ATTACHMENT 1

DO-09-003

Process Hazards Analysis for the Removal of Equipment and Piping from the HDP Process Building

Revision 0

Westinghouse

Hematite Decommissioning Project

DO-09-003

PROCESS HAZARDS ANALYSIS FOR THE REMOVAL OF EQUIPMENT AND PIPING FROM THE HDP PROCESS BUILDING

Revision 0
December 2009

Docket No. 70-36
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1.0 EXECUTIVE SUMMARY

This Process Hazards Analysis (PHA) was performed at the request of Gerry Couture, Hematite Licensing Manager. This PHA report and its recommendations will be distributed to responsible Hematite management personnel for their information and for action to address recommendations during preparation of Work Packages and during any Activity Hazards Analyses that are generated in accordance with procedure HDP-PR-EHS-034 (Activity Hazard Analysis Process) to ensure that safety controls are properly implemented.

A scoping document for this PHA showing the scope or boundaries of this hazard analysis and the bounding assumptions are shown in Appendix I. Prior to conducting this PHA, extensive and detailed surveillance was conducted on equipment and piping in the Process building. Results of this surveillance are summarized in the "2009 Characterization of the Process Buildings" and in NSA-TR-09-19 Rev 0 thru NSA-TR-23 Rev 0 (see attached TABLE 4). Elevated components are listed on spreadsheet "Bldg Components & Pipes.xls."

The PHA methodology selected and used was the What-If/Checklist Methodology. This What-If/Checklist methodology was used to identify consequences of interest associated with the equipment decontamination and the equipment and piping removal project with respect to nuclear criticality, radiological, fire, industrial, chemical and environmental safety.

An interdisciplinary PHA team consisting of knowledgeable individuals from the HDP examined each process section or node for the purpose of identifying the underlying process hazards and ensuring that there is adequate safety margin to protect against these hazards.

This Process Hazards Analysis resulted in the identification of 7 Recommendations (see attached Table 1) for disposition.

None of the recommendations were identified as HIGH RISK MITIGATION. Each was thought to provide defense in depth and was ranked as LOW RISK MITIGATION items for consideration as the project moves forward.

APPENDIX II (attached) shows the signatures of the PHA Facilitator, Project Manager and Management sponsor to indicate concurrence and approval of this report.

2.0 HAZARD REVIEW

2.1 PHA TEAM

To achieve a thorough review, a PHA requires participation by a variety of personnel familiar with and knowledgeable of the specific process or task being evaluated. TABLE 3 (attached) shows the team members for this PHA. Some individuals were unavailable during the formal conduct of the PHA and were contacted individually.

Also, the PHA must be facilitated by personnel experienced in the analysis methodology. The analysis was led by a former Westinghouse employee who has experience in the PHA methodology using the What-If/Checklist and who has participated in and facilitated numerous PHAs during the conduct of Integrated Safety Analyses for Westinghouse.

2.2 PHA ANALYSIS METHODOLOGY

The What-If/Checklist review technique was used to identify and evaluate process hazards for this PHA. This technique is a systematic and "brain storming" method for identifying undesirable and unwanted incident events. The key elements of the What-If/Checklist review technique are defined by the following terms:

Intentions - Design operation and desired operating parameter ranges

What-If Questions - Departures/Deviations from the process design intentions

Root Causes - Reasons why Departures/Deviations might occur

Responses (Consequences) - Potential safety related effects of the Departures/Deviations

Safeguards - Controls designed to prevent the causes of and/or mitigate the consequences of the Departures/Deviations

Recommendations - Recommended (Action Items) for implementation of improved safeguards to reduce risk.

To apply the What-If/Checklist review technique, the process was divided into sections or nodes and the team examined each process section (node) to identify responses (consequences) of the departures/deviations from the intention. For this PHA, 3 nodes were identified. See attached TABLE 2.

