

# Hematite Decommissioning Project – Lessons Learned

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# Site/Decommissioning History

- Site operated from 1956 until 2001 (license SNM-0033)
- Site decommissioning plan (DP) originally submitted 2004
  - 8/12/2009 (accepted resubmittal)
  - Amendment 52 allowing building demolition and disposal issued in 2006.
- DP approved 10/13/2011
- Original DP schedule was < 3 yrs
- Final Status Survey Report (FSSR) submitted piecemeal (Volumes and Chapters) beginning in 2015...complete document received in March 2018
- Letter terminating license issued 9/30/2018

# Significant site work



# Scope of Decommissioning

- 16 buildings reduced to 3 at time of FSS
- Removal of on-site burials
- FSS scope
  - 69 Land Survey Units
  - 10 Reuse Soil Stockpiles
  - 55 Building Survey Units
  - 12 Pipe Survey Units
  - 6 Quarters of post-remediation GW monitoring

# Challenging Planning Issues

- Criteria development
  - layered vs uniform DCGLs for soil
  - Warehouse vs small office for structures
  - Trace radionuclides addressed by scaling down principle radionuclide DCGLs (U, Th, Ra, Tc-99)
- One principle radionuclide is notably difficult to detect via scanning (Tc-99) and environmentally mobile
  - Allowed to use surrogate relationship for planning survey only
- Leaving behind some piping and miscellaneous structures



**Table 4-1**  
**Adjusted Soil DCGL<sub>w</sub>'s by CSM<sup>a</sup>**

<b>Radionuclide</b>	<b>Three Layer Approach DCGL<sub>w</sub> Values (pCi/g)<sup>b</sup></b>			<b>Uniform Stratum (pCi/g)</b>
	<b>Surface Stratum</b>	<b>Root Stratum</b>	<b>Excavation Scenario</b>	
Radium-226+C <sup>d</sup>	<b>5.0</b>	<b>2.1</b>	<b>5.4</b>	1.9
Technetium-99	<b>151.0</b>	<b>30.1</b>	<b>74.0</b>	25.1
Thorium-232+C <sup>d</sup>	<b>4.7</b>	<b>2.0</b>	<b>5.2</b>	2.0
Uranium-234	<b>508.5</b>	<b>235.6</b>	<b>872.4</b>	195.4
Uranium-235+D <sup>c</sup>	<b>102.3</b>	<b>64.1</b>	<b>208.1</b>	51.6
Uranium-238+D <sup>c</sup>	<b>297.6</b>	<b>183.3</b>	<b>551.1</b>	168.8

<sup>a</sup> Table as presented in FSSFR Volume 3, Chapter 1.

<sup>b</sup> The reported DCGL<sub>w</sub>'s are the activities for the parent radionuclide and were calculated to account for the dose contribution from insignificant radionuclides.

<sup>c</sup> +D indicates the DCGL<sub>w</sub> includes short-lived (half-life ≤ 6 mo.) decay products.

