

Hematite Decommissioning Project

Decommissioning Plan Overview

October 15, 2009



Agenda

- Decommissioning Plan Approach
- Site Characterization Effort
- Treatment of Hazardous Materials
- Decommissioning Control Schemes
- Final Status Survey Overview



Key DP Additions in Response to Jan 06 RAIs

- Added detailed characterization results for burial pit and under building soil, groundwater
- Added comprehensive criticality and industrial safety controls for soil excavation and remediation
- Defined liquid waste collection and processing
- Provided detailed site hydrogeology descriptions
- Env. Report upgrade to follow NUREG 1748 guidance
- Added detailed dose modeling and FSS descriptions
- 77 specific NRC comments from Jan 2006 addressed



HDP Decommissioning Plan Approach

- Upgraded site programs and procedures to ensure proper safety controls
- New program requirements reflected in DP
- Based on NUREG-1757 "NRC Decommissioning Process of Material Licensees"
- Utilized 1757 15 chapter format with checklists used during chapter development to verify content
- Sequenced chapter content to match checklist wherever practicable



Decommissioning Approach

Decommissioning Activities

- Excavation of buried waste, impacted soil, and impacted sediment
- On-site treatment of waste and soil that exhibit Volatile Organic Compound (VOC) contamination
- Disposal of waste and impacted soil at a permitted disposal facilities
- Decontaminate and conduct radiological survey of remaining buildings
- FSS-Radiological surveys of entire site
- Site restoration



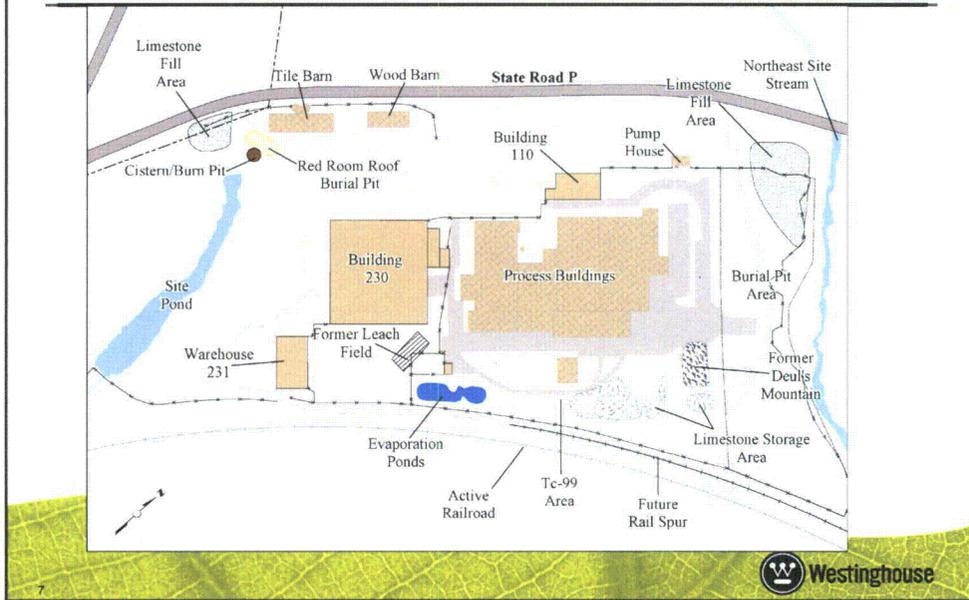
Decommissioning Approach

Remediation Areas

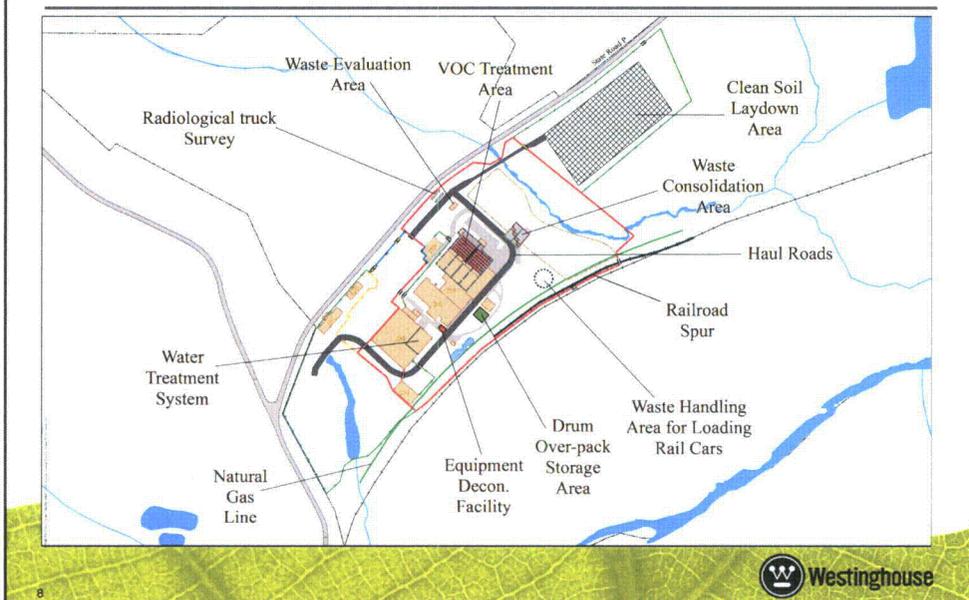
- Burial Pits
- Evaporation Ponds
- Building Slabs and Soil Beneath Slabs
- Red Room Roof Burial Area
- Site Pond
- Former Leach Field
- Technetium (Tc-99) Soil Area



Hematite Central Tract

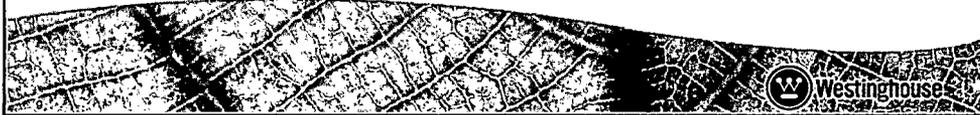


Decommissioning Approach-Conceptual



DP Approach (Cont.)

