaded trailers (as long as dose is within limits), as well as repair of unfit trailers. Following is a diagram of the TSA:



Filled packages will be staged onsite as required to allow inspection, final characterization and preparation of individual ISO's meeting the Envirocare WAC. Once a group of packages has been approved for disposal, it will be loaded into an ISO and prepared for shipment as described in Section 3.3. Staging of filled ISO's that have been certified for shipment will be limited to the period of time necessary to facilitate ongoing, continuous shipments to Envirocare. Once an ISO has been filled, inspected, and certified for shipment, it will remain on-site for only the length of time required to facilitate logistics between FCP, transportation contractors, and Envirocare. Barring outside circumstances (e.g., weather, etc) temporarily interrupting the ability to continue shipments, this period of time will not exceed 14 days.

At time of shipment, the ISO's will be placed onto a flatbed trailer. After the trailers are surveyed and released from the Silos area for shipment, the Shipping organization will prepare the remaining paperwork. Individual containers of Silo 3 material will be tracked using the existing on-site waste tracking databases.

3.5 CONTAINER MOVEMENTS

Once an inventory of material is approved for shipment, the final shipping certification will occur prior to loading. Containers will be loaded onto ISOs/flat bed trailers using fork trucks or other necessary heavy equipment.

4.0 HEALTH AND SAFETY

4.1 INTRODUCTION

The focus of this section will be the Health and Safety approach for on-site transportation operations-related activities. The overall on-site project Health and Safety responsibility lies directly with the DOE, Fluor Fernald, and its contractors and is implemented according to PL-3081, Safety Management System Description, which incorporates the core functions of the Integrated Safety Management System (ISMS). The specific functional areas of safety addressed in this section are Nuclear and Systems Safety, Occupational Safety and Health, Radiological Protection, and Security.

4.2 NUCLEAR AND SYSTEMS SAFETY

The FCP Nuclear and System Safety Program is identified in RM-2116, System Safety Requirements and is implemented by Fluor Fernald through site procedures. Safety analyses are performed to help ensure the health and safety of the public, the workers, and the environment. A Nuclear Health and Safety Plan (NHASP) has been developed for operation of the Silo 3 Project and has been approved by DOE.

Safety analysis documentation includes staging of material and motor vehicle shipping activities for Silos projects. All shipments and containers (including Silo 3 shipping containers) will comply with DOT regulations, which will help to ensure the health and safety of the public, the workers, and the environment.

4.3 OCCUPATIONAL SAFETY AND HEALTH

The FCP Occupational Safety and Health Program requirements are defined in the RM-0021, Safety Performance Requirements (SPR) Manual. The SPRs apply to activities at the FCP. SPRs identify requirements established by federal, state, and local regulations, in addition to requirements from DOE Orders and Best Management Practices established by Fluor Fernald through experience, lessons learned, and employee input. SPRs identify safety and health standards for assessing and planning work at the FCP. SPRs contain guidelines on what must be done to safely execute work and are not intended to specify how to execute work. The Fluor Fernald Silo 3 Project team will implement the SPRs by incorporating their requirements into any project-specific procedures and contracts that will be developed to guide the performance of transportation activities. Silo 3 material shipments will be performed in accordance with existing shipping procedures, which incorporate the required SPRs.

Project-specific safety and health requirements will be developed as the details of the project unfold. For planning purposes, however, existing SPRs are being used as the basis for health and safety on this project. The SPRs and additional project-specific safety requirements are incorporated into planning documents and implementing procedures.

4.4 SAFETY PRECAUTIONS

Staging of packaged Silo 3 material will be in designated and approved area(s).

4.5 RADIOLOGICAL PROTECTION

Equipment and material, including containers of Silo 3 material, will be released from the Silo 3 facility when the exterior of the item meets DOT surface contamination limits. Therefore, it is planned that shipping activities will take place in a Controlled Area. FCP Radiological Control Technicians (RCTs) will conduct routine radiological surveys to ensure contamination levels are maintained below Contamination Area limits. The exterior of each container, (soft-sided containers), will be surveyed by FCP Radiological Control for compliance with DOT regulations and Fluor Fernald Radiological Protection Program (RPP) requirements. Exterior non-fixed contamination levels will be determined per 49 CFR 173.443, Contamination Control for shipments and 10 CFR 835, Occupational Radiation Protection for staging. Once the containers have been surveyed and are ready for release, they will be loaded into ISOs and placed on flatbed trailers. After the trailers have been surveyed and released, they will be transported to the TSA or other on-site staging location.