The PHA team then determined whether any safety responses (consequences) of interest could result from the process departures/deviations listed for that node. A listing of the safety consequences of interest is shown below:

#	SAFETY CONSEQUENCE OF INTEREST DESCRIPTION
1	Any incident that could cause a **release of a toxic material** that could seriously injure or kill one or more workers
2	Any incident that could cause **a fire or an explosion** that could seriously injure or kill one or more workers
3	Any **other incident** that could seriously injure or kill one or more workers
4	Any incident that could cause a **nuclear criticality**
5	Any incident that would require **notification of the NRC**
7	Any incident that would put us **out of compliance with OSHA, EPA, NFPA or other industry standard codes(ANSI, ASME, etc.) guidelines**

If credible causes were identified, they were documented and then existing safeguards were identified and also documented.

The drawings and other documents used for this PHA are shown in the attached TABLE 4.

The final results of the analysis of each What-If Question for each of the 3 nodes is documented in attached Table 5.

3.0 PROCESS HAZARD ANALYSIS

3.1 PROCESS DESCRIPTION AND PROCESS DESIGN INTENT

The operations analyzed in this PHA start following the evaluation of equipment and materials within the Process building at the HDP. The equipment and piping in the Process building have been extensively characterized to determine the quantity of U^{235} held up in large equipment such as HEPA filter housings, equipment that remains in the building, valves, piping, and other miscellaneous components. This information is provided in NSA-TR-09-19 Rev 0 thru NSA-TR-23 Rev 0 (see attached Table 4). A summary of the results of the characterization is shown in "2009 Characterization of the Process Buildings" and elevated components listed on "Bldg Items & Pipes.xls, an internal work document generated and used by the Hazards Analysis team. This spreadsheet summarizes the results of the characterization and provides links to detailed surveillance data. It identifies the equipment that will be decontaminated and left in place and the equipment and piping that will be removed and ultimately disposed. Materials that will remain in place due to size or other constraints and that have been identified as containing a significant amount of SNM will be vacuumed to remove as much material as possible and a fixative will then be applied to minimize dispersion. Materials (equipment and piping) that are removed will be prepped for disposal at a low level radioactive burial site. It was determined following discussions with Mr. Chris Cummin, the manager responsible for waste disposal, that extensive decontamination of materials destined for disposal as Low Level Radioactive Waste (LLRW) is unnecessary. The estimated value of any low enriched uranium oxide recovered using advanced techniques would not justify the effort and increased exposure risk required to perform the task.

"Hotspot Removal Worksheet.xls" is similar to "Bldg Items & Pipes.xls", but also includes estimated waste volumes, information on the removal methods, expected manpower requirements and special notes for specific items of interest.

Following discussions related to expected difficulties in equipment/piping removal, "Bldg Items & Pipes removal or remain in bldg.xls" was generated. This spreadsheet slightly modified Building Items & Pipe.xls to allow specific items with low gram U^{235} quantities to remain in the building due to the small amount of SNM hold-up within.

3.2 HAZARDS OF THE PROCESS

The primary objective of the analysis was to identify hazards associated with the process described above (3.1). These hazards included criticality, radiation protection, industrial safety, chemical safety and fire protection. Knowledge of the process and site history, the area, and previous experience helped the team understand the hazards associated with this process.

The highest consequence hazard discussed during this PHA was a potential nuclear criticality accident.

Besides the nuclear criticality hazard, there is a minor radiological hazard associated with uranium oxides present in relatively small quantities on and in the equipment and piping if a spill or release occurs.

Work in elevated locations, the use of heavy equipment, and the handling of equipment removed poses industrial hazards that must be addressed.

The nature of the work and the packaging plans, all of which occur within the Process building or adjacent to the Process building negates any significant environmental concerns since any material released would remain within a confined area and within the Process building.

4.0 GENERAL ASSUMPTIONS AND GUIDELINES FOR PHA

As part of the PHA sessions, general ground rules and assumptions bound the analysis. These ground rules and assumptions are specified below:

1. For components whose failure could be initiated by a number of sub components, the failure identified to cause the hazard will be assumed to be a sum of the possible parts of the component. For example, loss of containment could imply loss of electrical power, spill due to mechanical failure, spill due to human error, or other operations resulting in loss of containment. This will preclude the need to comment on all the specific items which could cause spillage of material and only loss of containment will be identified.

2. Sabotage, war & terrorism activities and their possible accident scenarios will not be evaluated.

3. It is assumed that the process will be conducted within the design safety limits and that no alarms, instrumentation, or equipment will be modified or disabled during normal operation.