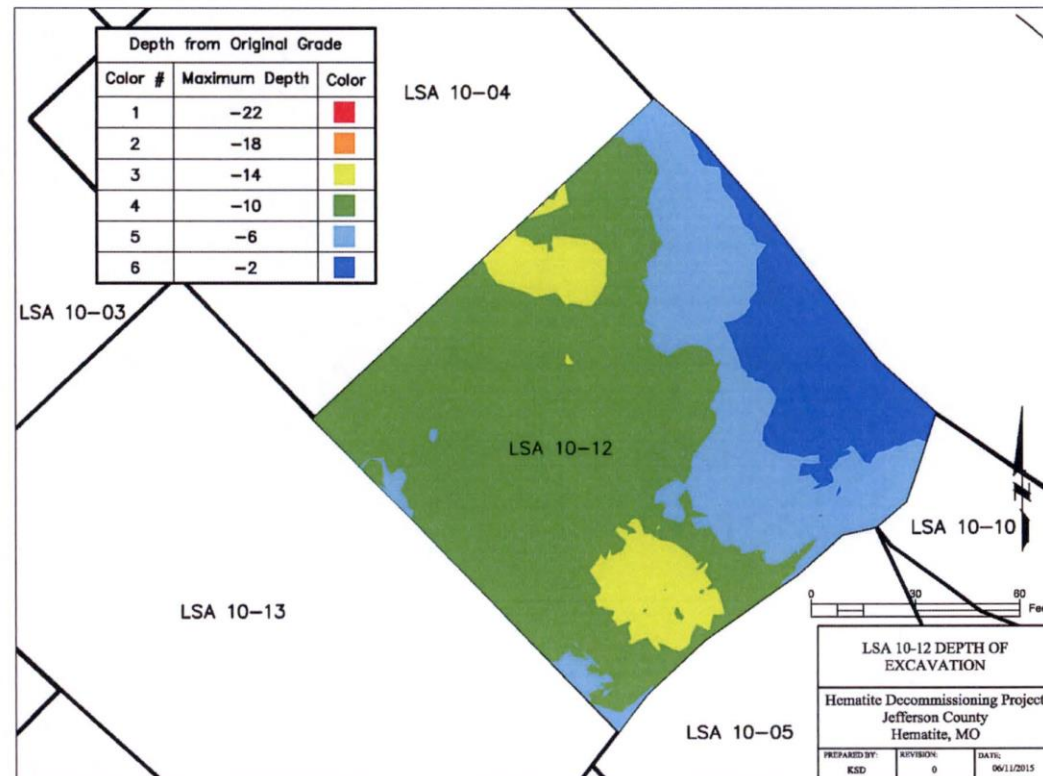
<sup>d</sup> +C indicates the DCGL<sub>w</sub> includes all radionuclides in the associated decay chain.

**Scan MDCs for 2" x 2" NaI detector, 10,000 cpm background: LSA 10-12**

	<b>Scan MDC (Total U)</b>	<b>DCGL<sub>w</sub> (Total U)</b>	<b>Scan MDC (Ra-226)</b>	<b>DCGL<sub>EMC</sub>* (Ra-226)</b>	<b>Scan MDC (Th-232)</b>	<b>DCGL<sub>w</sub>* (Th-232)</b>
LSA 10-12	82.6	104.0	2.8	5.04	1.8	3.0

\* DCGL<sub>EMC</sub> and DCGL<sub>w</sub> includes background concentrations of 0.9 pCi/g for Ra-226 (no ingrowth) and 1.0 pCi/g for Th-232. Ra-226 DCGL<sub>EMC</sub> values are based on the Root Stratum Release criteria and the AF<sub>Ra-226</sub> of 2.4. Th-232 DCGL<sub>w</sub> values are based on the Root Stratum release criteria.

