NRC Meeting Concerning Westinghouse Hematite

Paul Michalak, Branch Chief, Materials Decommissioning Branch

Jack Hayes, Hematite Project Manager
U.S. Nuclear Regulatory Commission

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Meeting Purposes

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- Inform stakeholders of pending NRC licensing actions
- Provide the stakeholders details of actions
- Provide information on the NRC review
- Answer questions concerning the review

Pending NRC Actions

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1. Approval of Decommissioning Plan

2. Approval for Soil Disposal in Idaho

1. Approval of Decommissioning Plan (DP)

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Permits Westinghouse to remediate Hematite Site in accordance with

- Approved DP
- Supporting DP documents
- NRC Safety Evaluation Report (SER)
- NRC license amendment

Hematite Background

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- Fuel fabrication facility (1956 – 2001)
- Fuel production for government, Navy and commercial entities
- Onsite burial of waste permitted 1964 – 1970

Westinghouse Implementation of DP

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- Remediation of
  - Burial Pits
  - Various Radiological Impacted Soils
  - Some Remaining Structures, Systems and Equipment

Decommissioning Process

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- Demolition of buildings used for Nuclear Fuel Fabrication – down to slab
- Burial Pit Excavation
- Evaporative Ponds & Site Ponds remediation
- Slabs & impacted soil under the slabs remediation

NRC DP Approval Criteria

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Derived Concentration Guideline Limits (DCGL) for radiological impacted surface & subsurface materials (e.g., soil, pipes, buildings)

- Dose to Critical Receptor = 25 mrem/yr

Major NRC Review Areas for DP Approval

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- Radioactivity Measurements (soil, structures, equipment, systems, ground & surface waters, vegetation) - (Characterization)
- Dose Methodology & Results (Dose Assessment)
- Determination of allowable concentrations for that which remains on site (Dose Assessment)
- Westinghouse's Plan for demonstrating site has been remediated & 25 mrem/yr dose criteria is met. (Final Status Survey)

NRC Confirmation of DP Implementation

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- Periodic NRC Regional Inspections
- NRC performance of confirmatory measurements
  - Utilization of independent contractor

Environmental Assessment

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- Performed under National Environmental Policy Act (NEPA)
- Evaluated environmental impact of proposed action (Implementation of DP)

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2. Approval of Disposal of Hematite Soil in Idaho

Permits disposal in accordance with:

- NRC regulations which permit certain alternatives
- May 2009 Westinghouse submittal & supplemental filings
- NRC Safety Evaluation Report

NRC Requirements

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- Certain radioactive materials ***always*** in possession of entity with NRC license or a NRC Agreement State License
- Exception (exemption) can be granted

Westinghouse Licensing Request

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- Bury certain soil material at a non-NRC & non-Agreement State Facility in Idaho
- Requires an exemption

NRC Approval Criteria for Soil Disposal

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Implementation of proposed exemption results in the following:

- Dose to critical receptor = a few mrem/yr

Major NRC Review Areas for Soil Disposal Approval

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- Methods for the measurement of radioactivity in materials to be disposed in Idaho
- Dose methodology & results

Poster Presentation Order

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John Clements – Decommissioning Plan Health Physics
Karen Pinkston - Decommissioning Plan Dose Calculations
Lifeng Guo - Decommissioning Plan Groundwater Issues
Phil Brandt - Decommissioning Plan Environmental Assessment
Mike McCann & Mike Lafranzo – NRC Region III Inspections
Leah Spradley – Soil Disposal Dose Calculations
John Clements – Soil Disposal Health Physics

NRC Staff Members Present

U.S.NRC
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- Paul Michalak
  - Branch Chief
- Jack Hayes
  - Project Manager
- Leah Spradley & Karen Pinkston
  - Radiological Dose Assessors
- Lifeng Guo
  - Groundwater Hydrologist
- John Clements
  - Health Physicist
- Mike McCann & Mike Lafranzo
  - NRC Region III Inspector
- Jenny Weil
  - Office of Congressional Affairs
- T. R. Rowe
  - Licensing Assistant

Major Health Physics Review Areas

- **Radiological Status of the Facility** – Chapter 4 of the Westinghouse Electric Company – Hematite (WEC) Decommissioning Plan (DP) provides details of radiological site characterization, the types and levels of radioactive material present, and the extent of radioactive material contamination at the facility. Specific information was provided on Contaminated Structures, Contaminated Systems and Equipment, and Soil Contamination. The NRC staff also reviewed the Hematite Radiological Characterization Report (HRCR) in conjunction with the DP. Both the HRCR and the DP Chapter 4 were reviewed using NUREG-1757, Consolidated Decommissioning Guidance, Volume 1, Rev. 2, Section 16.4.

- **ALARA (As Low as Reasonably Achievable) Analysis for Decommissioning Criteria** – Chapter 7 of the WEC DP describes the methods, results, and conclusions of an ALARA analysis for the soils and building surface criteria developed for use at the Hematite site. As defined in Title 10, Section 20.1003, of the Code of Federal Regulations (10 CFR 20.1003), ALARA is an acronym for "as low as (is) reasonably achievable," which means making every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest. The NRC staff reviewed Chapter 7 of the DP using Section 6 (ALARA Analyses) and Appendix N (ALARA Analyses) of the NUREG-1757, Volume 2, Rev. 1, and an NRC Federal Register Notice regarding aspects of ALARA guidance (72FR46102, dated August 16, 2007).

- **Planned Decommissioning Activities** - Chapter 8 of the DP describes the methods and procedures the licensee intends to use to remove residual radioactive material at the site to levels that allow for release of the site in accordance with NRC requirements. This information includes descriptions of how the licensee intends to remediate structures, systems and equipment, surface and subsurface soil, and surface and ground water at the site. Information was also provided on decommissioning programs and procedures, such as WEC's integrated safety analysis, criticality safety approach, security requirements, typical radiation protection and safety controls, and site preparation. The NRC Health Physics staff reviewed the Chapter 8 of the DP using NUREG-1757, Consolidated Decommissioning Guidance, Volume 1, Rev. 2, Section 17.1.