- Emphasis on Integrated Safety Management
 - Criticality Controls
 - Radiological controls
 - Airborne and liquid effluent controls
 - Industrial safety-Health and Safety Plan (HASP)
 - Project work control system
- Thorough understanding of site hazards/contaminants
 - Emphasized complete characterization
 - Comprehensive hazards analysis
 - Coupled with Historical Site Assessment (HSA), DP-2, DP-3, and DP-4 provide comprehensive knowledge of current conditions



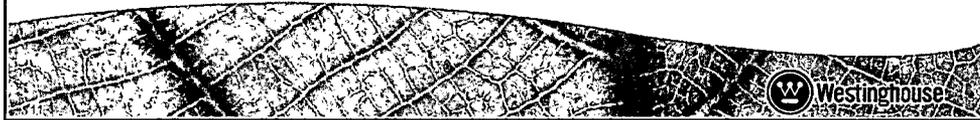
Site Characterization Effort

- Compilation of Characterization Data
- Radionuclides of Concern (ROC)
- Impacted and Non-Impacted Determination
- Groundwater Conditions
- Location of Subsurface Debris/Trash
- Uranium Enrichment



Site Characterization Effort

- November 2006 – Burial Waste Area borings and sampling
- November 2007 – Soil Under Buildings, Building Surfaces, Outlying Non-Impacted Areas
- June 2008 – Burial Pits, Rail Spur Footprint, Impacted Soil Areas
 - Served to fill data gaps
 - Obtained information to support future release of the rail spur
 - Water infiltration/re-charge tests in Burial Pit Area



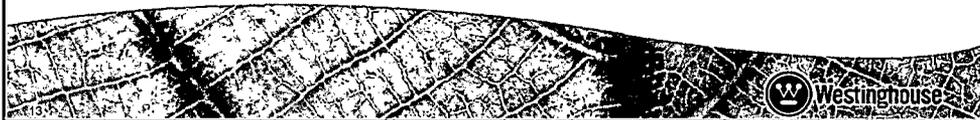
Site Characterization Effort

- Hematite Radiological Characterization Report (HRCR) consolidates all site characterization information
- Describes survey/sampling methods, location and depth of contamination, analytical methods, quality assurance measures
- Provides basis to define Impacted/Non-Impacted Areas



Site Characterization Effort

- HRCR and HSA identify the radionuclides of concern (ROC)
 - Primary ROC: Uranium-234 (U-234), Uranium-235 (U-235 + D), Uranium-238 (U-238 + D), and Technetium-99 (Tc-99)
 - Thorium-232 (Th-232 + C) and Radium-226 (Ra-226 + C) at limited locations in the Burial Pit Area
 - Americium-241 (Am-241), Neptunium-237 (Np-237 + D), and Plutonium-239/240 (Pu-239/240) at trace amounts in soil and Building 230 drains



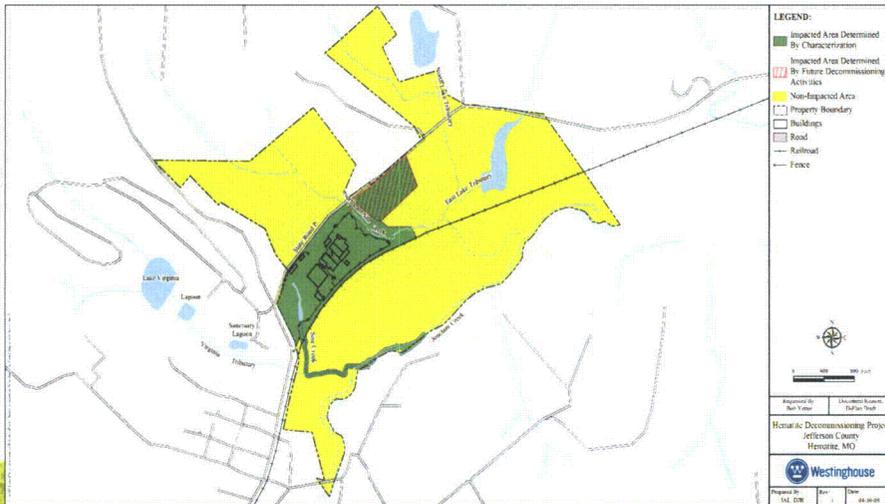
Site Characterization Effort

- HRCR Includes Results of Water Sampling
 - Overburden leachate: 85 of 143 >MDC for Tc-99
 - Sand/gravel and bedrock: 5 of 128 >MDC
 - Disparate pattern and very low concentrations for sand/gravel-bedrock positives
 - Conclusion of no significant groundwater contamination
- Identified the location and depth of trash/debris
- Identified uranium enrichment and location/depth