Figure 3-3  
LSA 10-12 Depth of Excavation Map (Depths in Feet)\*

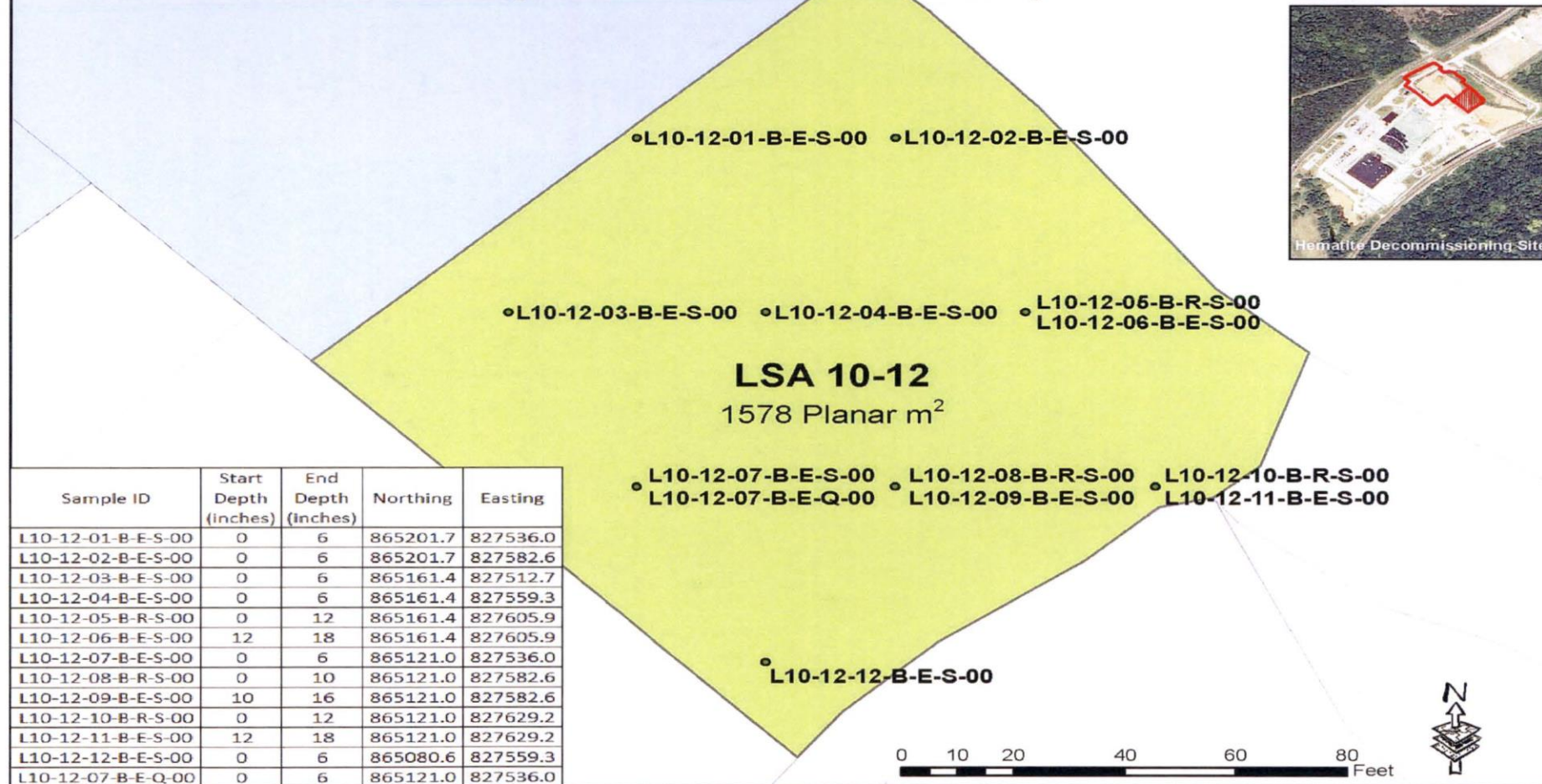


LSA 10-12 Prepared for RASS FSS Design





# LSA 10-12 Systematic Sample Locations



Upon completion of remediation, in its final excavated configuration as prepared for FSS, LSA 10-12 presents 1,578 square meters (m<sub>2</sub>) in planar (2-dimensional) extent, within an interior surface area of 1,926 m<sub>2</sub> (3-dimensional).



## Example of Burial Pit Soil Discoloration



# Problematic Implementation Issues

- Removal/reuse of upper layers of cover soil
  - Scanning initially insufficient to identify fuel fragments when performing 1' "lifts"
    - Scanning sensitivity was increased by slowing speed and decreasing distance between surface and detector
    - "lifts" decreased
    - Modified criteria due to composite sampling as each truckload was evaluated for reuse
    - Modified plan for reuse depending on analytical results of stockpile samples
    - Isolation and control issues for soil stockpiles
  - Had to use a soil scanner/sorter to partially reevaluate the soils already stockpiled

# Problematic Implementation Issues

- Excavation sidewall issues
  - Survey unit area
  - Sampling of sidewalls
  - Scanning of sidewalls
- Inaccessible areas
  - In standing or running water
  - Excavation sidewalls
  - Gas pipeline