4. It is also assumed that the existing characterizations which form the basis for work performed are essentially correct. These characterizations have been reviewed for accuracy and a significant amount of conservatism exists in the SNM values assigned.

5 It is assumed that all operators participating in the scope of work that is the subject of this PHA will be well trained and are knowledgeable of and follow applicable HDP procedures.

Table 1
Recommendations (Action Items) from the Equipment Removal PHA on November 11, 2009

No.	Recommendation (Action Item)	PHA Worksheet Table Reference	Responsible Person	Completion Date
1	Employ the use of mirrors to visually inspect all areas in work package	1.2 What if equipment configuration prevents visual verification?	R. Griscom	Prior to start of project
2	Cover open hoses during transport of vacuum units (include requirement in appropriate work packages)	1.8 What if contamination is spread via vacuum or HEPA unit hoses?	C. Finkenbine	Prior to start of project
3	Verify shelf life of fixative and replace if necessary	1.9 What if the fixative is outdated? Use of outdated fixative may result in poor fixation?	R. Griscom	Prior to start of project
4	Perform lighting survey and apply OSHA standards	1.10 What if lighting is inadequate?	D. Ridenhower	Prior to start of project
5	Conduct confined space training	1.11 What if entry to a confined space is required? Size of HEPA units might necessitate entry to perform necessary work.	D. Ridenhower	Prior to initiation of a confined space entry

Table 1
Recommendations (Action Items) from the Equipment Removal PHA on November 11, 2009

No.	Recommendation (Action Item)	PHA Worksheet Table Reference	Responsible Person	Completion Date
6	Evaluate individual areas during Activity Hazards Analysis for potential presence of chemicals and incorporate appropriate PPE	2.2 What if chemicals/acids/caustics are encountered?	D. Ridenhower	Prior to activities in areas where the hazard may exist
7	Evaluate identified pipe for asbestos and remediate as necessary	3.1 What if asbestos insulating material is encountered?	R. Griscom	Prior to pipe removal

Table 2
Process Sections (Nodes) for the Equipment and Piping Removal Project

No.	Name	Description	Design Intent and Normal Operating Conditions
1	Large components	Equipment in the Process building that is to be deconned and remain in building. This includes some HEPA filter housings and large equipment that cannot reasonable be removed	Equipment is to be examined and decontaminated by removing material to the extent possible. This will be accomplished primarily using vacuum systems. Following decontamination, a fixative will be applied to prevent dispersion of SNM during later operations.
2	Equipment	Equipment that has been identified as containing a significant amount of SNM and therefore is being removed from the Process Building	Equipment is to be detached from mountings within the Process building. Equipment will then be decontaminated and/or a fixative applied, as necessary and prepped for shipment as Low Level Radioactive Waste.
3	Pipe	Various diameter piping that is to be removed from the Process building	Remove identified pipes in sections. Decontaminate or apply fixative if necessary to meet waste acceptance criteria Cut pipes to lengths acceptable for transportation as Low Level Radioactive Waste. Package for transport.

Table 3
Team Members for the Equipment and Piping Removal from Process Building – January 3, 2009

First Name	Last Name	Job Title	Role
Gerry	Couture	Licensing Manager	Management Sponsor
Brian	Matthews	Criticality Engineer	Criticality Specialist
Bob	Griscom	Site Engineer	Project Manager
Chuck	Finkenbine	Health Physics Supervisor	Radiological safety
Tim	Arnold	Operations Supervisor	Operations
Steve	Bobbett	Operations Technician	Operations
Don	Ridenhower	Environment Health and Safety Lead	Environment Health and Safety, Industrial Health and Safety
Chris	Cummin	Waste Management / Transportation Specialist	Waste Packaging and Transport

Table 4
Documents Used for the Equipment Decontamination and Equipment and Piping Removal PHA