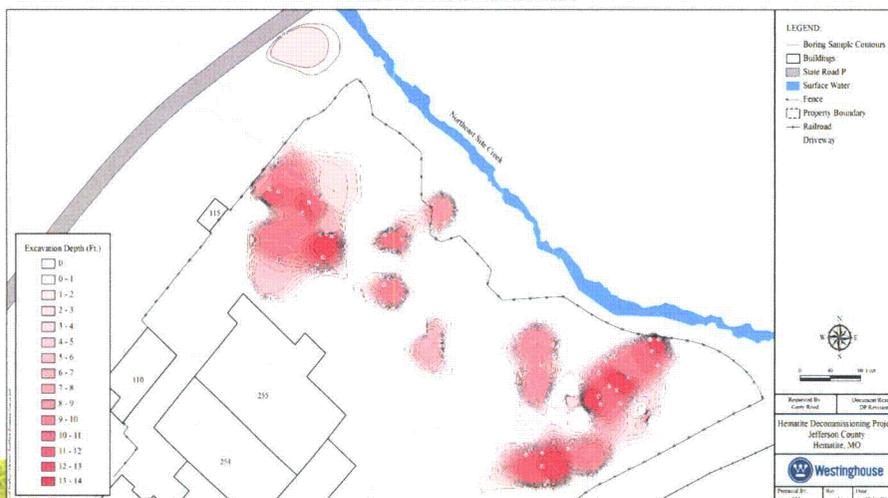
Site Characterization Effort

Impacted and Non-Impacted Areas



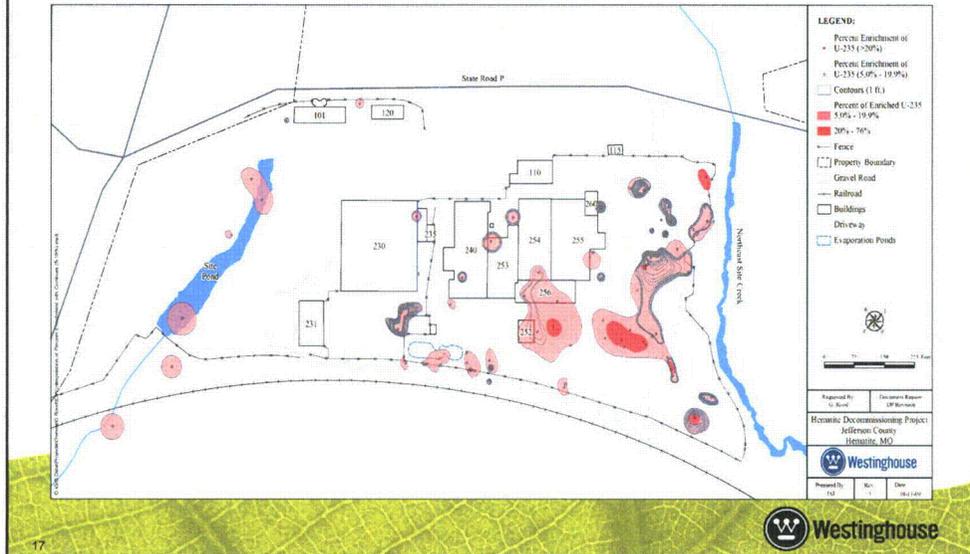
Site Characterization Effort

Debris/Trash Contours



Site Characterization Effort

Uranium Enrichment Contours

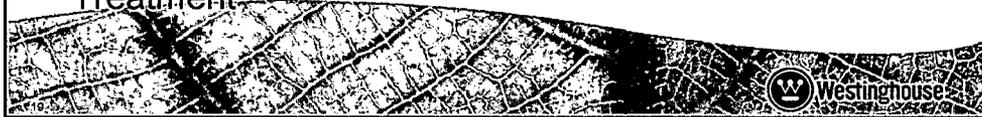


Hazardous Materials

- Radioactive Waste Management Program (DP-12)
- Potential Hazardous Waste
- Waste Determination
- Treatment of Volatile Organics
- Treatment of Additional Hazardous Materials (if encountered)
- Categories of Excavated Materials

Radioactive Waste Management

- DP-12 Radioactive Waste Management Program
 - Addresses solid, liquid and mixed waste
 - Generation; handling/packaging; storage; transportation; disposition
 - Westinghouse submitted request for low activity waste disposal at US Ecology under 10 CFR 20.2002 (5/21/09)
- Unique site with presence of Volatile Organics at potentially hazardous levels
- Use 40 CFR 266 Subpart N – Conditional Exemption for Low-Level Mixed Waste (LLMW) Storage and Treatment



Potential Hazardous Waste

Based upon the Historical Site Assessment (HSA)

- Toxic – Volatile organics (Likely present)
 - Perchloroethylene (PCE), Trichloroethylene (TCE), Vinyl Chloride
- Other Chemicals Used at Site
 - Corrosives – Acids and Base
 - Toxic – Dense Non-aqueous Phase Liquids
 - Toxic – Heavy Metals
 - Reactive – Pyrophoric Uranium



Waste Determination

- Generators of a solid waste must determine if a hazardous waste is listed or characteristic.
- At Hematite, TCE and PCE used as both process chemicals and solvents.
- TCE and PCE in waste and impacted soil cannot be attributed to any specific use.
- Consistent with EPA Policy regarding this type of situation, wastes and impacted soils exhibiting concentrations above TCLP limits will be handled as characteristic hazardous wastes.



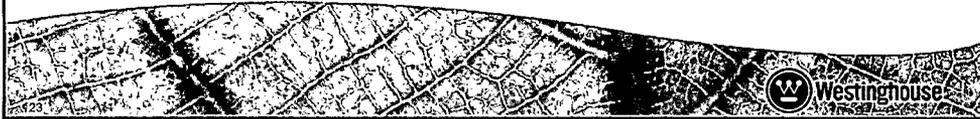
Treatment of Volatile Organics

- Soil Vapor Extraction (SVE)
 - Conducted in tank/accumulation units.
 - Air will be drawn through the material inside the tank.
 - Filters will be used to remove particulates from exhaust.
 - Carbon will be used to remove VOCs from exhaust.
 - Treated material will be tested to ensure waste acceptance criteria are met.
 - Treated material will be sent to an off-site disposal



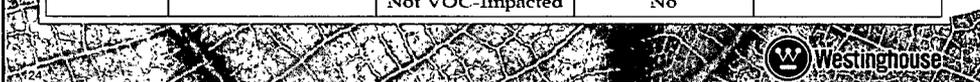
Additional Treatment Technologies (if necessary)

- Corrosives-Neutralization
- Dense Non-Aqueous Phase Liquids-Incineration/recovery
- Heavy Metals-Stabilization, Encapsulation, Recycling
- Pyrophoric Uranium-Solidification



Categories of Excavated Materials

Material Type	Degree of Radiologic Impact	Degree of VOC Impact	On-Site Treatment	Disposition
Waste	Above DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous	Off-site disposal: LLRW/LLMW
		Not VOC-Impacted	No	Off-site disposal: LLRW
	Below DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous	Off-site disposal: industrial waste
		Not VOC-Impacted	No	
Impacted Soil	Above DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous	Off-site disposal: LLRW/LLMW
		Not VOC-Impacted	No	Off-site disposal: LLRW
	Below DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous and to meet PRGs	On-Site Backfill
		Not VOC-Impacted	No	



