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40430-PL-0010 TAKE OFF DISTRIBUTION: <input type="checkbox"/>	1PCN7	APPROVED	SILO 3 RETREIVAL AND DISPOSITION NUCLEAR HEATH AND SAFETY PLAN	ATT: RAYER, DIANA L Project: 40430

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EFFECTIVE DATE	PCN NO.	REV. NO.	DESCRIPTION: 5990
03-23-05	2	1	<p>Changes to: (1) Section 1.4.3, <i>Silo 3 Material Retrieval and Packaging Activities</i>, to describe the in-line automatic samplers installed above Packaging Stations A and B; (2) Section 10.4, <i>Derivation of Safety Basis Requirements</i>, to make text consistent with PR-3; (3) Appendix B, under <i>Executive Summary</i>, and Sections B-3.2.3 and B-3.3, to change facility designation from Radiological to Less Than Nuclear; (4) Section, B-4.0, <i>Final Hazard Category</i>, to clarify purpose of Appendix G, and to change facility designation from Radiological to Less Than Nuclear; (5) Appendix F (FHA), on Pages 8, 16, 18, and 21, to remove the word "DELETION" left over from a previous PCN; (6) Appendix G, <i>Accident Analysis</i>, under Section G-2.3, <i>Common Assumptions</i>, to explain the calculated bulk density of 73 lb/ft³ used in EBA-4; (7) Section G-3.4, <i>EBA-4: Breach of Full Package</i>, to discuss the calculated bulk density of 73 lb/ft³; (8) Table G.3-4, <i>Breach of a Full Package Scenario Results</i>, to provide new dose values; (9) Section G-3.7, <i>EBA-7: ISO Penetrated</i>, to clarify ISO staging; (10) Table G.4-1, <i>Dose for Comparison to Emergency Guideline</i>, to provide new dose values for EBA-4; (11) Table G.4-2, <i>Dose for Comparison to Emergency Guideline Using Conservative Assumptions</i>, to provide new dose values for EBA-4; (12) App. G, Att. 4, <i>EBA-4 Spreadsheet, EBA-4 Solids Release</i>, to provide new dose values based on calculated bulk density of 73 lb/ft³.</p>
04-15-05	3	1	<p>Changes to: (1) Section 1.4.3, <i>Silo 3 Material Retrieval and Packaging Activities</i>, under <i>Preliminary Pneumatic Retrieval and Equipment Installation</i>, to make past tense and to delete references to vacuum wand boots; and under <i>Routine Pneumatic Retrieval</i>, to delete discussions of vacuum wand boots; (2) Table 10-1, <i>Silo 3 System Safety Requirements</i>, to delete PR-4 regarding the flexible boots on the vacuum wands per DCN 40430-JEG-277 and DCN 40430-JEG-278; (3) Section 10.4, <i>Derivation of Safety Basis Requirements and Process Requirements</i>, to explain deletion of PR-4.</p>

EFFECTIVE DATE	PCN NO.	REV. NO.	DESCRIPTION
05-24-05	4	1	Change to: (1) Section 16.0, <i>Emergency Response Plan</i> , to reflect replacement of landline phones with cell phones, elimination of the Communications Center, and clarification of Silos Project rally points; (2) Appendix F, <i>Fire Hazards Analysis</i> , to reflect replacement of land line phones with cell phones, and the replacement of the Savannah Communications Center monitoring system with local Protected Premises alarms.
07-07-05	5	1	Change to: (1) Section 10.3, <i>Silos Project Technical Safety Requirement (TSR)</i> , to specify new maximum values for area live loads and concentrated live loads; (2) Section 16.0 <i>Emergency Response Plan</i> , to change location of Rally Point 10; (3) Section 20, <i>References</i> , to update reference information for the OU4 TSR document.
08-31-05	6	1	Change to: (1) Section 1.4.3, <i>Silo 3 Material Retrieval and Packaging Activities</i> , to clarify that remote retrieval may require personnel entry into the Silo.
9/22/05	7	1	Change to (1) Section 7.0 <i>Hazards Assessment</i> to add Task 17, "Personnel Entry into Silo for excavator maintenance, ramp installation, material retrieval, etc", (2) Section 9.0 <i>Hazards Control Matrix</i> Table 9-1, to revise Task 15 "Cutting a Hole in the Silo 3 Wall Structure" to reflect current documentation (3) Section 9.0 <i>Hazards Control Matrix</i> Table 9-1, to add hazards from new Task 17. (4) Appendix A Section A-1.1, <i>Scope</i> , to clarify that Appendix A does not address wall cutting and personnel entry, these hazards are addressed in the OWI and in Section 9.