Type	Number	Title
MS Word Document	NSA-TR-09-19 Rev 0	Uranium Photon Spectra Calculations for the Hematite Decommissioning Project
MS Word Document	NSA-TR-09-20 Rev 0	Dose Rate vs. 235U Deposit on ACSI Portable Air Cleaning System HEPA Filter as a Function of 235U Enrichment
MS Word Document	NSA-TR-09-21 Rev 0	Calculations to Establish an Estimate of the Mass of 235U Associated with Piping, Ventilation Duct, and Miscellaneous Components in the Hematite Facility Former Process Buildings
MS Word Document	NSA-TR-09-22 Rev 0	Calculations to Establish an Estimate of the Mass of 235U Associated with Equipment Remaining in the Hematite Facility Former Process Buildings
MS Word Document	NSA-TR-09-23 Rev 0	Calculations to Establish an Estimate of the Mass of 235U Associated with the Floors, Walls, Ceilings, and Roof of the Hematite Facility Former Process Buildings
XLS Spreadsheet	HA Internal Work Document	Bldg Items & Pipes.xls
XLS Spreadsheet	HA Internal Work Document	Bldg Items & Pipes removal or remain in Bldg.xls
XLS Spreadsheet	HA Internal Work Document	Hot spot Removal Worksheet.xls

Table 4
Documents Used for the Equipment Decontamination and Equipment and Piping Removal PHA

Type	Number	Title
MS Word Document	HA Internal Work Document	2009 Characterization of the Process Buildings
Procedure	HDP-PR-EHS-034 AHA.doc	Activity Hazard Analysis
SER Amendment 52	ML061280324	Safety Evaluation Report for Authorized Building Dismantlement and Demolition

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.1	Recovered material (UO_2) is released	Spillage, equipment leak, HEPA filter failure, dropping, falling from elevated location. Loss during transit or storage. Any action that would result in containment loss	Criticality concern Radiation Protection – Elevated airborne Potential employee internal exposure	Total combined mass of U^{235} is slightly in excess of maximum subcritical mass limit for UO_2. Potential to achieve a critical state is effectively zero due to low mass and high level of material dispersion in the Process building. Spillage of material would result in more dispersion Ventilation available Personnel Protective Equipment	

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
				Respiratory Protection Operator training & procedures Procedures exist for spill containment & trained personnel available	
1.2	Large components cannot be inspected for loose material	Equipment configuration prevents visual verification	Areas must be visually checked prior to application of fixative	Work package defines requirements	Employ the use of mirror to visually inspect all areas in work package

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.3	All material (UO_2) cannot be removed from large components	Components contain radioactive material in varying amounts	Components will have elevated levels of material remaining in place Waste management is expected to process this material as is	Apply fixative Work package provides detailed instructions	
1.4	Something drops or is dropped by individuals working in elevated locations	Individuals required to use equipment overhead during necessary processes	Serious injury due to being hit by falling equipment/ tools during process	Personnel Protective Equipment Active work areas will be isolated or posted to alert individuals of overhead work Entrants will be briefed Existing work procedures	

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.5	Employee falls from elevated location	Employees required to work in elevated locations to perform tasks	Fall could result in serious injury	Emergency response personnel on site to administer aid pending arrival of off-site medical personnel Fall protection procedure Fall protection training Fall plan Activity hazards analysis	

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.6	Personnel protective equipment (PPE) is damaged	Working in cramped quarters around jagged equipment PPE becomes coated with fixative	PPE becomes ineffective to perform intended function Potential for personnel contamination	Replacement PPE available Personnel surveillance equipment available Procedures Work package instructions	

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.7	Individuals PPE becomes excessively contaminated while performing work	Equipment contains some radioactive material	PPE becomes ineffective to perform intended function Potential for personnel contamination	See 1.6 Respiratory protection Vacuum system available to remove contamination Wipes available Work package instructions Radiation Work Permits Contamination control procedures and contamination control	

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.8	Contamination is spread via vacuum or HEPA unit hoses	Some SNM remains in hoses and can escape during movement of units	Potential area contamination Potential elevated airborne activity Potential personnel exposure	Personnel Protective Equipment Contamination control procedures	Cover open hoses during transport of vacuum units
1.9	Fixative is outdated	Fixative may have a shelf life	Use of outdated fixative may result in poor fixation	Use fixative in accordance with manufacturers recommendations	Verify shelf life and replace if necessary
1.10	What if lighting is inadequate	Many lights in the Process building are inoperative	Difficulty in performing tasks	Use portable lighting Increase temporary lighting	Perform lighting survey and apply OSHA standards