Decommissioning Control Schemes

- This section provides an overview of the work and safety controls in place to ensure the safety of the public, environment and Hematite site personnel.
- DP-9 Project Management And Organization
- DP-10 Health And Safety Program During Decommissioning-Radiation safety controls
- DP-11 Environmental Controls
- DP-13 Quality Controls
- DP-10.9 Nuclear Criticality Safety



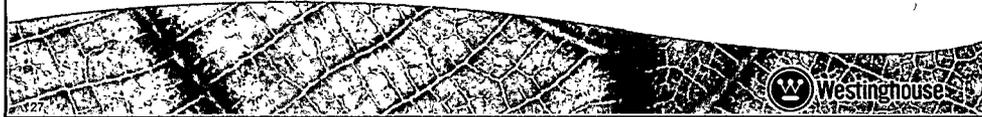
Work Planning

- Integrated work planning process involving all relevant management and field personnel
- Positions/areas key-to-safety for purpose of license:
 - Project Director
 - Project Oversight Committee (POC) Chairman
 - Radiation Protection
 - Licensing/Nuclear Criticality Safety
 - Operations



Work Planning (Cont.)

- Project Safety-STOP WORK
 - In addition to the stated responsibilities of site personnel to perform decommissioning activities safely and in accordance with site procedures, when anyone at HDP identifies a potentially unsafe condition, an imminent danger, a procedure step that cannot be performed as specified, or a condition that is not compliant with applicable requirements, they have the authority to stop work. The authority granted to anyone at HDP to stop work provides an approach that helps ensure decommissioning activities are conducted in a safe manner.



Work Planning (Cont.)

- Planned decommissioning tasks evaluated through site work control process
- Evaluation/approval committee includes minimum of Rad Protection, Operations, Licensing, EH&S
- Graded approach to work reviews
 - Routine work e.g. grounds maint., housekeeping
 - Procedure controlled work, e.g. system operation
 - Work packages, e.g. soil remediation, Bldg. D&D



Compliance Documents

- The HDP will comply with:
 - Federal, state, local regulations
 - Approved HDP Decommissioning Plan
 - Site programs and procedures
 - Nuclear Criticality Safety Assessments (NCSA) for criticality controls
 - Work packages



D&D Control Schemes-Industrial Safety

- HASP Contains
 - Requirement for Activity Hazards Analysis
 - Prioritization of controls
 - Addresses hazard controls including
 - Biological hazards
 - Confined space entry
 - Fall protection
 - Hoisting and rigging
 - Extreme temperatures



D&D Control Schemes-Rad Protection

- Radiological work controlled by RWP
- Inhalation/Ingestion primary routes for exposure- anticipate minimal external exposure
- Rad Protection Program includes:
 - Commitment to ALARA
 - Engineering Controls
 - Workplace and Environmental Air Sampling
 - Internal/External Dosimetry Program
 - Radioactive Material Control Program



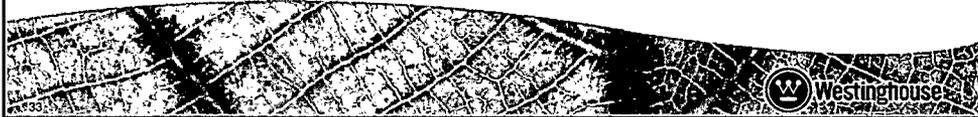
D&D Control Schemes-Env. Controls

- ALARA based per Regulatory Guide 8.37.
- Use of process and engineering controls
- Examples of engineering controls include:
 - water mists for dust suppression;
 - containment, storage, filtration, and adsorption for water treatment;
 - filter fabric (silt fence), erosion control blankets, and channels or barriers to direct storm water flows



Env. Controls-Mitigation of Impact

- Transportation –Rail spur to minimize road transportation
- Soil – Site restoration will blend in with surroundings and promote suitable drainage patterns.
- Surface water/ Groundwater – Erosion/sedimentation controls. Water Treatment System for potentially contaminated effluents.
- Air Quality – Engineering controls will be used to minimize the potential for airborne dust. Air sampling will be performed to ensure controls are effective



Effluent Sampling

Sample Medium	Sampling Points	Collection Mode / Analytical Frequency	Type of Analysis	Annual ALARA Goal [20% of Limit] ($\mu\text{Ci/ml}$)	Sample Invest. Level [50% of Limit] ($\mu\text{Ci/ml}$)	Annual Reg. Limit ($\mu\text{Ci/ml}$)
Air Effluent	Perimeter	Continuous / Daily During Work Activities	Gross α	1.0E-14	2.5E-14	5.0E-14
			Gross β	4.0E-11	1.0E-10	2.0E-10
Liquid Effluent	Sanitary Wastewater Treatment System	Weekly	Gross α	6.0E-8	1.5E-7	3.0E-7
	Site Dam	Composite /Weekly	Gross β	1.0E-6	2.5E-6	5.0E-6
	Water Treatment System	Composite / Weekly or Batch Grab Prior to Release				



DP Chapter 11, Eff. Control & Env. Monitoring

- Public dose estimates made by comparing effluent concentration values with the applicable regulatory limits in 10 CFR 20, Appendix B, Table 2, which are based on a potential exposure of less than 100 mrem/yr.
- For the past 4 years, the potential average annual public dose from effluents is about 5 mrem/yr.
- From 2006 through the 1st qtr. 2009, the annual net radiation level ranged from 20 to 22 mrem/yr.
- Monitoring increases based on planned D&D activities:
 - Increased air sample locations
 - Increased Thermoluminescent Dosimeter (TLD) locations
 - Adjusted outfall monitoring to match D&D activities