- **Health And Safety Program During Decommissioning** – Chapter 10 of the DP provides details on the health and safety measures used to control and monitor impacts of ionizing radiation on workers during decommissioning. Information was provided on radiation safety controls, monitoring for workers, workplace air sampling, respiratory protection, internal and external exposure determination, contamination control, instrumentation programs, and on health physics audits, inspections, and recordkeeping. The NRC staff reviewed Chapter 10 of the DP using NUREG-1757, Volume 1, Rev. 2, Section 17.3 and to ensure compliance with the NRC regulations in 10 CFR Parts 19 and 20.
- **Environmental Monitoring Program** – Chapter 11 of the DP provided descriptions of the environmental exposure evaluations to be performed during decommissioning, the effluent

monitoring for radioactive material at potential points of release to the environment, and the controls that WEC will implement to ensure that radioactive material in effluents does not exceed applicable NRC, State, or local requirements. In addition to the DP, WEC provided the Effluent and Environmental Monitoring Plan which will be in effect during decommissioning. The NRC staff reviewed Chapter 11 of the DP and the Effluent and Environmental Monitoring Plan using NUREG-1757, Volume 1, Rev. 2, Section 17.4 and to ensure compliance with regulatory requirements of 10 CFR 20.

- **Radioactive Waste Management Program** – Chapter 12 of the DP provided a description of the program for the management of radioactive waste generated during decommissioning and described the types of radioactive waste that will be generated along with waste management processes. Solid, liquid, and mixed waste programs were described. Additionally, WEC provided the Waste Management and Transportation Plan that will be in effect during decommissioning. The NRC staff reviewed Chapter 12 of the DP and the Waste Management and Transportation Plan using NUREG-1757, Volume 1, Rev. 2, Section 17.5 and to ensure compliance with waste management requirements of 10 CFR Part 20, Subpart K, 61.55, 61.56, 61.57 and 71.5.

- **Final Status Survey Design and Reporting** – Chapter 14 of the DP provided details on characterization surveys, remedial action support surveys, and the design of final status surveys related to decommissioning. Characterization surveys, as described in Chapter 4 of the DP and in the HRCR, assisted in the determinations of impacted and non-impacted areas and the initial classifications of impacted areas into Class 1, 2, and 3 survey units. The design of remedial action and final status surveys was provided in Chapter 14 along with the survey methods, including systematic measurements, scans, radionuclide analyses, background reference areas, investigation levels, and statistical tests. An outline was also provided of the Final Status Survey Reports that will be generated after decommissioning. NRC staff will review these reports prior to a final determination that the site can be released for unrestricted release. The staff reviewed the information in Chapter 14 of the DP using NUREG-1757, Volume 2, Chapter 4 (Facility Radiation Surveys) and Appendix A (Implementing the MARSSIM Approach for Conducting Final Radiological Surveys) and the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, and the checklist of Volume 1, Appendix D, Section XIV.

Overview of the Derived Concentration Guideline Levels (DCGLs) Review for the Hematite Decommissioning Plan

What are Derived Concentration Guideline Levels (DCGLs)?

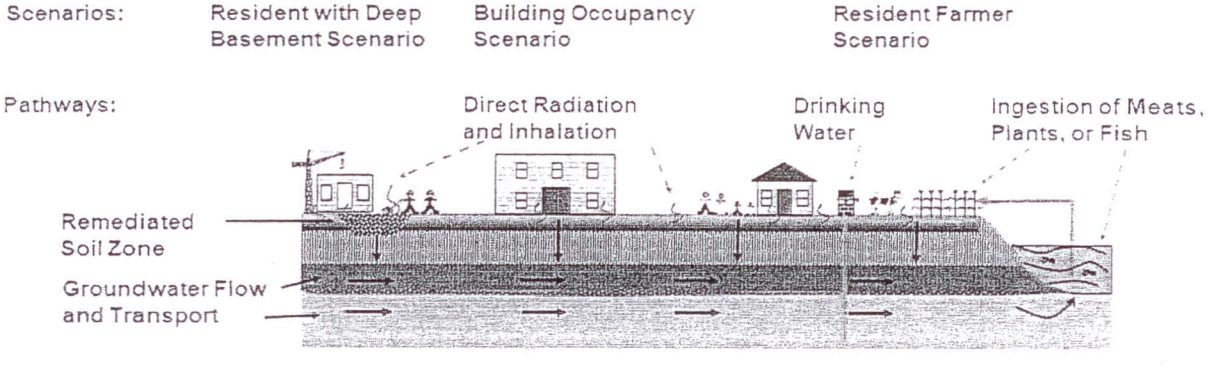
- Derived Concentration Guideline Levels or DCGLs are radionuclide-specific concentration limits used to guide clean-up of a decommissioning site in order to meet radiological dose criteria for license termination
- DCGLs are determined for each radionuclide expected to be present, and the sum of the annual dose from all the radionuclides must remain below 0.25 mSv/yr (25 mrem/yr) if the site is to be released for unrestricted use
- If the Final Status Survey shows that the concentrations are below the DCGLs, the property is permitted to be released and the NRC license can be terminated

How were the DCGLs for the Hematite site derived by Westinghouse?

- Site-specific DCGLs were derived using mathematical models in the RESRAD and RESRAD-BUILD computer codes. RESRAD models the transport of radionuclides through the natural environment and RESRAD-BUILD models the transport of radionuclides inside buildings
- The dose was calculated for all applicable exposure pathways over a 1000 year compliance period
- DCGLs were based upon an average member of a 'critical group', or group of individuals reasonably expected to receive the highest dose from the applicable exposure pathways

What scenarios were considered by Westinghouse?

- **Resident Farmer Scenario with Fishing:** constructs house and lives on waste disposal site; uses water from aquifer under site for drinking and irrigation of crops; grows food and raises animals; eats fish from local pond/lake
- **Resident Farmer Scenario with Deep Basement:** exposed to same pathways as the Resident Farmer, but is also exposed to contaminated soil at greater depth
- **Building Occupancy Scenario:** exposed to fixed and removable residual radioactivity on walls, floor, and ceiling of decommissioned facility from using the building for commercial or light industrial activities



What topics did NRC staff ask questions about during its review?

- The values assumed in Westinghouse's calculations (such as the contaminated soil depth, root depth, depth to groundwater table, evapotranspiration and runoff coefficients, and building air exchange rates)
- The deep soil DCGLs and potentially exposed individuals
- The DCGLs for pipes and ducts
- The area factors for higher contamination areas (hot spots)
- The ratios of radionuclides assumed in the sensitivity analyses for soil and buildings
- The method used to evaluate Th-232 and Ra-226 contamination in the Final Status Survey
- The characterization of contaminated soil at depth under the buildings

What independent calculations did NRC perform?

- NRC staff performed independent calculations of the DCGL values for the clean-up of contaminated soil, buildings, and pipes
- The results of the NRC calculations were consistent with Westinghouse's results

What were the major actions resulting from the review?