If the equipment or material in the Controlled Area exceeds Contamination Area levels, a Contamination Area will be established and a new Radiation Work Permit (RWP) will be issued. The RWP will define the level of anti-contamination clothing and RCT coverage required. If decontamination is feasible, decontaminating the work surface to a level below Contamination Area limits will eliminate the need for routine wearing of anti-contaminating clothing and reduce the RCT coverage requirements. If/when Contamination Areas are established, whole body monitoring will be required for exiting the area. Immediately following the completion of work, the area will be decontaminated, as necessary, and surveyed for the purpose of down-posting.

Detailed project-specific radiological control requirements will be developed and incorporated into procedures and work permits.

4.5.1 Access of Personnel

Only necessary personnel with the appropriate training will be given access to the radiologically-controlled areas. The crew will ingress/egress through a radiological control point(s) and will be subject to personal contamination monitoring upon exit. Incidents of personal contamination will be addressed per existing, approved site procedures.

4.6 SECURITY

Areas where Silo 3 material will be loaded and staged pending the completion of shipment will be within the site fence and provided with the appropriate levels of security and lighting. FCP Security monitors site access by using stationary posts, conducting walking, driving, and perimeter patrols on a 24-hour basis.

5.0 EMERGENCY RESPONSE

5.1 INTRODUCTION

This section documents the emergency response procedures that are in place to respond to transportation accidents involving shipments of Silo 3 material. The scope of this discussion focuses on off-site occurrences and references procedures for on-site occurrences.

DOE Order 151.1B, Comprehensive Emergency Management System, provides for a DOE Emergency Management System (EMS). This order requires sites and facilities to have emergency plans and procedures in place and to address transportation emergencies for onsite and offsite. The FCP has established plans and procedures. Also, pursuant to DOE O 151.1, EM has authority to maintain the Transportation Emergency Preparedness Program, which assists Department of Energy (DOE) and other federal, state, tribal and local authorities to prepare for response to a transportation incident involving DOE shipments of radioactive material. DOE O 151.1 also addresses DOE's responsibilities under the National Contingency Plan (NCP) and the Nuclear Rad Annex of the National Response Plan.

5.1.1 Department of Energy Requirements

DOE Order 435.1, Radioactive Waste Management and associated manual DOE M 435. 1-1, Chapter IV, Section L.2, Transportation, also state that the volume of waste and number of waste shipments shall be minimized to the extent practical. This requirement was considered in development of the Silo 3 waste form and associated transportation planning.

5.2 FCP EMERGENCY RESPONSE PREPAREDNESS PLANS

The FCP Transportation Emergency Plan (TEP), PL-3043, is part of the DOE-FCP Transportation Emergency Preparedness Program. The FCP TEP provides a centralized program approach to off-site transportation emergency response including products, samples, waste, and rail shipments.

The FCP TEP describes the overall DOE/FCP process developed for the coordination of response efforts to off-site transportation incidents. This assistance planning is

accomplished by adherence to applicable federal, state, and local transportation-related emergency response requirements, plus utilizing existing DOE programs designed to protect the well-being of citizens and the environment from accidental release of transported materials.

Procedures for on-site emergencies are addressed in PL-3020, FCP Emergency Plan, which details the procedures to be followed at the FCP in the event of an accident or emergency, highlights FCP safety features, and governs the spill response actions. The FCP Emergency Plan is distributed to participating mutual aid organizations, such as local fire departments and hospitals, in the general vicinity of the FCP. Silo-specific emergency procedures are addressed in EM-0030, Silos Area Emergency Procedure. Loading of soft-sided containers, including response to a damaged container is directed by procedure 11-C-344, "Loading of Silo 3 Soft-Sided Shipping Containers for Off-site Shipment." Response to a spill or release is directed by procedure 11-E-006, "Silo 3 Abnormal/Emergency Events Response."