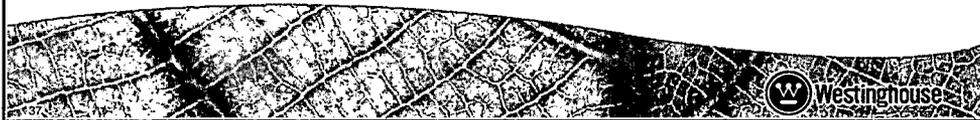
D&D Control Schemes-QA

- DP13 Quality Assurance
- QA Program including specific RP and FSS QA measures (e.g. replicate surveys, sample splits etc.)
- Document control
- Control of Measuring and Test Equipment (M&TE)
- Corrective actions
- Audits/surveillances



D&D Control Schemes-Nuclear Criticality Safety (NCS) Program

- Applicable regulations
 - 10 CFR 70
 - Reg. Guide 3.71, “Nuclear Criticality Safety Standards for Fuels and Material Facilities”
 - ANSI/ANS 8 National Standards
- Responsible HDP organization
 - Licensing Manager
 - Supported by NCS Engineers



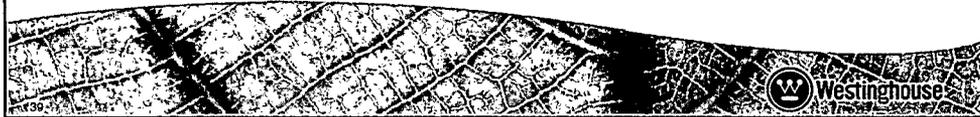
NCS Program (Cont.)

- NCS training
 - Entry level (Gen. Employee)-all personnel
 - Advanced level (Fissile Worker)-project personnel directly involved with SNM operations
- Audits and inspections
 - Quarterly criticality safety inspections/walkdowns
 - Annual audits with formal report to Project Director



NCS Program-NCSAs

- Documented NCSAs for HDP operations to establish:
 - The NCS control parameters, barriers (controls and requirements) and associated limits necessary to ensure criticality safety under all normal and credible abnormal conditions; and
 - To demonstrate that HDP operations incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality event could occur.



NCS Program-NCSAs (Cont.)

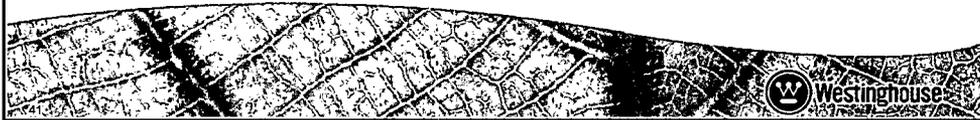
NCSAs include documented analysis/bases:

- A description of the operations and processes covered by the NCSA;
- A description of all assumptions important to the scope of the NCSA
- A description and assessment of normal conditions;
- A description and assessment of abnormal (i.e., unanticipated) conditions;
- Identification of controlled parameters, and their associated limits;
- Determination of Criticality Safety Controls, and their limits
- Identification of any practicable defense-in-depth measures
- A summary of any explicit calculations



NCS Program-Field Controls

- Control scheme similar for buried waste, contaminated soils and sub-surface structures (e.g. concrete slabs, buried piping)
 - Exempt Material Limit (EML) based on <math><1\text{g}</math> U-235 in any contiguous 10 liter volume
 - Double verification surveys prior to excavation
 - Double verification surveys prior to each lift (~one foot)
 - Visual inspection for:
 - Potential fissile material (e.g. process filter)
 - Intact containers
 - Bulk items with dimensions >cut depth
 - Metallic items



NCS Program-Field Controls (Cont.)

- Excavation removal continues to depth where historical knowledge and visible/radiological evidence indicates suspect material removed
- >EML or suspected fissile material placed in Field Container
- Field Containers transported in Collared Drums (CDs)
- By making NCS clearance of areas the initial goal, remaining Health Physics and FSS can proceed unencumbered by NCS controls



NCS Program-NCSA Defined Areas

- Collared Drum Storage Area (CDSA)
 - Clearly delineated; Local to excavation site
 - Level terrain
 - Robust physical barrier (e.g. concrete highway barricade)
- Collared Drum Buffer Store
 - CDSA with weather shelter
 - Interim storage awaiting Waste Evaluation Area (WEA)/Material Assay Area (MAA) availability



NCS Program-NCSA Defined Areas (Cont.)

- Waste Evaluation Area (WEA)
 - Suspect fissile material evaluated for fissile content
 - Clear perimeter; Single sorting tray
 - Identified fissile materials transferred to MAA
- Material Assay Area (MAA)
 - Houses radiological counting instrumentation to establish U-235 mass content



NCS Program-NCSA Defined Areas (Cont.)

- Collared Drum (CD) Repack Area
 - For consolidation of CDs with small fissile content
 - Enclosed area
- Fissile Material Storage Area
 - For CDs with known fissile content
 - Operations include only receipt, storage, export
 - Enclosed area



NCS Program-Water Collection/Treatment

- Water pumped from burial pits not expected to entrain significant fissile contamination (picoCurie/liter (pCi/l) levels)
- Periodic cleanout of holding tanks and filter media; Solids will be transported in CD to WEA or MAA
- At such low levels, minimum critical mass of 760g U-235 (for optimum conditions) should not be approached



Final Status Survey

- Derived Concentration Guideline Level (DCGL)
- Approach for Dose Modeling
- Profile of Radiological Contamination
- Surrogate Radionuclide Relationship
- Survey Unit Classification
- Final Status Survey Design
- Investigation Action Levels
- Data Assessment and Reporting



Final Status Survey

- **DCGL for Soil, Building Surfaces and Buried Pipe**
 - Soil: Resident Farmer - RESRAD Version 6.4
 - Buildings: Occupancy - RESRAD-BUILD Version 3.4
 - Buried Pipe: Based on Contained Activity



Final Status Survey

- Conceptual approach to dose modeling for residual radioactivity in soil identifies multiple soil strata
- Based on depth of residual radioactivity (in-situ and soil re-used as backfill)
- Provides flexibility for comparing the final condition to release criteria