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FIGURE 6-1: SILO 3 SAFETY BASIS IMPACT SCREEN (SBIS)

Description of Activity/Design Change:	
Work Plan/ Design Doc. No.:	Change Originator:
SBIS Originator:	SBIS Date:
<p>IF the proposed change could involve silo containment as described in the Technical Safety Requirements (TSR) document (see N-HASP Section 10.3), THEN a USQD/safety evaluation must be completed per NS-0002 (Unreviewed Safety Question [USQ] Determination).</p>	
1	Will the proposed change affect any parameters used in calculations supporting the Hazard Analysis as documented in the Silo 3 N-HASP? <input type="checkbox"/> YES <input type="checkbox"/> NO / EXPLAIN:
2	Will the proposed change affect any of the System Safety Requirements in the Silo 3 N-HASP? <ul style="list-style-type: none"> • Safety Basis Requirements (SBRs)? • Process Requirements (PRs)? <input type="checkbox"/> YES <input type="checkbox"/> NO / EXPLAIN:
3	Does the proposed change identify a potential inadequacy (e.g., new accident, hazard) in the Silo 3 N-HASP or any potential reduction in any SBR? <input type="checkbox"/> YES <input type="checkbox"/> NO / EXPLAIN:
4	Does the proposed change affect the activities or requirements of a nearby or adjacent facility or activity operating under a different safety basis (e.g., Silos 1 & 2, RCS, TTA)? <input type="checkbox"/> YES <input type="checkbox"/> NO / EXPLAIN:
5	Does the proposed change result in a change in the inventory or amount of hazardous material? <input type="checkbox"/> YES <input type="checkbox"/> NO / EXPLAIN:
<p>IF the answer to ANY of these questions is YES, THEN: (1) update the analysis; (2) determine whether the change will put the project or affected project outside the safety envelope; (3) incorporate any mitigators or controls into the work plan/permit; (4) attach the updated analysis to this impact screen. IF the change will result in a higher hazard categorization, THEN a USQ must be performed per NS-0002 and submitted to the SRC, the Fluor Fernald President, and the DOE for concurrence.</p>	
6	Per this SBIS, the proposed change <input type="checkbox"/> DOES <input type="checkbox"/> DOES NOT impact the Silo 3 safety basis.
<p>Signature: _____ Date: _____ System Safety Analyst</p> <p>SSA: Are there descriptive changes not requiring analysis, but requiring inclusion in the annual update? <input type="checkbox"/> Y <input type="checkbox"/> N</p> <p>NOTE: IF there is an impact to the safety basis, THEN the Project Manager's signature is required.</p> <p>Signature: _____ Date: _____ Silo 3 Project Manager</p>	

7.0 HAZARDS ASSESSMENT

The hazards assessment associated with this N-HASP will focus on the activities necessary to support operations and maintenance of Silo 3. To date, sixteen Silo 3 operations tasks have been identified for routine performance by Fluor Fernald maintenance and operations personnel, and one by construction personnel (#15):

NOTE: Hazards associated with these tasks may initiate accidents are addressed in Appendices A, B, and G.

1. Truck transport of empty containers and containerized additive materials
2. Receipt of Silo 3 bulk chemicals
3. Manipulation of the Pneumatic Retrieval System (PRS) vacuum wand and hose
4. Maneuvering of the Mechanical Retrieval System (MRS) remote control vehicle
5. Conditioning and packaging of retrieved waste
6. Loading of containerized material
7. On-site transportation of containerized waste materials
8. Maintenance of the Pneumatic Retrieval System (PRS), Air Handling Systems, and Process Vent System
9. Maintenance of motorized vehicles
10. Maintenance of conveyors, feeders, and packagers
11. Maintenance of cranes
12. Maintenance of Waste Additive System and Wastewater System
13. Maintenance of Plant/Breathing Air System
14. Shift-by-shift surveillance of Silo 3
15. Cutting a hole in the Silo 3 wall structure (Note: This is Construction work)
16. Headspace venting, preliminary pneumatic retrieval, and equipment installation
17. Personnel entry into silo for excavator maintenance, ramp installation, material retrieval, etc

The identified hazards listed below are based on the potential exposure of personnel to the Standard Industrial Hazards, chemical hazards, and radiological hazards posed during Silo 3 operations and maintenance activities. A brief description of the expected hazards and their associated controls are provided in Section 8.0. A Hazards Control Matrix is presented in Section 9.0. This matrix identifies the above tasks in conjunction with their hazards and their controls/mitigators. The matrix forms the basis for employee briefings.