5.3 EMERGENCY RESPONSE FOR THE FCP OFF-SITE SHIPMENTS

A Silo 3 material shipment will become an off-site shipment at the point when the entire shipment crosses the facility boundary. When the shipment is off-site, the motor carrier will be responsible for providing emergency response support to the local authorities in proximity of any incident. The carrier also has contractors available for containment and cleanup as necessary. The FCP will provide technical assistance via the 24-hour emergency response telephone number. DOE will advise and provide support as requested by the local response authority (49 CFR 172.604). Local response personnel including police, firefighters, and emergency responders, typically are the first to arrive on the scene of an incident. They must be provided with the technical information needed by first responders to accurately identify the hazards involved in the incident. Information contained in the shipping papers includes source terms, health and safety concerns, and recommended protective actions. The information is consistent with the DOT, Research and Special Programs Administration publication, North American Emergency Response Guidebook, Guide 162.

Consistent with the procedure for other shipments to Envirocare, advance notification will be provided to state and tribal emergency response organizations prior to the beginning of the Silo 3 shipping campaign. The notification will include information such as the number of shipments, the type of material and packaging configuration, the projected dates for initiation and completion of shipments, and on-site contact information. Primarily for security reasons, current policy for waste shipments does not provide for notification of the date, time, and route of individual Silo 3 waste shipments. A contact list of the organizations notified prior to initiating shipments will be provided to OEPA and USEPA for information.

The following is an overview of the emergency response responsibilities of the motor carriers, DOE, individual states, and the FCP to support local authorities at an accident scene.

1. Carriers
   - Trained in accordance with DOT Emergency Response Guidebook and the carrier's respective Emergency Response Plans
   - Stabilize situation
   - Provide notification of incident to carrier home office
   - Provide notification to FCP/DOE

2. Carrier Emergency Response Organization
   - Make appropriate additional notification (local authorities, DOE, etc.)
   - Dispatch Emergency Response Personnel to the scene to support On-Scene Commander
   - Mobilize strategically positioned emergency response subcontractors, if necessary
   - Responsible for Recovery Actions

3. Local Authorities
   - Typically function as the On-Scene Commander

4. State Emergency Response Organizations
   - Each state possesses an Emergency Response Organization capable of responding to radiological emergencies

5. DOE Regional Radiological Assistance Teams
   - Eight Radiological Assistance Team offices across the United States
   - Provide On-Scene Commanders with support in terms of radiological monitoring, communications, and information coordination during an emergency
   - Consist of DOE and contracted personnel possessing expertise in health physics, public information, and communications

The FCP TEP is activated when the carrier or the local response organizations contacts the FCP to notify DOE that an incident has occurred. The 24-hour emergency phone number provided on the bill of lading, as required by 49 CFR 172.604, Emergency Response Telephone Number, is a direct telephone line to the FCP Communications Center.

The FCP Communications Center provides communication capability for the FCP, monitors conditions, and makes notifications as required. The FCP Communication Center establishes and maintains direct communication with the On-Scene Commander and the FCP Assistant Emergency Duty Officer (AEDO) until the Emergency Operations Center (EOC) is activated.

The FCP EOC is activated at the direction of the AEDO or Emergency Duty Officer (EDO) for events categorized at the emergency level, including transportation events and for non-

emergency events at the discretion of the EDO. The EOC officially becomes operational when the Emergency Director or Deputy Emergency Director arrives at the EOC, determines that sufficient personnel are available to manage the response, and declares the EOC operational. The combined efforts of EOC staff members provide support, guidance, and direction to the On-Scene Commander in the field. The EOC staff assumes responsibilities such as making protective action recommendations, providing notifications, and obtaining necessary resources, as required by the specific circumstances of the event.