“The solution matches the situation”



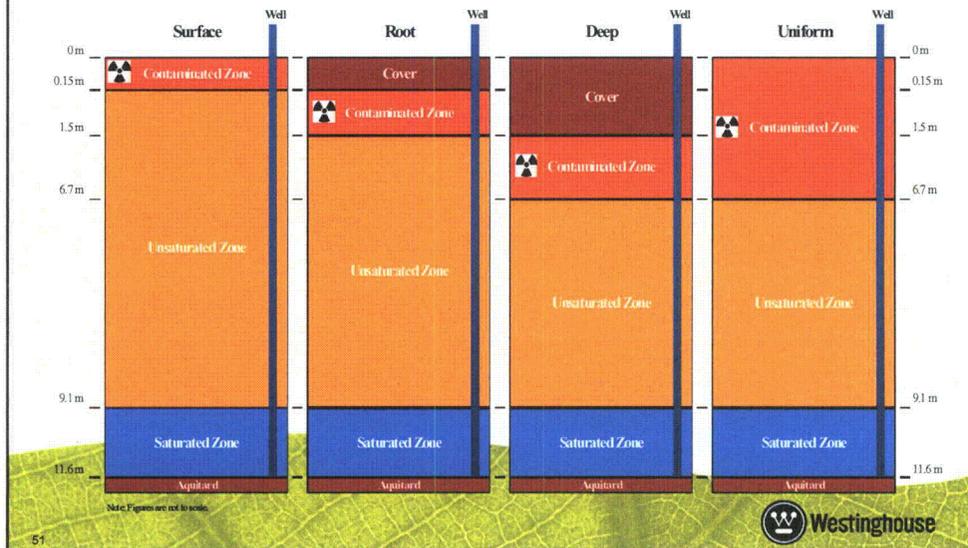
Final Status Survey

- Model provides framework for comparing concentrations to criteria for license termination
 - Surface stratum - uppermost 15 cm of soil
 - Root stratum – 15 cm to 1.5 m. (root depth 0.9m)
 - Deep stratum - 1.5 m to 6.7 m (conservative depth based on Fig. 5-5 characterization data)
 - Uniform stratum - Surface to 6.7 m
- Excavation scenario also evaluated to address hypothetical future actions
 - Determined dose at Deep stratum concentration (between 1.5 - 3m) could be a limiting condition
 - Excavation scenario is utilized in consideration of ALARA during application of Unity rule



Final Status Survey

Model for Soil DCGL



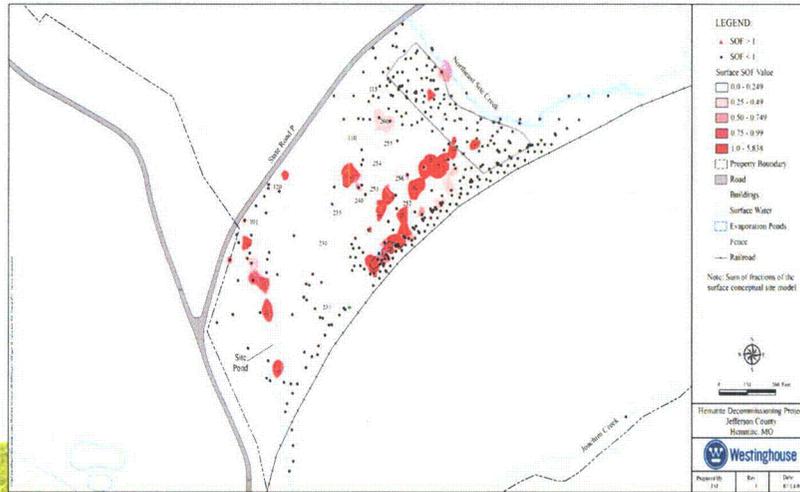
Final Status Survey

Proposed Site-Specific Soil DCGL (pCi/g)

Radionuclide	Conceptual Site Model			
	Surface	Root	Excavation	Uniform
U-234	545.5	255.0	935.6	206.9
U-235 + D	109.8	90.6	223.2	77.8
U-238 + D	319.3	198.6	591	181.0
Tc-99	161.9	31.4	79.2	26.9
Th-232 + C	5.1	2.2	5.6	2.2
Ra-226 + C	6.0	2.2	5.2	2.0
Np-237 + D	17.3	5.0	0.3	0.3
Pu-239/240	239.5	84.8	246.6	83.1
Am-241	220.7	118.5	229.2	79.3