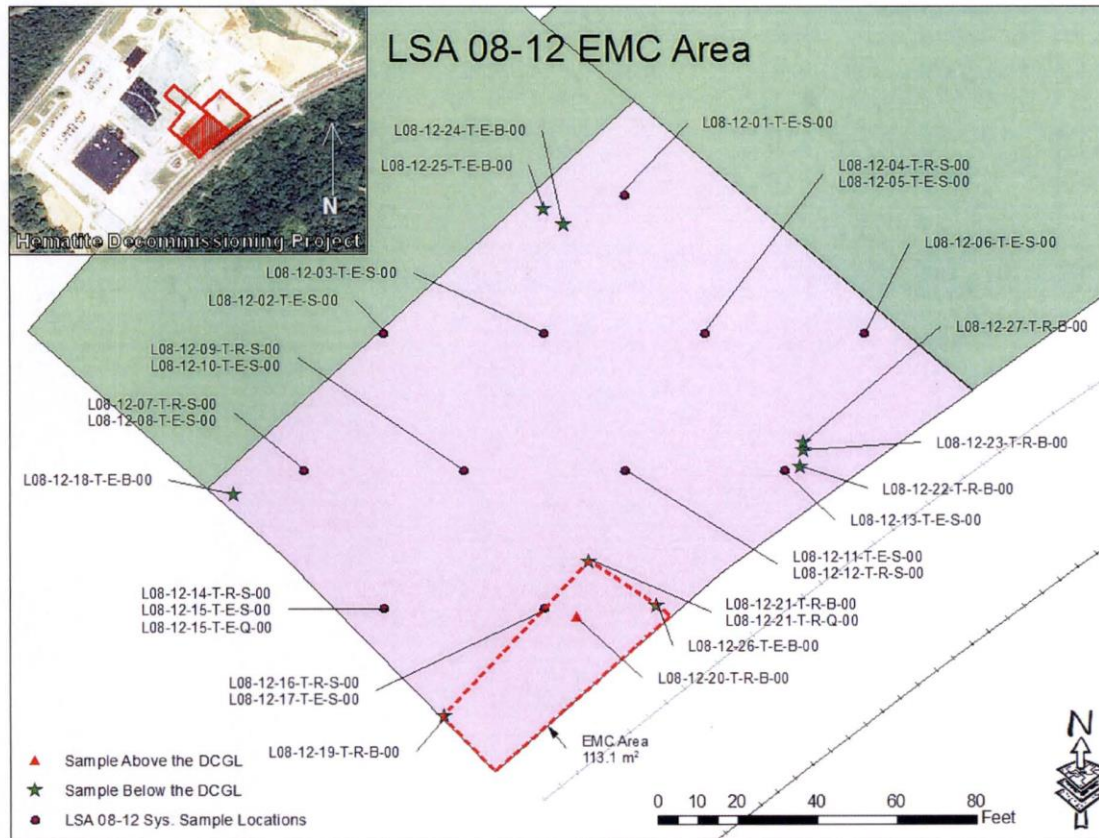
# Problematic Implementation Issues

- Layered approach
  - Assurance that reuse soil is properly accounted for
    - Eventually decided it would be best to evaluate reuse soil separately and use only “uniform” criteria
  - Licensee had to very carefully document depth of remaining soil and samples
  - How to assess sampling statistically
    - MARSSIM approach is using WRS test for “surface” soil only