5.3.1 Motor Carriers

Motor carriers maintain Emergency Response Plans (ERP), which outline the procedures the carrier's employees must take in the event of an incident. The plan includes notification responsibilities, emergency response procedures for personnel on the scene, environmental considerations, and additional precautions to take in the event of an incident. DOE, as the shipper, will be notified by the carrier immediately should an incident occur. Both the carrier and DOE will initiate emergency procedures upon notification.

6.0 WASTE DISPOSAL

6.1 INTRODUCTION

This section describes procedures for receipt and disposal of Silo 3 material at Envirocare. Envirocare is authorized by its 11e.(2) license to accept 11e.(2) byproduct material with an average concentration in any transport vehicle (truck or railcar) not to exceed 4,000 pCi/g for natural uranium or for any radionuclide in the Radium-226 series, 60,000 pCi/g for thorium-230, or 6,000 pCi/g for any radionuclide in the thorium decay series. The specified concentration limits are for each radionuclide in the corresponding decay series.

The average concentration on receipt will be based upon the total activity and waste mass (including moisture and additives) in each ISO container as opposed to each individual soft-sided container. Consequently, some shipments may contain individual disposal containers with manifested radionuclide concentrations above the specified limits. This will be acceptable as long as the total shipment concentration (i.e., total shipment activity divided by total waste mass) of all disposal containers in the ISO is less than the specified concentration limits.

6.2 SILO 3 MATERIAL QUANTITIES/CHARACTERISTICS

Silo 3 contains approximately 5,100 yd3 of material that was generated at the FCP during uranium extraction operations in the 1950s. Samples collected from Silo 3 indicate the presence of significant activity and concentrations of the radionuclides within the uranium decay series, confirming prior process knowledge. The predominant radionuclide of concern identified within Silo 3 is Th-230, a radionuclide produced from the natural decay of Uranium-238. Approximately 450 curies of Th-230 are distributed within the Silo 3 material. (Note: The 450 curies is a mean inventory value. The 95% upper confidence

limit inventory value is approximately 530 curies. For most determinations, the upper confidence limit values are used for conservatism.)

The Silo 3 material is classified as 11e.(2) by-product material under the Atomic Energy Act (AEA), of 1954, as amended, because the material resulted from the processing of uranium ore concentrate and is specifically exempt, as defined, from regulation as solid waste under the Resource Conservation and Recovery Act (RCRA), 40 CFR 261.4(a)(4), Identification and Listing of Hazardous Waste, Exclusions. Since Silo 3 material is not a solid waste, requirements under RCRA are not applicable.

The current approach is for disposal of conditioned Silo 3 material. The conditioning process, which results in a minimal volume increase, will reduce material dispersability and reduce the mobility of certain RCRA metals contained in the material.

6.3 DISPOSAL OF SILO 3 MATERIAL AT ENVIROCARE

6.3.1 Shipment Receipt and Acceptance

Upon arrival at Envirocare, shipments of Silo 3 material will be inspected to verify compliance with Department of Transportation (DOT) and State of Utah regulations, applicable licenses and permits and with the Radioactive Waste Profile Record. Envirocare Transportation Compliance personnel will perform an initial visual inspection of each shipment to ensure compliance with DOT requirements. The initial DOT inspection will include radiological surveys, inspection of the integrity of disposal containers, inspection for load shifting, and review of shipping documentation. The ISO containers will be opened and inspected outside of Envirocare's restricted area. Individual soft-sided packages will not be opened until the ISO container is brought into the restricted area and sampled as described below.

Envirocare Transportation Compliance personnel will sign the Uniform LLRW Manifest once the waste shipment has been inspected, prior to entering the disposal facility. Any discrepancies will be noted on the manifest and formal written notification will be provided to Fluor Fernald. The signed manifest will be returned to Fluor Fernald within seven days of receipt of the shipment. After the initial shipment inspections, ISO containers will be moved into the disposal site and staged for waste receipt inspections and sampling.

The ISO containers will remain closed until health physics and sampling personnel are ready to sample the waste. ISO containers will be selected for WAC verification sampling in accordance with Envirocare's disposal license and as the associated procedures, and analyzed onsite to quantify the activity from the gamma-emitting radionuclides. The measured concentrations (wet weight basis) will be compared against the license limits to verify compliance prior to disposal.