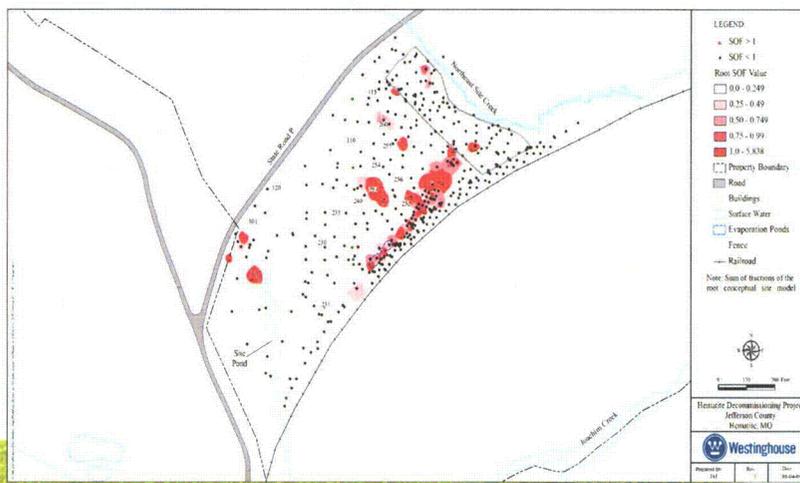
Final Status Survey

Contamination Contour – Surface Stratum



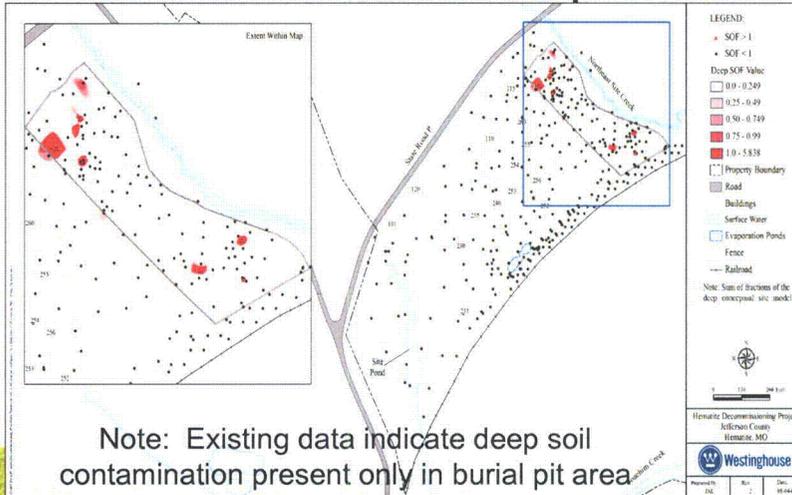
Final Status Survey

Contamination Contour – Root Stratum



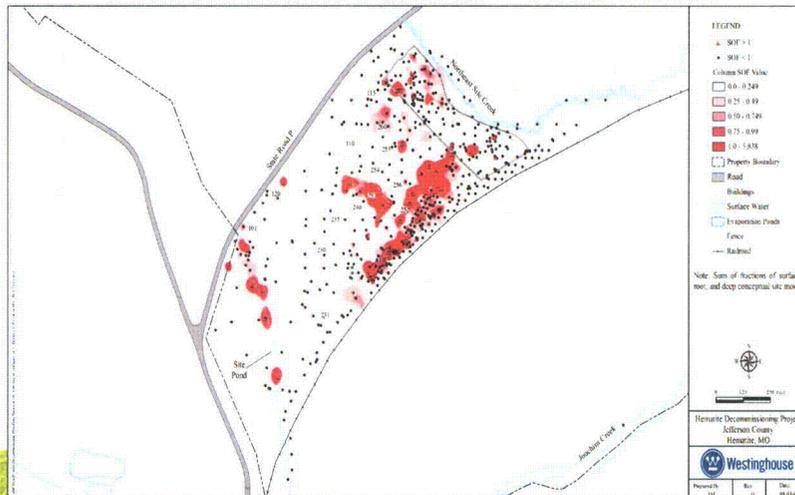
Final Status Survey

Contamination Contour – Deep Stratum



Final Status Survey

Contamination Contour – Total Strata



Final Status Survey

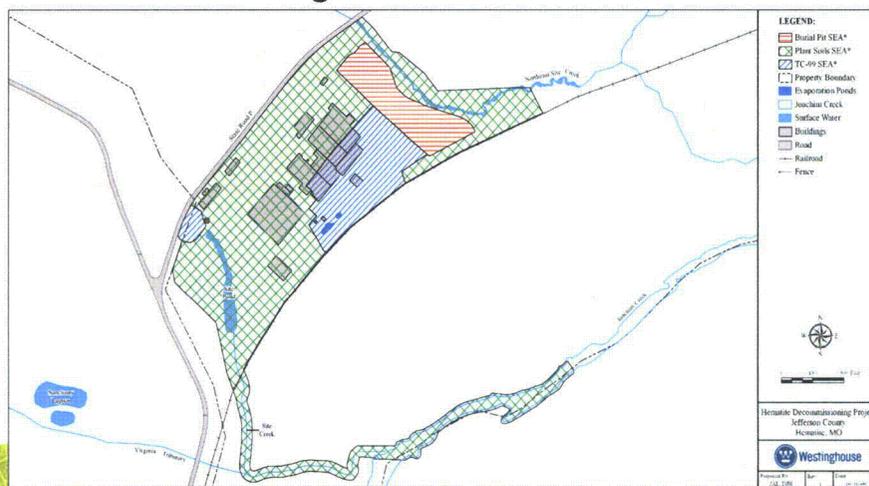
- **Surrogate Radionuclides:** “Derivation of Surrogates And Scaling Factors For Hard-To-Detect Radionuclides”
 - Defined ROC that are insignificant contributors to dose
 - Defined Tc-99:U-235 ratios to account for measurement limitations
 - DCGL *modification* to account for insignificant contributors to dose
 - DCGL *adjustment* to account for hard-to-detect (e.g., Tc-99)
 - Identified three Surrogate Evaluation Areas (SEAs) for applying surrogate relationships

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Final Status Survey

Surrogate Evaluation Areas

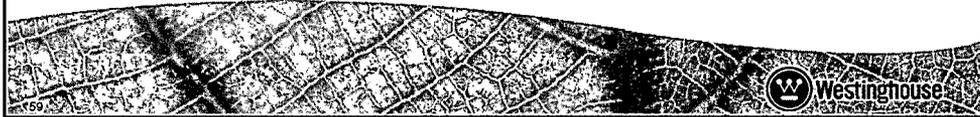


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Final Status Survey

- Remedial Action Support (In-Process) Surveys (RASS)
 - Gamma radiation scans and sampling to guide excavation
 - Soil for potential re-use as backfill evaluated to identify hot spots during excavation (typically one-foot lifts)
 - Remove and segregate potentially elevated soil
 - Utilize HPGe, or additional scans and sampling for further confirmation prior to re-use as backfill
- Controls to prevent re-contamination (admin/physical)
- Measurements documented and input to final survey design
- Final scan during RASS may be incorporated into FSS provided Data Quality Objectives (DQOs) are satisfied



Final Status Survey

- Initial Classification for Final Status Survey
 - DCGL adjustment (insignificant ROC)
 - Soil DCGL modification (Hard to detect radionuclides)
 - Classification based on Characterization and RASS data