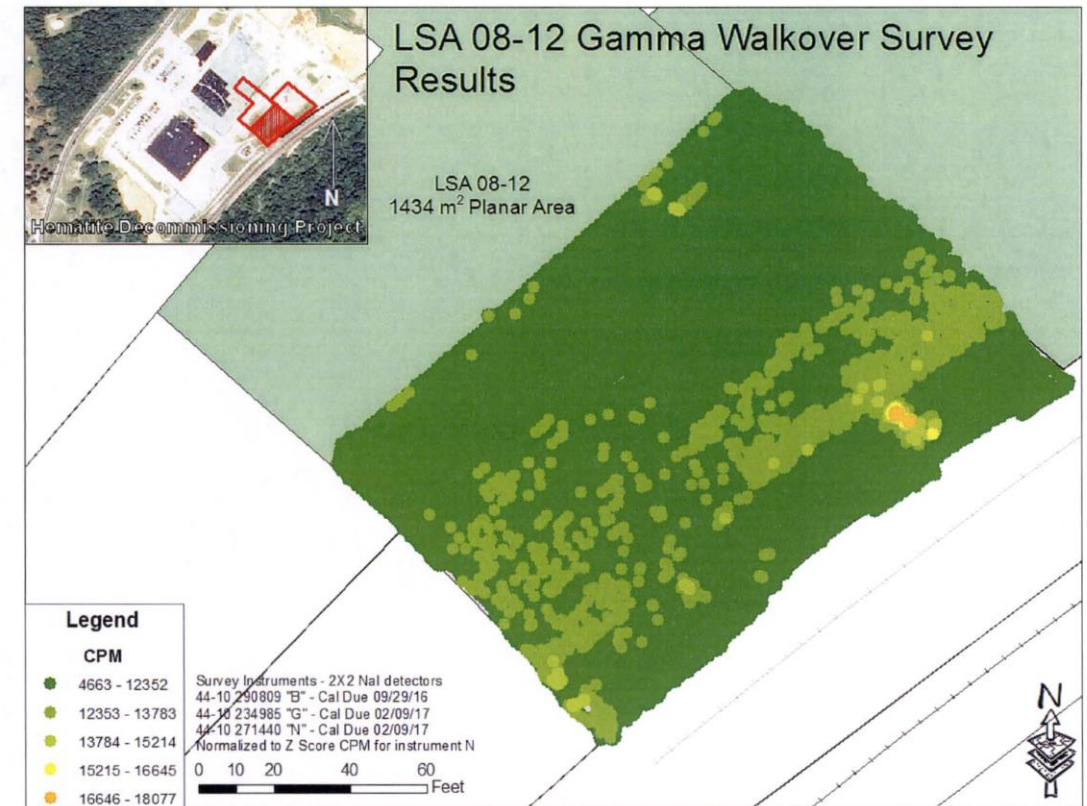
# Problematic Implementation Issues

- Elevated areas
  - Using SU borders to define the elevated area
  - Using scanning to define the elevation when insufficient samples taken
    - Hard to detect radionuclides (Tc-99) were of particular difficulty to address (had to assume surrogate relationship)

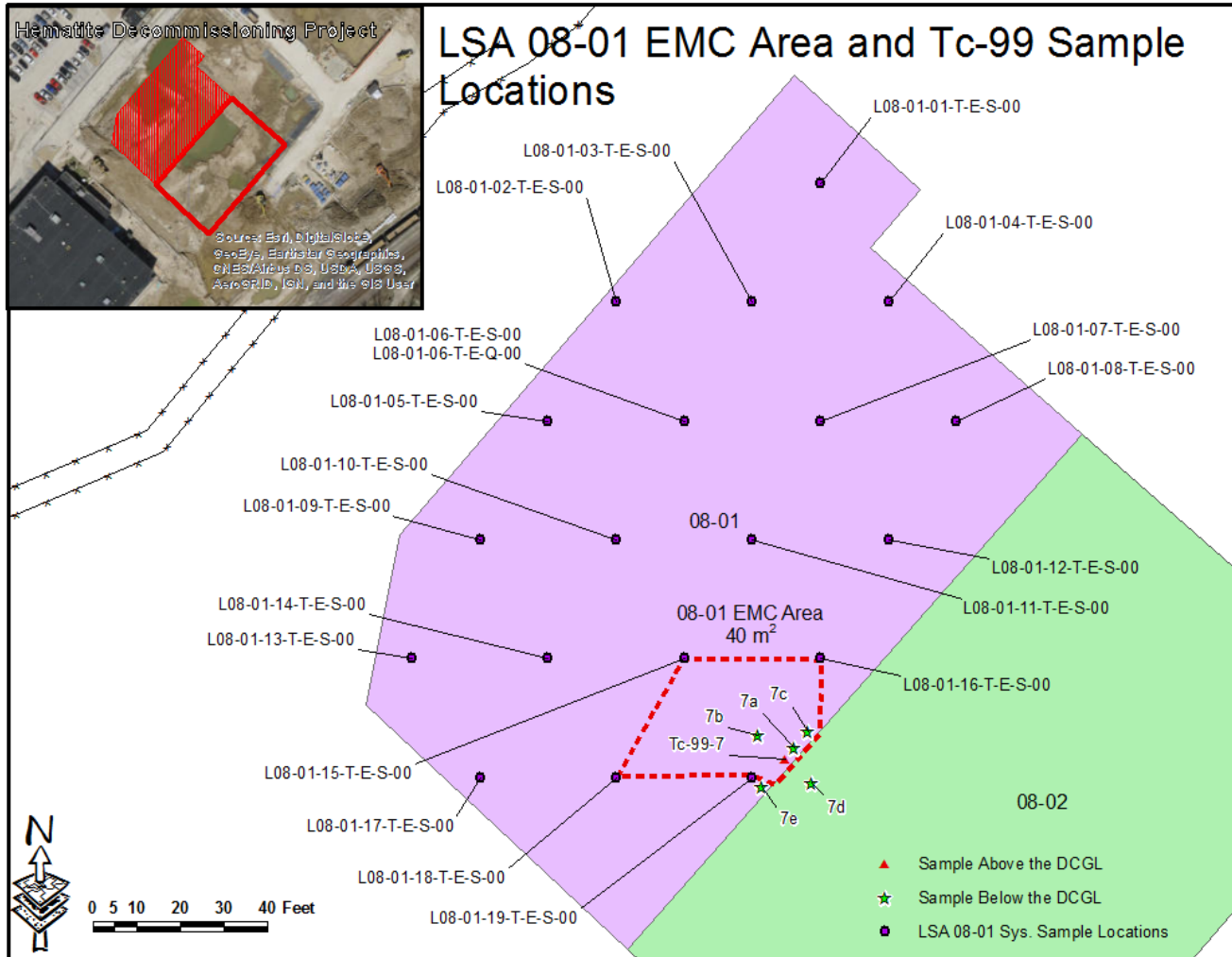
## EMC Investigation Area within LSA 08-12