- Westinghouse provided more information to justify the basis for their calculations
- For some parameters, Westinghouse redid their calculations using different values
- Westinghouse changed their approach for the deep soil DCGL values
- Westinghouse provided additional information about clean-up standards for pipes and ducts
- Westinghouse provided additional description of their area factor methodology
- Westinghouse provided additional sensitivity analyses assuming different ratios
- Westinghouse changed their final status survey approach to include Th-232 and Ra-226 in the evaluation for the whole site
- Westinghouse provided more characterization information for soil under the buildings

What are the conclusions in the Technical Evaluation Report (TER)?

- NRC staff concluded that the scenarios and parameters used in Westinghouse's calculations of the DCGL values are appropriate
- NRC staff's analyses confirmed Westinghouse's calculations
- The proposed DCGL values for clean-up of the Hematite site are consistent with the 0.25 mSv/yr (25 mrem/yr) NRC requirement

Westinghouse Electric Corporation Hematite Facility Decommissioning Plan
Environmental Assessment

Proposed Federal Action

- Remove buried radioactive material, surface and subsurface soil
- Removal actions to meet NRC requirements for "clean closure"
  - Dose limit of 25 mrem/yr total effective dose equivalent (TEDE)
  - Based on modeling
  - Modeling uses the most conservative assumption
    Resident Farmer scenario
- No deed restrictions
- Consistent with the Missouri Department of Natural Resources record of decision for removal of chemically contaminated waste
- NRC regulates the radioactive portion of the site cleanup
- MDNR regulates the chemical portion of the site cleanup

Environmental Assessment

- NRC follows a formal process in their assessment
- NRC is required by law to conduct an environmental assessment
  - Limited exceptions
  - Not applicable in this instance
- Addresses whether the proposed action will have a significant impact on the environment
- Outcome of the NRC assessment leads to one of two conclusions
  - Finding of No Significant Impact (FONSI)
  - Conduct an Environmental Impact Statement (EIS)

Areas Assessed

- Radiological assessment focused on 18 acres within 228 acres owned by Westinghouse
  - Area where operations and environmental releases occurred
- Environmental areas beyond the 18 acres were also assessed
- Areas assessed
  - Surface water
  - Ground water
  - Ecology
    Terrestrial
    Aquatic
- Air Quality
- Noise
- Transportation
- Historic and Cultural Resources
- Visual and Scenic Resources

- Socioeconomics
- Public and Occupational Health

Impacts Evaluated

- Short term during the removal action
- Long term or long lasting effects after removal actions are completed

Status of the Environmental Assessment

- A draft has been prepared
- The draft assessment resulted in a **finding of no significant impact**
- A copy of the draft assessment and finding was sent to the Missouri Department of Natural Resources
- The Missouri Department of Natural Resources has provided comments to the NRC
- The Missouri Department of Natural Resources agrees with the NRC finding
- The NRC is in the process of responding to the State's comments
- The finding is consistent with other environmental assessments
  - Demolition of selected buildings
    All rubble removed and disposed of at facility's outside of Missouri
  - Removal of buried waste/soil
    Buried waste/soil removed and disposed of at facility's outside of Missouri
  - Limited exception
- Meets State's requirements for chemical contaminants
- Meets NRC requirements for radiological contaminants for clean closure

Next Step

- Finalize the Environmental Assessment
- Publish the Environmental Assessment in the Federal Register
- Public opportunity to request a public meeting
- Document becomes final at the close of the public comment period with no request for a public meeting

Summary of Decommissioning Hydrological Review at the Hematite Site

Occurrence of Groundwater and Flow Systems

- Ground water occurs in unconsolidated overburden sediments and bedrock in the vicinity of the Hematite site. In the unconsolidated overburden sediments, the hydrostratigraphic units consist of (i) an aquitard of silty clay approximately 20 to 30 feet thick, and (ii) a thin sand/gravel unit (averaging between 2 to 3 feet in thickness at the Hematite site) underlying the silty clay. The bedrock material beneath the overburden sediments consists of the Jefferson City-Cotter dolomite and Roubidoux sandstone aquifers.
- The shallow groundwater flow system is comprised of the overburden sand/gravel and the Jefferson City-Cotter aquifer. This shallow system flows in a southeastern direction towards Joachim Creek, with an average hydraulic gradient of approximately 0.0109 feet/foot.
- The deeper groundwater flow system consists of the Roubidoux sandstone aquifer, with an ambient flow direction to the northeast.

Distribution and Transport of Radionuclides in Groundwater

Analytical results from groundwater samples collected from the unconsolidated overburden sediments have confirmed that U-234, U-235, U-238 and Tc-99 are the primary radionuclides of concern in groundwater.

- Overburden silty clay
  Elevated levels of Tc-99 are found underneath and downgradient of the process buildings, spent limestone storage area, and evaporation ponds.
  Uranium is detected primarily at the burial pits.
- Only trace amounts of Tc-99 and uranium have been detected in the overburden sand/gravel unit.
- Bedrock Aquifers (Jefferson City-Cotter limestone and Roubidoux sandstone) are not impacted by radionuclides from historical Hematite operations.

Decommissioning Activities Associated with Groundwater and Surface Water

- Extensive soil excavations in the burial pits area and underneath former process buildings, including spent limestone to remove subsurface radiological contamination.
- Groundwater seepage and surface runoff accumulated in the soil excavations will be pumped out and treated prior to release.
- Water in the evaporation ponds and the Site Pond will also be pumped out and treated prior to release.

Post - Remediation Groundwater Monitoring

Select monitoring wells, downgradient of radiological source areas (e.g., burial pits and former process buildings), have been identified in the sand/gravel unit, Jefferson City-Cotter limestone, and Roubidoux sandstone for post - remediation monitoring. Until license

termination, quarterly water samples will be collected from the monitoring wells and analyzed for uranium isotopes and Tc-99.

Hematite Soil 20.2002 Request - Major Health Physics Review Areas

- **NRC staff request for additional information (RAI) -** NRC Health Physics staff reviewed the original WEC "Request For Alternate Disposal Approval And Exemption" (20.2002 request - ML091480071) submitted on May 21, 2009, and determined that additional information was needed on the characterization of waste materials. During the RAI process, NRC staff requested that WEC provide a description of the radiological sampling and survey measurement procedures and quality control and assurance procedures to be employed by WEC to ensure compliance with the USEI Waste Acceptance Criteria (WAC). NRC staff also requested that WEC provide the methods and logistics to be employed to ensure radioactive waste homogeneity and the measures to ensure non-contaminated soil and materials are not blended or intentionally mixed with radioactive soil and debris to reduce the specific activity of the waste.