- | | |
|----------------------------|--------------------------|
| 1. Slips, trips, and falls | 12. Hoisting and rigging |
| 2. Noise | 13. Confined space |
| 3. Housekeeping | 14. Flammable material |
| 4. Illumination | 15. Hot work |
| 5. Ergonomics | 16. Compressed gas |
| 6. Head impact | 17. Biological |
| 7. Pinch/Crush Points | 18. Environmental |
| 8. Ladders | 19. Heat and cold stress |
| 9. Hand and power tools | 20. Heavy Equipment |
| 10. Electrical | 21. Radiological |
| 11. Hazardous energy | 22. Chemical |

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TABLE 9-1: SILO 3 HAZARDS CONTROL MATRIX

Task	Hazard	Mitigators/Controls	Permits/ Guid. Docs
Task 14 (cont.): Shift-by-shift surveillance of Silo 3	Head impact	<ul style="list-style-type: none"> Workers will perform tasks in accordance with standard operating procedures Head protection will be worn by personnel when the potential for falling objects or head injuries due to impact exist. 	SPR SOP
	Biological	<ul style="list-style-type: none"> On-site personnel are instructed to use discretion and avoid all contact with wild animals. If insects present a problem, insect sprays will be used to remove them. Workers will be instructed on how to recognize poisonous plants and to avoid contact with them. When found, these hazards will be removed. 	SPR
	Environmental	<ul style="list-style-type: none"> In the event of adverse weather conditions, the Fluor Fernald S&H Representative will determine if operations may continue without the potential for injury to personnel. 	SPR
	Illumination	<ul style="list-style-type: none"> Work area lighting levels optimal for performing remote operation of excavator Industrial Hygiene lighting surveys performed to ensure compliance 	HFE SOP Standing Orders S&H Procedures

TABLE 9-1: SILO 3 HAZARDS CONTROL MATRIX

Task	Hazard	Mitigators/Controls	Permits/ Guid. Docs
Task 15: Cutting a Hole in the Silo 3 Wall Structure	See Operations Work Instruction OWI-02-S3-04.	Hole cutting is a one time activity that will be addressed in Operations Work Instructions. The associated hazards and their controls/mitigators are addressed in OWI-02-S3-04.	See OWI-02-S3-04
Task 16: Headspace Venting, Preliminary Pneumatic Retrieval, and Equipment Installation	Illumination	<ul style="list-style-type: none"> • Work area lighting levels optimal for performing the activity • Industrial Hygiene lighting surveys performed to ensure compliance 	HFE SOP Standing Orders S&H Procedures
	Falls	<ul style="list-style-type: none"> • Fall protection system silo 3 dome 	SOP SPRs FCP Work Permit
	Hoisting and rigging: Operating hoist over each manway to assist vacuum wand/hose handling	<ul style="list-style-type: none"> • Workers will perform tasks in accordance with standard operating procedures • Workers will be trained in accordance with SPR reqs. 	SOP SPR

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TABLE 9-1: SILO 3 HAZARDS CONTROL MATRIX

Task	Hazard	Mitigators/Controls	Permits/ Guid. Docs
Task 16 (cont.): Headspace Venting, Preliminary Pneumatic Retrieval, and Equipment Installation	Pinch/crushing points	<ul style="list-style-type: none"> Workers will perform tasks in accordance with standard operating procedures Workers will wear proper PPE 	SOP Standing Orders FCP Work Permit
	Hand and power tools	<ul style="list-style-type: none"> Workers will perform tasks in accordance with procedures 	SOP Vendor procedures
	Hazardous energy: Electrical shock/ inadvertent equipment start-up	<ul style="list-style-type: none"> Energy isolation will be performed per site procedures Only trained personnel will perform work on locked out/tagged-out equipment 	EIP/SOP
	Hazardous energy: Static electricity	<ul style="list-style-type: none"> Equipment properly grounded prior to chemical delivery 	Vendor procedures
Task 17: Personnel Entry into Silo for excavator maintenance, ramp installation, material retrieval, etc	Slips, trips, and falls	<ul style="list-style-type: none"> Good housekeeping practices will be followed by all personnel Area lighting will be adequate for the type of work to be performed If possible, avoid walking on uneven surfaces Observe work area tripping hazards when coming to and leaving the area Fall protection Dome access prohibited during cutting work 	SOP SPRs FCP Work Permit
	Noise	<ul style="list-style-type: none"> Workers will be trained in accordance with SPR reqs. Wear hearing protection if required by area posting 	SPR S&H Procedures