## Colorimetric GWS Plot for LSA 08-12







# Problematic Implementation Issues

- Structural Contamination Measurements
  - Piping
    - not 100% scanned
    - Time frame of scan logging
  - Structures
    - Utilized ambient background
  - Ventilation surveys
    - Dose estimate didn't follow the approved method
    - Didn't use proper calibration (on-site calibration is modified from off-site calibration)

# FSS Data Summary for BSA 02-24

MEASUREMENT ID	MEASUREMENT LOCATION	DATE MEAS	MEASUREMENT	GROSS cpm ( $\alpha+\beta$ )	BKG cpm (a+b)	Net cpm ( $\alpha + \beta$ )	Combined Net dpm/100 cm <sup>2</sup> ( $\alpha+\beta$ )	Corrected Net dpm/100cm <sup>2</sup>	Fraction of DCGL
B02-24-01-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	126	157	-30.67	-308	0	0%
B02-24-02-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	118	157	-38.67	-388	0	0%
B02-24-03-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	107	157	-49.67	-498	0	0%
B02-24-04-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	139	157	-17.67	-177	0	0%
B02-24-05-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	127	157	-29.67	-298	0	0%
B02-24-06-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	133	157	-23.67	-237	0	0%
B02-24-07-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	142	157	-14.67	-147	0	0%
B02-24-08-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	145	157	-11.67	-117	0	0%
B02-24-09-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	134	157	-22.67	-227	0	0%
B02-24-10-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	122	157	-34.67	-348	0	0%
B02-24-11-S-W-S-00	South Wall	8/12/2015	alpha + beta TSC	129	157	-27.67	-277	0	0%
B02-24-12-S-W-S-00	East Wall	8/12/2015	alpha + beta TSC	151	157	-5.667	-57	0	0%
B02-24-13-S-W-S-00	East Wall	8/12/2015	alpha + beta TSC	144	157	-12.67	-127	0	0%
B02-24-14-S-W-S-00	East Wall	8/12/2015	alpha + beta TSC	145	157	-11.67	-117	0	0%
B02-24-15-S-W-S-00	East Wall	8/12/2015	alpha + beta TSC	148	157	-8.667	-87	0	0%
B02-24-16-S-W-B-00	South Wall	8/12/2015	alpha + beta TSC	860	157	703.33	7054	7054	37%
B02-24-17-S-W-B-00	South Wall	8/12/2015	alpha + beta TSC	431	157	274.33	2752	2752	15%