- **RAI responses, December 29, 2009 (ML100320540)** – WEC's response to the RAIs (ML100320540) was received on December 29, 2009. The response provided a general overview of sampling and survey processes that would be used to ensure compliance with the U.S. Ecology WAC. NRC staff concluded that more specific details were needed on characterization activities and instrumentation before the NRC could complete a radiological safety analysis of the proposed waste characterization and disposal activities.

- **Additional response, May 24, 2010 (ML101450240) -** In a May 24, 2010, response (ML101450240) to the HP clarification questions, WEC provided information regarding the detection capabilities for radiological surveys and field measurements of soil during excavation and waste packaging. Inferred U-234 and Tc-99 values were presented based upon gamma instrumentation measuring U-235. Surrogate ratios for U-234 and Tc-99 were based on the Westinghouse report titled "Derivation of Surrogates and Scaling Factors for Hard-To-Detect Radionuclides (ML092870492)." The U-234:U-235 ratio was based on observations of the enrichment in a large number of characterization samples, assumptions regarding the consistency of the enrichment shown by the characterization data, and on published values for the enrichment (based on isotopic ratios). The Tc-99:U-235 ratio was based on characterization data for both Tc-99 and U-235. During the development of the Tc-99:U-235 surrogate ratio, the laboratory instrument's associated Minimum Detectable Concentrations (MDC) were substituted when Tc-99 or U-235 results were below the lower limit of detection. NRC staff reviewed the number of laboratory samples that were below the detection limit and concluded that U-235 and Tc-99 are not sufficiently co-located at the site to allow the use of the Tc-99:U-235 surrogate ratio. Additional concerns on the proposed sampling plan were provided to WEC during September and October 2010 conference calls. In particular, there was a large variability (± 1447 pCi/g) noted within the Tc-99 characterization data, and NRC staff wanted assurance that continued QA/QC checks were in place to confirm assumptions about the distribution of the data (e.g., assumption of normality, assumed standard deviation).

- **"Technical Basis for Characterization of Decommissioning Soils Waste to be Sent to U.S. Ecology Idaho, Inc." (ML110530153)** – The "Technical Basis for Characterization of Decommissioning Soils Waste to be Sent to U.S. Ecology Idaho, Inc." was provided as Attachment 1 to a February 18, 2011, submittal. In order to address one of the NRC staff's previous concerns, this document included a detailed Sampling Plan. Visual Sample Plan (VSP) software, developed by Pacific Northwest National Laboratory, was used to initially determine the number of Tc-99 samples required. To address the NRC staff concerns that the Tc-99:U-235 surrogate relationship was not viable, laboratory data will be used for Tc-99 rather than Tc-99:U-235 surrogate ratios (using U-235 gamma results). As a

part of the sampling plan, one Tc-99 lab sample will be performed per 15–20 yd^3 of waste material. A QA/QC program related to the 20.2002 project was developed, and it includes such things as: in-process data checks to ensure inventory and disposal site WAC limits met prior to shipment, field duplicate samples (using MARLAP guidance), field blanks, and laboratory control samples. For the purpose of compliance calculations, the Tc-99 total inventory limit (1 Ci) and 95% upper confidence limit $UCL_{(0.95)}$ (1.6 Ci) must be met prior to material being shipped to U.S. Ecology. Contingency plans were also provided, which are tied to specific action levels to address unexpected conditions. These are further detailed below in Table 1. As a part of the Technical Basis document, WEC also provided details on measurement instrumentation detection capabilities. On-site detection capabilities will be within a reasonable magnitude of Ra-226 and Th-232 limits, and the uranium MDA values will be within a reasonable fraction of US Ecology Waste Acceptance Criteria.

Table 1. Pre-Shipment Contingency Plans Proposed by Westinghouse

Parameter	Action Level	How Monitored	Actions
Total Quantity of Tc-99 shipped to USEI (mean)	>1 Ci	Running total activity (both shipped and pending shipment), based on laboratory sample results prior to shipment	• Reanalyze composite sample and/or analyze individual aliquots used to create the composite sample; • Resample stockpile and re-evaluate; [c] • Ship material to alternate facility.
95% Upper Confidence Level of the mean Tc-99 shipped to USEI (UCL(0.95).	>1.6 Ci	Running confidence interval (both shipped and pending shipment) based on laboratory sample data prior to shipment	• Reanalyze composite sample and/or analyze individual aliquots used to create the composite sample; • Resample stockpile and re-evaluate; [c] • Ship material to alternate facility.
Total activity contribution from all radionuclides within individual railcar	>3000 pCi/g > 40 μR/hr[a]	Laboratory sample results for stockpile evaluated at 95% UCL prior to shipment Gamma radiation levels on railcars prior to shipment.	• Analyze additional aliquot of composite sample; • Unload railcar (at HDP) and re-load with material containing lower concentration (either blended or alternate material from onsite waste stream);[c] • Ship material to alternate facility.
Unexpected Tc-99 results for stockpile samples	>99th percentile of the site wide dataset (599 pCi/g)[b]	Laboratory sample results for stockpile evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate;[c] • Blend with less contaminated material, resample stockpile and re-evaluate; • Ship material to alternate facility.
Maximum average concentration of Ra-226 and Th-232 within individual railcar	Ra-226 >13 pCi/g Th-232 >16 pCi/g	Laboratory sample results for each railcar evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate;[c] Blend with less contaminated material, resample stockpile and re-evaluate; • Ship material to alternate facility.

[a] Based on analysis previously transmitted in HEM-10-46

[b] Value shown is the 99th percentile of the pooled site wide Tc-99 dataset with EP-08-00-SL and EP-10-00-SL excluded using Microsoft® Excel® spreadsheet software.

[c] Resampling of material will generally occur after down blending of stockpile material. When such sampling is performed, the new sample dataset will replace the initial data for the purpose of subsequent calculations. If re-sampling is performed without down blending (which would be the case if the material was sampled insitu railcars) then, the additional samples will be used to augment the initial dataset.

Hematite Soil Disposal Exemption Request Dose Assessment Review

What is a § 20,2002 Exemption Request?