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TABLE 9-1: SILO 3 HAZARDS CONTROL MATRIX

Task	Hazard	Mitigators/Controls	Permits/ Guid. Docs
Task 17 (cont): Personnel Entry into Silo for excavator maintenance, ramp installation, material retrieval, etc	Housekeeping	<ul style="list-style-type: none"> Maintain work areas and personnel access-ways free of obstructions and debris 	SPR
	Illumination	<ul style="list-style-type: none"> Work area lighting levels optimal for performing the activity Spotters employed when needed 	SOP S&H Procedures
	Ergonomics: Lifting/holding/ manipulating debris or ramp material	<ul style="list-style-type: none"> Work durations will be administratively controlled/limited via worker rotation Mechanical devices to be used to minimize lifting when possible 	SOP FCP Work Permit
	Head impact	<ul style="list-style-type: none"> Head protection will be worn by personnel when the potential for falling objects or head injuries due to impact exist. 	SPR FCP Work Permit
	Pinch/crushing points	<ul style="list-style-type: none"> Workers will wear proper PPE Guards on tools where possible 	FCP Work Permit
	Hand and power tools	<ul style="list-style-type: none"> Workers will perform tasks in accordance with procedures/instructions Guards on tools where possible Ground fault interrupters 	FCP Work Permit
	Hazardous energy: Electrical shock/ inadvertent equipment start-up	<ul style="list-style-type: none"> Energy isolation will be performed per site procedures Only trained personnel will perform work on locked out/tagged-out equipment Lockout of excavator during personnel entry into silo 	EIP/SOP FCP Work Permit

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TABLE 9-1: SILO 3 HAZARDS CONTROL MATRIX

Task	Hazard	Mitigators/Controls	Permits/ Guid. Docs
Task 17 (cont): Personnel Entry into Silo for excavator maintenance, ramp installation, material retrieval, etc	Confined spaces	<ul style="list-style-type: none"> • Confined Space Entry procedures • Confined Space Training • Proper labeling of Confined Spaces • Silo will be considered confined space until testing determines otherwise <ul style="list-style-type: none"> • 2 man rule • Retrieval harness required 	SOP FCP Work Permit Confined Space Entry Permit
	Heat stress	<ul style="list-style-type: none"> • Implementation of the FCP cold/heat stress programs 	S&H Procedures SPRs FCP Work Permit
	Radiological: Airborne radioactivity, contamination, radiation	<ul style="list-style-type: none"> • Use of remote cameras • Workers will perform tasks in accordance with procedures • Workers will qualify as 40-hr HAZWOPER/Rad Worker • Protective clothing and equipment will be used as prescribed by Radiological Controls • Work area contamination levels will be kept to a minimum • RCTs will perform contamination surveys to determine work area control levels • RCT oversight • Workers will doff potentially contaminated PPE per posted instructions 	FF RWP ALARA Analysis HPP SOP
		<ul style="list-style-type: none"> • Personnel instructed not to approach areas inside the silo where material is adhered to the wall at heights greater than 4 ft 	

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TABLE 9-1: SILO 3 HAZARDS CONTROL MATRIX

Task	Hazard	Mitigators/Controls	Permits/ Guid. Docs
Task 17 (cont): Personnel Entry into Silo for excavator maintenance, ramp installation, material retrieval, etc	Chemical	<ul style="list-style-type: none"> • Workers will perform tasks in accordance with procedures • Workers will qualify as 40-hr HAZWOPER • Industrial Hygiene monitoring, as needed • Workers to wear prescribed PPE • Follow the directions outlined in the MSDS for handling lockdown spray, plumber's stop, etc. 	FCP Work Permit S&H Procedures MSDS
		<ul style="list-style-type: none"> • 	

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The IHA workshop involved a multidisciplinary team that consisted of approximately 25 individuals from Jacobs and Fluor Fernald, Inc. The disciplines represented were engineering, occupational safety and health (OS&H), radiological control, industrial hygiene, operations, construction, and waste management. In addition, the Fernald Atomic Workers and Labor Council (FAT&LC) was represented.