As an alternative approach, WAC verification sampling may be conducted, with oversight of Envirocare personnel, at the FCP prior to shipment.

Waste will be authorized for disposal once the analytical results have been reviewed and approved by the laboratory manager.

6.3.2 Disposal Operations

Envirocare utilizes an above-ground engineered disposal technology. The design of the 11e.(2) disposal embankment includes standard liner and cover requirements. Waste material is placed in the disposal embankments in 12-inch lifts using a continuous cut and cover process. After placement, native clay is blended with the waste in the lift and is compacted to 90 percent of its optimum density based upon results of Standard proctor measurements determined by ASTM-D698. Debris items placed in the disposal lifts are required to be less than 8 feet in any dimension and less than 10 inches in one dimension. Soil is compacted in and around debris to eliminate void space and minimize the effects of settlement of the disposal embankment during and after disposal operations.
After shipment inspection and sampling, the ISO containers will be transferred to the 11e.(2) disposal embankment and remain closed until the disposal operator is prepared to begin waste placement. Each ISO container will be emptied within 14 days after being transferred to the disposal embankment. All disposal operations for the Silo 3 material will be performed under the direct supervision of health physics personnel in accordance with a specific Radiation Work Permit.

Prior to opening an ISO container, the disposal area will be prepared for immediate placement of the inner disposal packages. Each palletized soft-sided package will be removed from the ISO container using a forklift and placed on the disposal embankment. Due to the radionuclide content and physical properties of Silo 3 material, the packages will immediately be covered with native clay to minimize the potential for airborne material during the process of opening and emptying the packages. Disposal operators will then use heavy equipment to break open the bags and blend the contents with native clay. The use of heavy equipment will allow disposal operators to maintain adequate distance from the waste as it is being blended and compacted into the disposal lifts. Disposal operators will wear the appropriate protective clothing and equipment as specified in the Radiation Work Permit. The disposal operator and surrounding area will be closely and continuously monitored using air sampling equipment to ensure proper controls are in place and functioning at all times during disposal operations.

The addition of conditioning solution to the Silo 3 material during packaging will significantly reduce the airborne potential during disposal operations at Envirocare. In addition, Envirocare will employ dust suppression as needed during disposal operations as the blended clay and Silo 3 material is compacted in the 12-inch lifts. Disposal operators will have sufficient clay material available while the Silo 3 material is being blended and compacted to ensure that the waste is covered at all times. Envirocare will ensure that 11e.(2) material from other generators is not blended with the Silo 3 material.

Empty soft-sided packages, debris and other secondary wastes associated with the Silo 3 project will be placed with the Silo 3 material in the disposal embankment. The debris and secondary wastes will be uniformly distributed throughout the disposal lift and blended with native clay to achieve the required compaction criteria in accordance with Envirocare's license and associated procedures.

Once the waste is compacted in the disposal lift, Envirocare's quality control technicians perform compaction testing to ensure the lift is compliant with the applicable design and construction criteria. If necessary, the disposal lift will be further compacted until the compaction criteria are met.

The specific location of each shipment in the disposal embankment is identified using standard survey practices, and is maintained in Envirocare's Waste Information and tracking database.

<end of page>

7.0 REFERENCES

Code of Federal Regulations, 10 CFR 835,"Occupational Radiation Protection"

Code of Federal Regulations, 10 CFR Chapter 1,"Nuclear Regulatory Commission"

Code of Federal Regulations, 40 CFR 261.4, "Identification and Listing of Hazardous Waste, Exclusions"

Code of Federal Regulations, 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan"

Code of Federal Regulations, 41 CFR 101-40, "Transportation and Traffic Management"

Code of Federal Regulations, 49 CFR 171-180, "Hazardous Materials Regulations"

Code of Federal Regulations, 49 CFR 107, "Hazardous Materials Program Procedures"

Code of Federal Regulations, 49 CFR 350-399, "Federal Motor Carrier Safety Administration"

Code of Federal Regulations, 49 CFR 397, Subpart D, "Routing of Class 7 (Radioactive) Materials"

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Fluor Fernald, 2003, "Silo 3 Project Remedial Design/Remedial Action Package," (40430-RDP-0001), Rev. 2., December 2003.