- 10 CFR § 20,2002 is a general provision that allows for other disposal methods, different from those already defined in the regulations, provided that doses are maintained as low as reasonably achievable (ALARA) and within the dose limits in 10 CFR 20.
- It is most often used for disposal of low activity waste (LAW) in hazardous or solid waste landfills that are permitted under Resource Conservation and Recovery Act (RCRA), but it can be used for any type of disposal not already defined in the regulations, such as disposal on a licensee's site or on off-site private property.
- Each request is reviewed on a case-by-case basis.

Why has Westinghouse proposed US Ecology Idaho (USEI) as a disposal facility?

- USEI has accepted more than 2,000,000 tons of LAW for disposal since 1998.
- Idaho Department of Environmental Quality (IDEQ) has defined radioactive material disposal limits, environmental and personnel monitoring, as well as closure and post-closure requirements in USEI's RCRA permit.
- Both Idaho's radioactive materials regulations and USEI's radioactive materials Waste Acceptance Criteria (WAC) have undergone an extensive public outreach and review process.
- The NRC has reviewed and approved USEI's dose assessments for other waste generators and all prior exempted waste has been disposed of safely and in compliance with NRC's approvals and the facility's operating permit.

What questions does the NRC ask during its review?

- Can contamination move from the disposal site and through the environment?
- If so, how will it move (through groundwater, dust, erosion)?
- How could the land be used in the future (industrial, residential, or agricultural use)?
- How could a person be exposed to radiation (e.g., external radiation, ingestion, inhalation)?
- What is the potential radiological dose?
- What is the range of potential dose accounting for uncertainty?
- Is the potential dose less than the NRC policy of "a few mrem" per year?

What independent calculations did the NRC perform?

- Verification of all Westinghouse's calculations
- USEI worker dose considering packages were shipped at the WAC
- Post-closure dose assuming that shipments were sent at a maximum possible concentration and maximum shipping rate (20 railcars/wk) until the inventory limit was reached
- Post-closure dose assuming no dilution occurred with other non-Hematite waste
- Well-driller dose assuming packages are sent at their maximum limits under this evaluation

What were the major findings of and actions resulting from the review?

- Tc-99 is the primary contributing radionuclide through the groundwater pathway.
- The total quantity of Tc-99 (as opposed to the concentration) will drive the dose.
- A total Tc-99 limit of approximately 37 GBq (1 Ci) will applied.
- Westinghouse will enforce a 59.2 GBq (1.6 Ci) limit for the 95th upper confidence limit derived by assuming a standard deviation roughly equivalent to 0.01mSv (1 mrem).
- Ra-226 and Th-232 will be limited to 0.48 Bq (13 pCi/g) and 0.59 Bq (16 pCi/g) respectively.
- Westinghouse will sample the outgoing shipments to ensure the inventory limits.
- To ensure control of rail shipments prior to dispatch, Westinghouse will perform a number of in-process data checks to ensure all applicable inventory and disposal site WAC limits are met prior to shipment.
- A comprehensive quality assurance, quality control program will be in place.
- Westinghouse will have contingency plans in place that are tied to specific action levels to ensure that unexpected conditions are identified.

What are the conclusions in the Technical Evaluation Report (TER)?

- Evaluation of activities and potential doses associated with transportation, waste handling and disposal are reasonable and appropriate.
- Determination that Westinghouse has provided an adequate description of the waste containing licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal.
- Determination that the proposed statistical evaluation, sampling plan, quality assurance and control program, and contingency plans are acceptable and should allow the licensee to demonstrate that the NRC's alternate disposal requirement (of contributing a dose of not more than "a few millirem per year" to any member of the public) can be met.

PUBLIC MEETING

Westinghouse Hematite Pending Issuance

Hematite Decommissioning Plan and Soil

10 CFR 20.2002 Alternate Disposal Amendments

Meeting

Tuesday, July 12, 2011

6:00 – 8:00 P.M.

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PUBLIC MEETING

Westinghouse Hematite Pending Issuance

Hematite Decommissioning Plan and Soil

10 CFR 20.2002 Alternate Disposal Amendments

Meeting

Tuesday, July 12, 2011

6:00 – 8:00 P.M.

NAME		ORGANIZATION	EMAIL
Ramona Huckstep		Missouri Department of Natural Resources	ramona.huckstep@dnr.mo.gov
William Church		810 Linpsay Crystal City MO	933-2458
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Charlie + Beinva Hariga		1819 Springdale Festus mo	436-937-7035
Jim + Joette Nanney		1731 Lake Virginia Dr Festus	636-465-0232
David + Barbara Jarvis		5409 Lakeview Ln Festus, 63028	636-937-6773
John E Kuhlman		P.O. Box 13 3809 Sixth	636-937-235
Debra Dayton		821 Virginia Ave Festus Mo	636 933-9448
Matthew Petri		62	314 750 7657
Gary Davis		Garcon Construction 13000 Davis Lane Festus MO	Connie K D @ SBC Global.Net 636 931-7788
Kurt Hackmann		Westinghouse	HackmaeK@westinghouse.com
Jeri Mouser		7195 Valley Dr Barnhart	
~~Ramona Huckstep~~		~~MDNR~~	
Jonathan Garoutte		MO Dept of Health + Sr. Srvcs	jonathan.garoutte@health.mo.gov
Kathy Walsh			

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NAME		ORGANIZATION	EMAIL
JOHN TARNOW		131 S. GORE AVE SCL. MO 63144	jwt7788@sbcglobal.net
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Don Willey		Laborers Local 110	dwilley@Lu110.com
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JAY SUTTON		DBI	JSUTTON@DBISERVICES.COM

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NAME		ORGANIZATION	EMAIL
Betty + Dan Ackers			

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Decommissioning Hydrological Review

Groundwater Flow Systems

- Shallow flow system: sand/gravel, and Jefferson City-Cotter aquifer
- Deeper flow system: Roubidoux aquifer