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.11	What if entry to a confined space is required	Size of HEPA units might necessitate employee entry for performance of work	Potential dangerous/hazardous work location	Confined space procedure Employee training Work package instructions	Confined space entry necessitates that training be conducted using mockups or the use of trained responders

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.12	What if a greater than maximum safe mass is removed from an item during decontaminati on	Inaccurate estimate of amount of material contained	Potential criticality concern	Total combined mass of U^{235} in all equipment is only slightly in excess of the maximum subcritical mass limit for UO_2. Potential to achieve a critical state is effectively zero due to low mass and high level of material dispersion.	

Table 5
Worksheets from the Equipment and Piping Removal PHA on November 9, 2009

No.	Large components – Remain in place, loose contamination removed, fixative applied				
Item	**What if...?**	**Root Causes/Related Questions**	**Responses**	**Safeguards**	**Recommen-dations**
1.13	What if a greater than safe mass of UO_2 is accumulated in a vacuum cleaner, container, or in any other item/equipment used for decontamination operations	Failure to routinely remove material clean equipment, greater than expected mass encountered,	Potential criticality concern	Recovery of UO_2 presents no credible criticality safety concerns because the recovered mass would not represent a large fraction of the 1767 total grams of U^{235}. Therefore, criticality is not credible	

Appendix I

Scoping Document for the Equipment Decontamination and Equipment and Piping Removal PHA

- This Process Hazards Analysis (PHA) is being done at the request of Gerry Couture, HDP Licensing Manager. A design review for this project has not been conducted and is unnecessary for pending equipment and piping removal. However, extensive surveys have been performed as part of the Process building characterization, and using information acquired, calculations have been performed to determine quantities of U^{235} in and on subject components.

- The planned activities in the Process building at HDP are in support of decommissioning the site. Contaminated components and building debris will be disposed as Low Level Radioactive Waste in accordance with Federal and State disposal requirements. Large components will be decontaminated and a fixative applied.

- The boundaries for this PHA are as follows:

    - The PHA will start following the characterization of equipment and piping in the Process building and the identification of equipment to be decontaminated or removed.
    - The PHA ends with the packaging for disposal and temporary storage of equipment and piping removed from the Process building and for the application of fixative to large components that will remain within the building.

- The purpose of the PHA is:
    - To identify and list process hazards that could cause safety consequences of interest during the removal process and during the packaging and storage process. Additionally, to identify and list the safety consequences of interest for each of these process hazards.
    - To identify and list the causes for each for these process hazards
    - To identify and list existing safeguards that prevent or mitigate the consequences of these process hazards.
    - To determine if the risk of any of these process hazards necessitates additional safeguards and if so, to identify and list these as recommendations (action items)

Appendix I, continued

Scoping Document for the Equipment Decontamination and Equipment and Piping Removal PHA

- This PHA does **NOT** include the following:
  - Activities not directly associated with the removal, temporary storage and packaging of waste materials from the Process building
  - Consequences caused by acts of war, terrorism or sabotage

- The safety consequences of interest for this PHA are as follows:
  - Any incident that could lead to a Nuclear Criticality
  - Any incident that would require notification of the NRC
  - Any incident that could cause over exposure to radiological contamination for personnel or the public
  - Any incident that could cause a release of a toxic material that could seriously injure one or more workers
  - Any incident that could cause a fire or an explosion that could seriously injure one or more
  - Any other incident that could injure one or more workers or kill one or more workers from other causes
  - Any incident that would result in HDP being out of compliance with OSHA, EPA, NFPA, or other industry standard codes (ANSI, ASME, etc) guidelines

- The assumptions for this PHA are as follows:
  - The equipment selected and being used is fit for use during normal operating conditions.
  - Trained operators will be used to conduct the process

Procedures are accurate and the responsible personnel will be trained on these procedures.

APPENDIX II

Sign-off and Approval of this PHA Report

The dated signatures below indicate concurrence and approval of this PHA Report:

PHA Facilitator: 12/9/09
Jim Heath

Project Manager: 12/9/09
Robert Griscom

Management Sponsor: 12/9/09
Gerry Couture