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U.S. Department of Energy, "Departmental Materials Transportation and Packaging Management," DOE-460.2-1, September 2002

U.S. Department of Energy, "Packaging and Transportation Safety," DOE Order 460.1B, April 2003

U.S. Department of Energy, "Comprehensive Emergency Management System," DOE-151.1B, October 2003

U.S. Department of Energy, , "Radioactive Waste Management," DOE-435.1, August 2001

U.S. Department of Energy, 2003, "Safety Basis Requirements," 10 CFR 830, Subpart B, January 2003

APPENDIX A
SILO 3 MATERIAL LSA DETERMINATION (HM-230, EFF. OCTOBER 1, 2004)

The table below represents the source term for the Silo 3 material, as well as the LSA classification and packaging determinations. On January 26, 2004 Research and Special Programs Administration (RSPA) issued a final rule [Docket No. RSPA-99-6283 (HM-230)] amending the requirements in the Hazardous Material Regulations (HMR) pertaining to the transportation of radioactive material. The purpose of this rulemaking initiative is to harmonize requirements of the HMR with international standards for radioactive materials as well as to disseminate other Department of Transportation (DOT)-initiated requirements. The mandatory compliance date is October 1, 2004. RSPA is authorizing a voluntary compliance date of February 25, 2004.

Column 1 identifies each radionuclide present in the Silo 3 material.

Columns 2 and 4 identify the activity concentration for each radionuclide in terabecquerels per gram (TBq/g) and becquerels per gram (Bq/g), respectively. Columns 3 and 5 identify the total activity of each radionuclide in terabecquerels (TBq) and becquerels (Bq), respectively. The values in Columns 3 and 5 were arrived at by taking the activity concentration per radionuclide multiplied by the net weight in grams of material.

The radionuclide specific limits shown in Columns 6 and 8 are prescribed by 49 CFR 173.436. 49 CFR 173.436 Footnote (b) specifies the progeny that have been taken into consideration when assigning the activity concentration and consignment limits of the parent. The table provides a list of these parent/progeny relationships included in Silo 3 material.

Column 7 contains the result of the unity calculation per nuclide for the activity concentration limit for exempt material (ACEM) and is derived by the following:
Column 4, "Activity Concentration (Bq/g)" divided by Column 6, "ACEM [Activity Concentration Limit for Exempt Material] (Bq/g)"

Column 9 contains the result of the unity calculation per nuclide for the activity limit for exempt consignment (ALEC) and is derived by the following:
Column 5, "Total Activity (Bq)" divided by Column 8, "ALEC [Activity Limit for Exempt Consignment] (Bq)"

If the sum of either column is less than or equal to 1, then the material is not regulated as Class 7 radioactive material. As demonstrated in the table, the sum of each unity calculation individually exceeds 1; therefore, the Silo 3 material meets the definition of Class 7 radioactive material.

Column 10 identifies the applicable LSA-I limit, which is 30 times the ACEM. Column 11 contains the result of the unity calculation per nuclide for LSA-I and is derived by the following:
Column 4, "Activity Concentration (Bq/g)" divided by Column 10, "LSA-I(1)(iv) 30x Activity Concentration Limit (Bq/g)"

If the sum of Column 11 exceeds 1, then the radioactive material cannot be shipped as LSA-I material. As shown in the table, the LSA-I unity calculation greatly exceeds 1; therefore, it does not meet the definition of LSA-I.

Column 14 identifies the A2 values prescribed by 49 CFR 173.435. 49 CFR 173.435, Footnote (a), indicates that certain A2 values already include the contributions from daughter nuclides with half-lives less than 10 days and considered to be in secular equilibrium with their parent nuclide. The table provides a list of these parent/daughter relationships included in Silo 3 material.