# FSS Data Summary for BSA 02-25

MEASUREMENT ID	MEASUREMENT LOCATION	DATE MEAS	MEASUREMENT	GROSS cpm ( $\alpha+\beta$ )	BKG cpm (a+b)	Net cpm ( $\alpha + \beta$ )	Combined Net dpm/100 cm <sup>2</sup> ( $\alpha+\beta$ )	Corrected Net dpm/100cm <sup>2</sup>	Fraction of DCGL
B02-25-01-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	113	172	-58.67	-588	0	0%
B02-25-02-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	122	172	-49.67	-498	0	0%
B02-25-03-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	120	172	-51.67	-518	0	0%
B02-25-04-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	144	172	-27.67	-277	0	0%
B02-25-05-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	149	172	-22.67	-227	0	0%
B02-25-06-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	134	172	-37.67	-378	0	0%
B02-25-07-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	137	172	-34.67	-348	0	0%
B02-25-08-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	134	172	-37.67	-378	0	0%
B02-25-09-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	119	172	-52.67	-528	0	0%
B02-25-10-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	137	172	-34.67	-348	0	0%
B02-25-11-S-W-S-00	North Wall	8/12/2015	alpha + beta TSC	142	172	-29.67	-298	0	0%
B02-25-12-S-W-S-00	West Wall	8/12/2015	alpha + beta TSC	128	172	-43.67	-438	0	0%
B02-25-13-S-W-S-00	West Wall	8/12/2015	alpha + beta TSC	139	172	-32.67	-328	0	0%
B02-25-14-S-W-S-00	West Wall	8/12/2015	alpha + beta TSC	124	172	-47.67	-478	0	0%
B02-25-15-S-W-S-00	West Wall	8/12/2015	alpha + beta TSC	906	172	734.33	7365	7365	39%

\*NOTE: Differences from documented survey results are due to rounding in Excel.