A-1.1 Scope

The scope of activities included within this IHA includes the continued storage (in situ), surveillance and maintenance (S&M), construction, operation, maintenance, on-site handling and staging of containers, and demobilization of the Silo 3 Project. Approximately 5,088 yd³ of byproduct metal oxide material stored in Silo 3 will be removed, treated, packaged, and transported to an off-site facility for treatment and/or disposal. Access and retrieval will be accomplished by both pneumatic and mechanical systems. The material will be transferred to a Process Building where the material will be fed into storage bags, packaged in ISO containers, and staged for shipment (for up to 6 months analyzed duration). However, wall cutting, and personnel entry are not within the scope of this Appendix. These hazards are addressed in either Operations Work Instructions or Section 9.0 of this N-HASP.

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A-1.2 Description Of Documentation

This IHA is organized into 6 major sections. This introduction is followed by SECTION A-2.0, which provides background information on the Fernald silos and a description of the Silo 3 Project. The description incorporates by reference the system design descriptions detailed in the *Process Description for the Silo 3 Project* [Ref. 3]. These detailed descriptions provide the basis for identifying hazards that can occur at any step of the storage, S&M, construction, operation, maintenance, or demobilization of the Silo 3 Project. SECTION A-3.0 provides the methods used in performing the final integrated hazard analysis, and SECTION A-3.1 delineates the tasks and subtasks of the Silo 3 and presents the final integrated hazard analysis table. SECTION A-5.0 includes the conclusions of the final integrated hazard analysis, the hazards of concern, and the resolutions of these concerns. SECTION A-6.0 contains the references.

A-2.0 PROJECT DESCRIPTION

From 1952 until 1989, the Fernald site provided high-purity uranium metal products to support U.S. defense programs. Uranium production halted in 1989 because of declining demand and a recognized need to commit available resources to environmental remediation. Former uranium operations at the site were limited to a fenced 136-acre tract of land known as the Production Area located near the center of the site. Large quantities of liquid and solid wastes were generated by the various production operations at the site. Before 1984, solid and slurried wastes from processes were stored or disposed of in the Waste Storage Area (WSA). This area, located west of the production facilities, includes six low-level radioactive waste storage pits, two concrete silos with

earthen berms containing K-65 residues, one concrete silo containing metal oxides, one unused concrete silo, two lime sludge ponds, a burn pit, a clearwell, and a solid waste landfill. The WSA is addressed under OUs 1, 2, and 4. The former Production Area and WSA are fenced and closed to the general public. The remaining areas consist of forest and pasture lands [Ref. 4].

Silo 3 was constructed for the transfer and storage of "cold" 11(e) 2 uranium processing byproduct material (as designated by the Atomic Energy Act) generated through refinery operations at the Feed Materials Production Center (FMPC), now known as the Fernald Closure Project (FCP). The Silo 3 material is a byproduct of uranium ore concentrate processing. The ore concentrates had been preprocessed through a uranium mill where a significant portion of the ^{226}Ra and the gamma-emitting progeny were removed, and thus they were termed "cold" feed material. Silo 3 received metal oxide raffinates generated by all FMPC refinery operations from May 1954 until late 1957.

A-2.1 Silo 3 Facility

Silo 3 was constructed in 1952 and is located south of the Waste Pit Area of the FCP property. Silo 3 is a freestanding, pre-stressed concrete, domed silo approximately 80 feet in diameter and approximately 25 feet above ground level (vertical wall). The floor system is constructed of approximately 17 inches of compacted clay, a 2-inch-thick layer of asphaltic concrete, and an 8-inch layer of gravel topped by 4 inches of concrete. Silo 3 has no under drain system. The domed roof tapers from 8 inches thick at the silo walls to 4 inches thick at the apex. The apex is 36 feet high. Increased reinforcing around the dome periphery (ring beam) is provided to support the additional loading from the pneumatic transfer system that has since been removed.

The Remedial Investigation conducted for Silo 3 [Ref. 4] reveals that the silo contains approximately 5,088 yd³ of residue. Based on an estimated in situ material density ranging from 29 to 58 pounds per cubic foot (lb/ft³), the available silo material weighs approximately 3,925 tons.

The physical composition of the Silo 3 waste, based on process knowledge and visual observations, is:

- potentially dry, loose, or fine powder at the top
- compacted powder towards the central and lower portions
- potentially water-saturated powder at bottom (approximately 1 ft)

On December 20, 1991, a project was initiated to ensure that all penetrations through the Silo 3 dome were covered and sealed. Removal of the dust collector and permanent sealing of all obvious open pathways was completed January 8, 1992.

An Interim Staging Area (ISA) was constructed in the year 2000 east of Silo 3. It is a 9-inch-thick reinforced concrete pad. A portion of the pad may be used for loading IP-2 soft-sided containers into ISOs, and loading ISOs onto trucks. Another portion is now