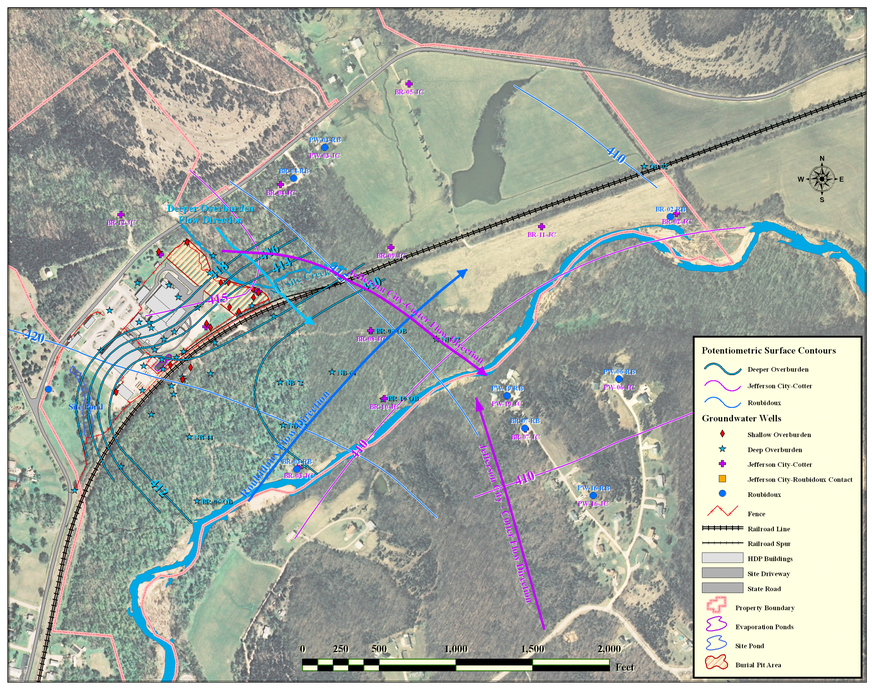
Distribution of Radionuclides in the Groundwater

- Elevated uranium and Tc-99 in the overburden silty clay
- Only trace amounts of uranium and Tc-99 detected in the sand/gravel unit
- Bedrock aquifers (Jefferson City-Cotter and Roubidoux) are not impacted by the site operations

Decommissioning Activities Associated with Surface Water and Groundwater

- Evaporation ponds and the Site Pond
- Waste waters from site decommissioning activities
- Groundwater and surface runoff accumulated in the soil excavation pits

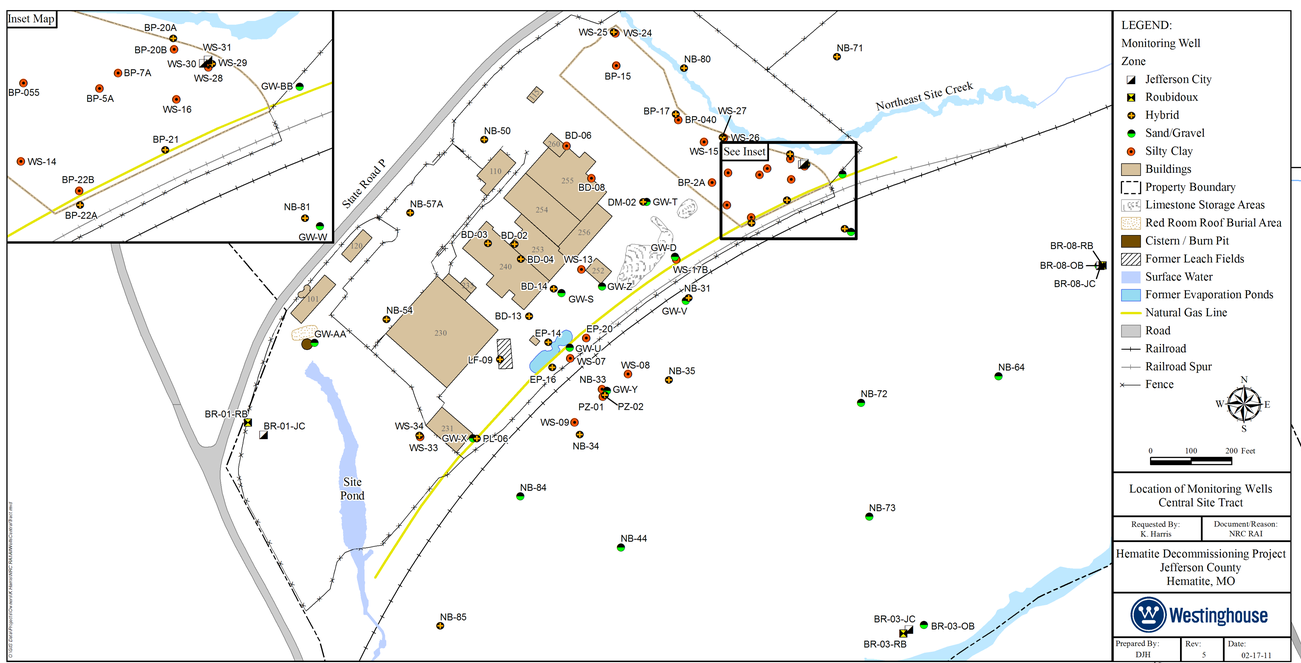
Groundwater Flow Systems



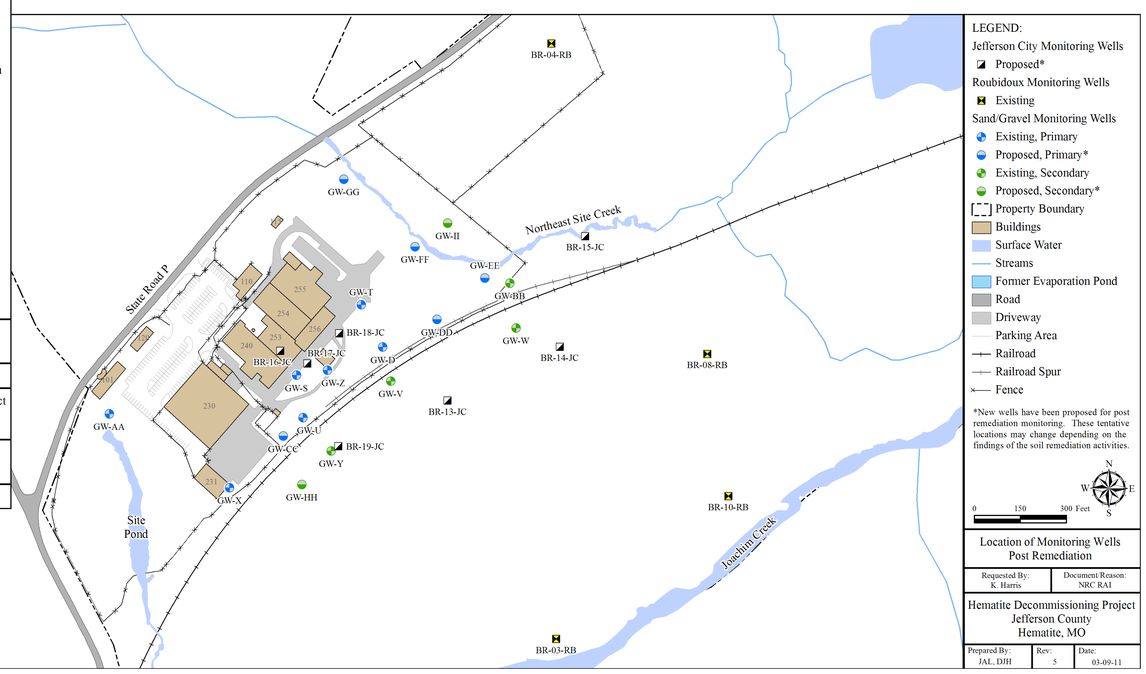
Post - Remediation Groundwater Monitoring Program