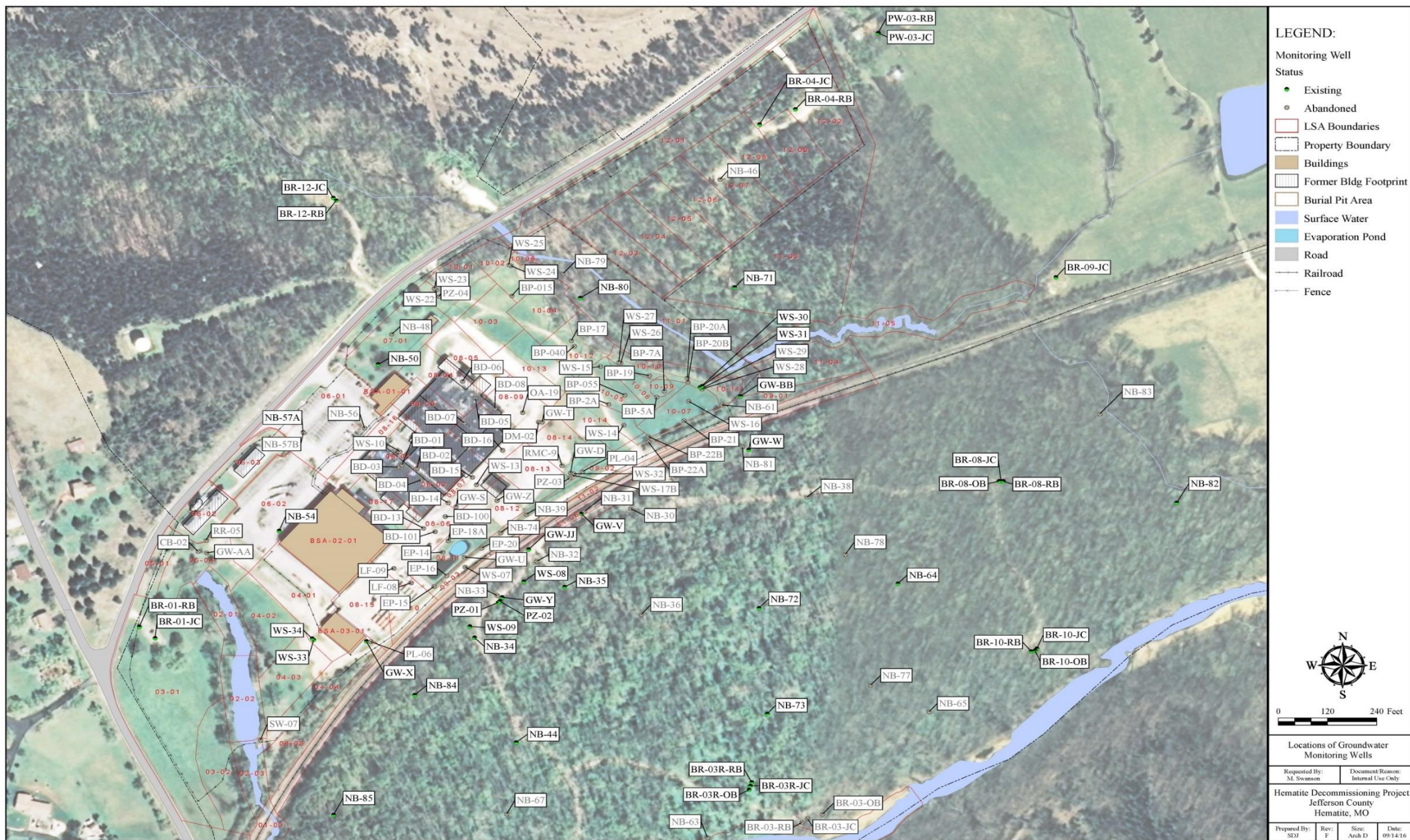
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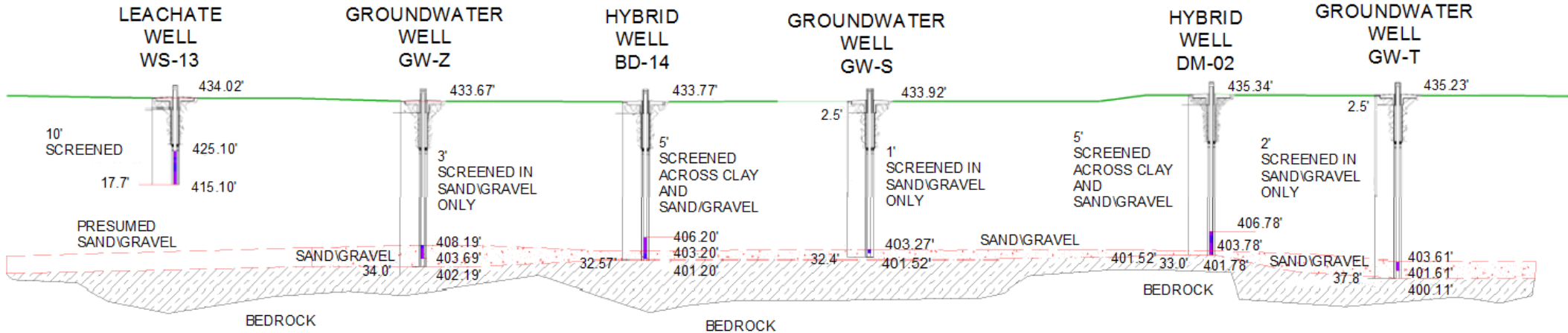
# Problematic Implementation Issues

- **Post-remediation groundwater monitoring**
  - **Frequency and length of monitoring**  
No specific requirements on provided in either regulation or guidance documents (e.g., NUREG-1757)
  - **A minimum of four (4) Quarterly sampling**
  - **Monitoring network**
    - **Silty clay**
    - **Sand/gravel aquifer**
    - **Bedrock aquifers**
  - **Statistical analysis to confirm stability of levels of radionuclides of concerns (e.g., Mann-Kandell trend test)**





Wells in Vicinity of the Process Buildings  
Alignment B - B'





# Best Practices

- A quality licensee product speeds up the acceptance/review
  - Pre-submittal audits could help assure a quality incoming product and understanding of novel approaches to decommissioning
- Routinely scheduled public teleconferences
  - More coordination/documentation for PM
  - Consider adjusting the frequency based on work being performed
- Modifications should be incorporated into the original document (revisions of original)

# Best Practices Cont'd.

- Be careful with piecemeal reviews...
  - Feedback on initial documents is generally helpful
  - Can devolve into consulting vs helping
  - Misunderstanding of schedule impacts (licensee vs staff expectations)
- For long, involved documents, vertical and horizontal slice review makes the project manageable
  - Similar to inspections and FCSE ISA reviews
- Good communication and attitude between all involved
- Call out mistakes having negligible impact but not requiring revision



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