The definition of LSA-II solid material found at 173.403 *LSA material* requires that the activity is distributed throughout and the average specific activity of the material is less than 10^{-4} A_2/g. This limit is identified in Column 12. Column 13 contains the result of the unity calculation per nuclide for LSA-II and is derived by the following:
Column 2, "Activity Concentration (TBq/g)" divided by Column 12, "LSA-II (2)(ii) Limits 10^{-4} A2/g"

If the sum of Column13 exceeds 1, then the radioactive material cannot be shipped as LSA-II material. As shown in the table, the sum of the LSA-II unity calculation does not exceed 1; therefore, it can be classified and shipped as LSA-II material. At this point, it has been determined the Silo 3 material meets the DOT definitions of radioactive and LSA-II material.

Column 15 contains the result of the A2 unity calculation per nuclide and is derived by the following:
Column 3, "Total Activity (TBq)" divided by Column 14, "A2 Limits (TBq)"

If the sum of Column 15 exceeds 1, thereby exceeding an A2 quantity, the material cannot be shipped in an excepted package as permitted by 173.427(b)(4). As shown in the table, the sum of the A2 unity exceeds 1; therefore, the Silo 3 material must and will be packaged in a Type IP-2 packaging, subject to the limitations of Table 6, as required by 49 CFR 173.427 (b)(1). Per Table 5, the activity limit for the conveyance is unlimited for LSA-II Non-combustible Solids.

Project: Silo 3 Transportation & Disposal Plan - Appendix A-2
Container: Non-Bulk IP-2 Bag
Weight/Unit: 4400 Lbs.
Net Weight: 4400.0 Lbs. **Net Wt (Gms):** 1,995,786.0