- Sand/gravel unit
- Jefferson City-Cotter aquifer
- Roubidoux aquifer

Decommissioning Groundwater Monitoring Wells



Post - Remediation Groundwater Monitoring Wells



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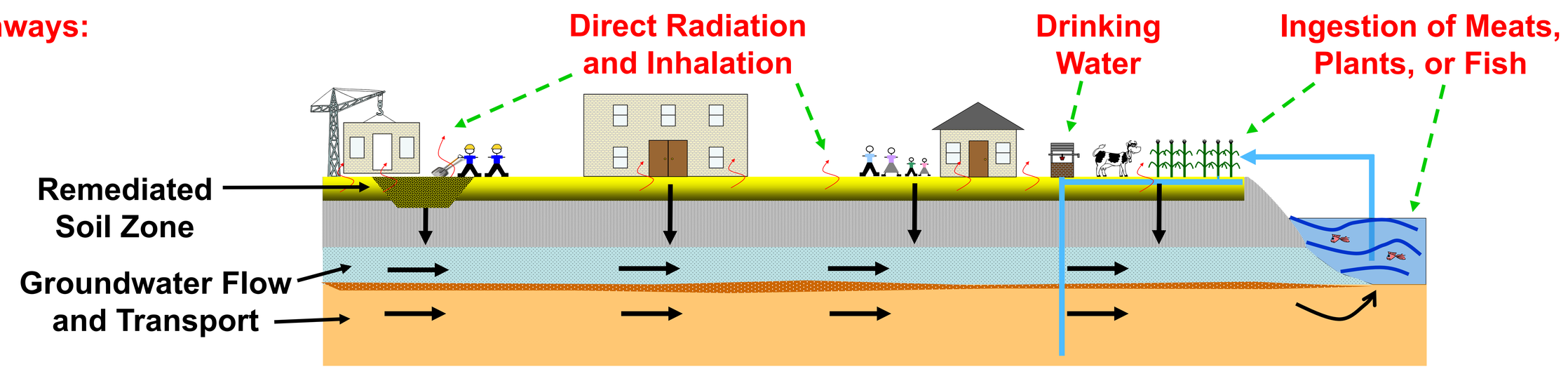
Development of Derived Concentration Guideline Levels (DCGLs)

Scenarios: Resident with Deep Basement Scenario; Building Occupancy Scenario; Resident Farmer Scenario



What are Derived Concentration Guideline Levels (DCGLs)?

- Clean-up levels used to remediate
- Concentration level that would result in at most 25 mrem/yr dose for the next 1000 years

Scenarios Evaluated by Westinghouse in Determining DCGLs

- Resident Farmer Scenario
  - Uses water from aquifer under site for drinking and irrigation of crops, grows food, and raises animals
- Resident Farmer with Deep Basement Scenario
  - Also exposed to contaminated soil at greater depth
- Commercial Building Occupancy Scenario
  - Residual radioactivity on walls, floor, and ceiling of building

Examples of Topics NRC Staff Asked Questions About During Review

- Hematite's site-specific parameters (such as the contaminated soil depth, depth to groundwater table, root depth, evapotranspiration and runoff coefficients, and building air exchange rates)
- Deep soil DCGLs and potentially exposed individuals
- DCGLs for pipes and ducts
- The area factors for higher contamination areas
- The ratios of radionuclides assumed in the sensitivity analyses for soil and buildings

NRC Review Conclusions

- NRC staff's analyses confirmed WEC's calculations
- The proposed DCGL values meet the 25 mrem/yr NRC requirement for unrestricted release

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Soil Disposal Exemption Request (Dose Assessment)

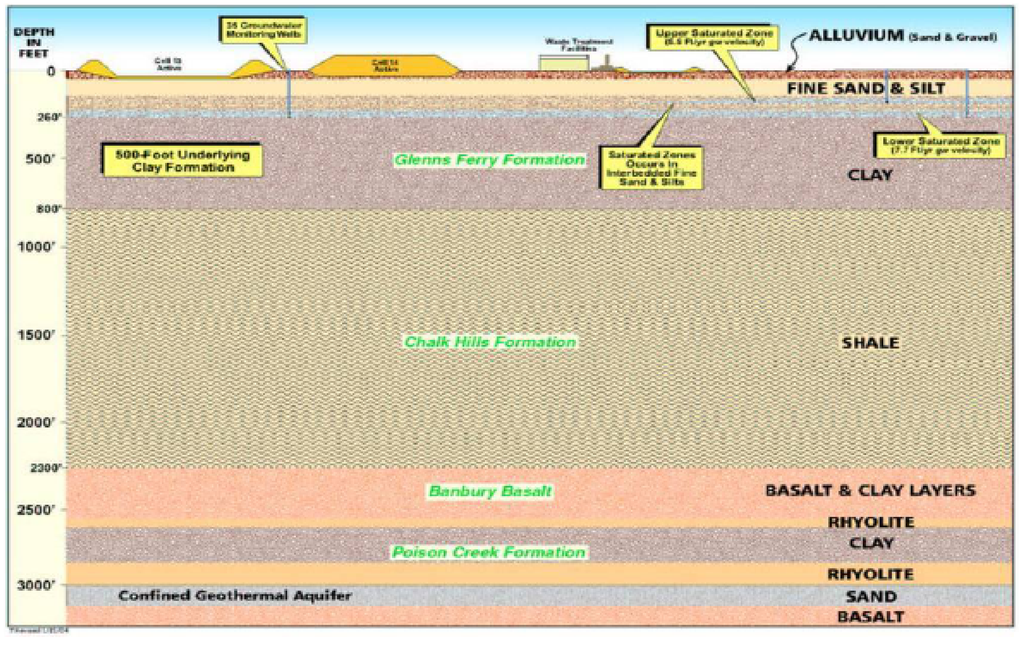
What Questions Did NRC Ask?