Criteria for Initial Classification

Class 1	Areas that have, or had prior to remediation, a potential for radioactive contamination or known contamination in excess of the $DCGL_w$
Class 2	Areas that have, or had prior to remediation, a potential for radioactive contamination or known contamination, but the levels are not expected to exceed the $DCGL_w$
Class 3	Any impacted areas that are not expected to contain residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the $DCGL_w$



Final Status Survey

Current Survey Units and Initial Classification

	Class 1	Class 2	Class 3	TOTAL
Buildings ¹	10	6	10	26
Open Land	32	4	6	42
Systems/Drains	4	0	0	4
TOTAL	46	10	16	72

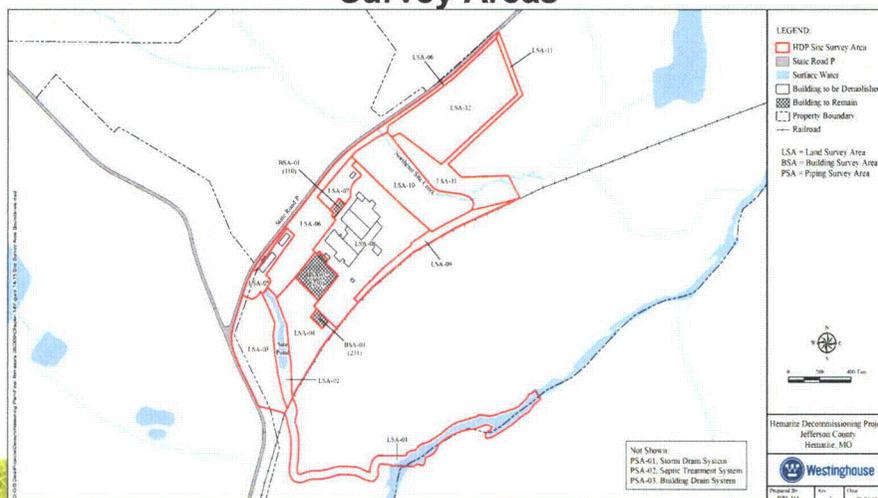
1. Includes the interior and exterior surfaces of ventilation components.

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Final Status Survey

Survey Areas



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Final Status Survey

Current Survey Units and Initial Classification



Final Status Survey

• Final Status Survey Design

- Define final location/size of survey unit
- Define sample size and location (grid or random)
- Define scan coverage based on classification
- Define special or biased measurement requirements

General Survey Specifications Based on Classification

Area Classification	Scan Coverage	Surface Activity Measurements Or Soil Samples
Class 1	100 percent	Determined by statistical tests; additional measurements/samples for small areas of elevated activity as necessary
Class 2	10 to 100 percent	As determined by statistical tests; additional measurements/samples if action level exceeded
Class 3	1 to 10 percent (Judgmental)	

Final Status Survey

- **Final Status Survey Investigation**

- Investigation Action Levels
- Remediation, reclassification and resurvey

Action Levels for Investigation Based on Classification

Survey Unit Classification	Flag Scanning Measurement Result When:	Flag Direct Measurement Or Sample Result When:
Class 1	> DCGL _{EMC}	> DCGL _{EMC} Or > DCGL _W
Class 2	> DCGL _W	> DCGL _W
Class 3	> DCGL _W or > scan	> 50 percent of DCGL _W



Final Status Survey

- **Final Status Survey Data Assessment**

Unity rule applied to account for radioactivity in multiple strata

- Where residual contamination is in a vertical configuration of multiple strata, an extension of the unity rule will ensure the dose does not exceed 25 mrem per year
- Secondly, analytical data for each individual stratum evaluated and the weighted fractions of the criterion summed
- If the SOF is less than or equal to one (1), the survey unit will be considered to meet the criterion
- This approach is consistent with the guidance provided in NUREG-1757, Volume 2 and MARSSIM



Final Status Survey

Review of DQO and Survey Design

- Confirm all data have been acquired in accordance with requirements

Preliminary Data Review

- Convert results to reporting units, calculate basic statistics (e.g., mean, standard deviation, and median)
- Initial determination whether the survey unit passes or fails the release criterion
- Test the null hypothesis (H_0) that the residual radioactivity within the survey unit exceeds the DCGLw



Final Status Survey

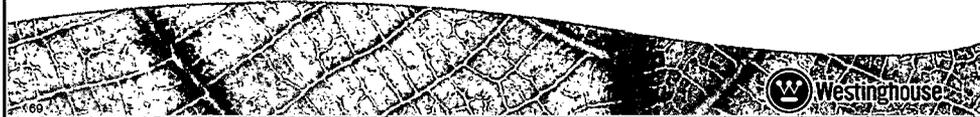
- The Wilcoxon Rank Sum (WRS) Test is a non-parametric statistical evaluation typically used when the ROC is present in the background
- The Sign Test is a non-parametric statistical evaluation typically used in situations where the ROC are not present in background, they are present at low levels compared to the DCGLw, or for gross radioactivity measurements for structural surfaces



Final Status Survey

Data Conclusions

- The survey unit meets the site release criterion through the rejection of the null hypothesis. The data provide statistically significant evidence that the level of residual radioactivity within the survey unit does not exceed the release criteria
- The survey unit fails to meet the release criteria. The data may not be conclusive in showing that the residual radioactivity is less than the release criteria. As a result, the data will be analyzed further to determine the reason for failure



Final Status Survey

- FSS Report
 - Survey Unit Description/Release Records
 - Field Measurement Data / Laboratory Analytical Data
 - Coordinate Data and/or Mapping
 - Discussion of Investigation (if applicable)
 - Data Reduction and Summary Conclusions
 - FSS Final Report (phased)
- Coordination between WEC, NRC and ORISE
 - Multiple survey units prepared for third-party verification
 - Frequent communication with NRC
 - Onsite support readily available to support survey



QUESTIONS?

- Schedule for additional technical sessions?
 - Nuclear Criticality Safety?
 - Dose Modeling?
 - FSS?
 - Others?