					49 CFR 173.436 [HM-230]				49 CFR 173.403 [HM-230]				49 CFR 173.435 [HM-230]	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Radionuclide	Activity Concentration (TBq/g)	Total Activity (TBq)	Activity Concentration (Bq/g)	Total Activity (Bq)	ACEM [Activity Concentration Limit for Exempt Material] (Bq/g)	ACEM Unity	ALEC [Activity Limit for Exempt Consignment] (Bq)	ALEC Unity	LSA-I (1)(iv) 30X Activity Concentration Limit (Bq/g)	LSA-I Unity	LSA-II (2)(ii) Limits 10^{-4} A2/g	LSA-II Unity	A2 Limits (TBq)	A2 Unity
Ac-227	3.078E-11	6.144E-05	3.078E+01	6.144E+07	1.000E-01	3.078E+02	1.000E+03	6.144E+04	3.000E+00	1.026E+01	9.000E-06	3.420E-03	9.000E-05	6.827E-01
Ac-228	2.808E-11	5.605E-05	2.808E+01	5.605E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Bi-210	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Bi-211	3.078E-11	6.144E-05	3.078E+01	6.144E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Bi-212	2.808E-11	5.605E-05	2.808E+01	5.605E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Bi-214	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Fr-223	4.255E-13	8.492E-07	4.255E-01	8.492E+05	1.000E+01	4.255E-02	1.000E+04	8.492E+01	3.000E+02	1.418E-03	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Pa-231	3.078E-11	6.144E-05	3.078E+01	6.144E+07	1.000E+00	3.078E+01	1.000E+03	6.144E+04	3.000E+01	1.026E+00	4.000E-06	7.694E-04	4.000E-04	1.538E-01
Pa-234m	6.216E-11	1.241E-04	6.216E+01	1.241E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Pb-210	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	5.000E-06	2.575E-05	5.000E-02	5.140E-03
Pb-211	3.078E-11	6.144E-05	3.078E+01	6.144E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Pb-212	2.808E-11	5.605E-05	2.808E+01	5.605E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Pb-214	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Po-210	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	2.000E-06	6.438E-05	2.000E-02	1.285E-02
Po-211	8.399E-14	1.678E-07	8.399E-02	1.678E+05	1.000E-01	8.399E-01	1.000E+03	1.678E+02	3.000E+00	2.800E-02	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Po-212	1.798E-11	3.589E-05	1.798E+01	3.589E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Po-214	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Po-215	3.078E-11	6.144E-05	3.078E+01	6.144E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Po-216	2.808E-11	5.605E-05	2.808E+01	5.605E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Po-218	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Ra-223	3.078E-11	6.144E-05	3.078E+01	6.144E+07	1.000E+02	3.078E-01	1.000E+05	6.144E+02	3.000E+03	1.026E-02	7.000E-07	4.398E-05	7.000E-03	6.777E-03
Ra-224	2.808E-11	5.605E-05	2.808E+01	5.605E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Ra-226	1.288E-10	2.570E-04	1.288E+02	2.570E+08	1.000E+01	1.288E+01	1.000E+04	2.570E+04	3.000E+02	4.292E-01	3.000E-07	4.292E-04	3.000E-03	8.566E-02
Ra-228	2.808E-11	5.605E-05	2.808E+01	5.605E+07	1.000E+01	2.808E+00	1.000E+05	5.605E+02	3.000E+02	9.361E-02	2.000E-06	1.404E-05	2.000E-02	2.802E-03
Rn-219	3.078E-11	6.144E-05	3.078E+01	6.144E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Rn-220	2.808E-11	5.605E-05	2.808E+01	5.605E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Rn-222	1.288E-10	2.570E-04	1.288E+02	2.570E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Th-227	3.078E-11	6.144E-05	3.078E+01	6.144E+07	1.000E+01	3.078E+00	1.000E+04	6.144E+03	3.000E+02	1.026E-01	5.000E-07	6.157E-05	5.000E-03	1.229E-02
Th-228	2.808E-11	5.605E-05	2.808E+01	5.605E+07	1.000E+00	2.808E+01	1.000E+04	5.605E+03	3.000E+01	9.361E-01	1.000E-07	2.808E-04	1.000E-03	5.605E-02
Th-230	2.005E-09	4.002E-03	2.005E+03	4.002E+09	1.000E+00	2.005E+03	1.000E+04	4.002E+05	3.000E+01	6.685E+01	1.000E-07	2.005E-02	1.000E-03	4.002E+00
Th-231	2.842E-12	5.671E-06	2.842E+00	5.671E+06	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Th-232	2.808E-11	5.605E-05	2.808E+01	5.605E+07	1.000E+01	2.808E+00	1.000E+04	5.605E+03	3.000E+02	9.361E-02	Unlimited	0.000E+00	Unlimited	0.000E+00
Th-234	6.216E-11	1.241E-04	6.216E+01	1.241E+08	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	3.000E-05	2.072E-06	3.000E-01	4.135E-04
Tl-207	3.078E-11	6.144E-05	3.078E+01	6.144E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
Tl-208	1.010E-11	2.016E-05	1.010E+01	2.016E+07	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(b) - Progeny	0.000E+00	(a) - Daughter	0.000E+00	(a) - Daughter	0.000E+00
U-234	6.216E-11	1.241E-04	6.216E+01	1.241E+08	1.000E+01	6.216E+00	1.000E+05	1.241E+03	3.000E+02	2.072E-01	8.000E-07	1.036E-04	6.000E-03	2.068E-02
U-235	2.842E-12	5.671E-06	2.842E+00	5.671E+06	1.000E+01	2.842E-01	1.000E+04	5.671E+02	3.000E+02	9.472E-03	Unlimited	0.000E+00	Unlimited	0.000E+00
U-238	6.216E-11	1.241E-04	6.216E+01	1.241E+08	1.000E+01	6.216E+00	1.000E+04	1.241E+04	3.000E+02	2.072E-01	Unlimited	0.000E+00	Unlimited	0.000E+00
TOTALS						2.408E+03		5.818E+05		8.025E+01		2.527E-02		5.043E+00
RESULTS					RADIOACTIVE ? (T/F): TRUE				Not LSA-I		LSA-II		>A2	

173.436, Footnote (b) - Parent nuclides and their progeny included in secular equilibrium are listed in the following:	
Parent	Progeny
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212
U-235	Th-231
U238	Th-234, Pa-234m

173.435, Footnote (a) - A_2 values include contributions from daughter nuclides with half-lives less than 10 days.:	
Parent	Daughter
Ac-227	Fr-223
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Po-211, Tl-207
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Bi-210
Ra-228	Ac-228
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212
Th-234	Pa-234m
U-235	Th-231