- Can contamination move from the disposal site and through the environment? How?
- How could the land be used in the future? How could a person be exposed to radiation?
- What is the potential radiological dose, and is the potential dose less than “a few mrem” per year?

What Were the Major Actions Resulting from the Review?

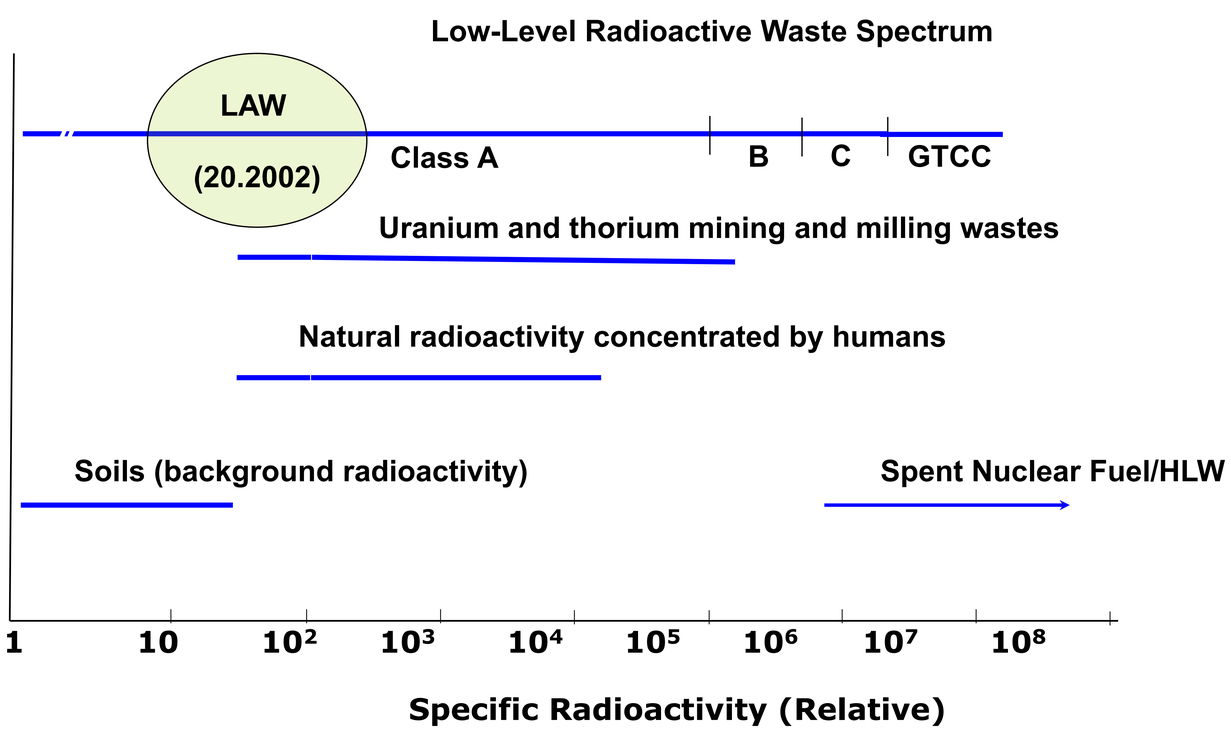
- Limits:
  - 50,000 tons
  - 1 Ci of Tc-99
  - 13 pCi/g of Ra-226
  - 16 pCi/g of Th-232
- WEC will perform data checks to ensure all applicable inventory limits and US Ecology Idaho Waste Acceptance Criteria are met prior to shipment.

US Ecology Geology Hydrogeology



What Is Low Activity Waste (LAW)?

- LAW is low-level radioactive material that may be disposed of in a non-licensed facility.



What Are the NRC Conclusions?

- WEC’s evaluation of activities and potential doses associated are reasonable and appropriate.
- WEC provided an adequate description of the waste.
- The proposed sampling, quality assurance, and contingency plans are acceptable.
- WEC’s calculations were verified by NRC staff.
- NRC’s alternate disposal requirement can be met.

Health Physics Reviews for the Hematite Decommissioning Plan

Major Health Physics Review Areas

- **Radiological Status of the Facility**
  - Contaminated soil and remaining structures, systems, and equipment

Radionuclides of Concern

Radionuclide	Abbreviation
uranium-234	U-234
uranium-235	U-235
uranium-236	U-236
uranium-238	U-238
technetium-99	Tc-99
thorium-232	Th-232
radium-226	Ra-226
americium-241	Am-241
neptunium-237	Np-237
plutonium 239/240	Pu-239/240

- **ALARA (As Low as Reasonably Achievable) Analysis for Decommissioning Criteria**
  - ALARA is the concept of maintaining radiological dose and contamination as low as practical while balancing costs
- **Health And Safety Program During Decommissioning**
  - Radiological monitoring for workers (occupational)
  - Controlling offsite radiological releases (public)
- **Environmental Monitoring Program**
  - Effluent and environmental monitoring and ALARA programs
- **Radioactive Waste Management Program**
  - Solid, liquid, and mixed waste programs
- **Final Status Survey Design and Reporting**
  - Survey areas are classified (Class 1, 2, 3) based on the degree of radiological contamination and the extent of survey required
  - Final Status Survey Reports provided to NRC

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Soil Disposal Exemption Request (Health Physics)

Major Health Physics Review Areas/Concerns

- **NRC staff had concerns with the following areas:**
  - Radiological sampling and survey measurement procedures
  - Quality control and assurance procedures
  - Use of U-235 measurements in lieu of actual Tc-99 values (surrogate)
  - Large variability within the Tc-99 characterization data

WEC Response to NRC Concerns

- **Sampling Plan**
  - Detailed sampling plan provided
  - Laboratory data will be used for Tc-99 rather than Tc-99:U-235 surrogate ratios
- **Quality Assurance**
  - In-process data checks to ensure inventory and U.S. Ecology, Idaho, disposal site Waste Acceptance Criteria (WAC) limits met prior to shipment
  - Field duplicate samples, field blanks, and laboratory control samples
- **WEC Compliance Calculations and Contingency Plans**
  - Compliance with the Tc-99 total inventory limit determined prior to each shipment
  - Contingency plans tied to specific action levels to address unexpected conditions
- **Measurement Instrumentation**
  - Adequate detection capabilities available

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NRC Regional Inspection for Decommissioning Sites

Routine Activities

- Monitor Decommissioning Work
- Perform Independent Measurements
- Document Inspection in Written Reports