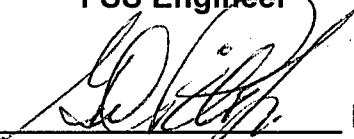


**Rancho Seco**  
**Final Status Survey Summary Report**  
**Revision 1**  
**April 17, 2008**  
**Spent Regenerant Tank Room**  
**Room 40**  
**Survey Unit F8130541**

Prepared By: Gary Frank  Date: April 17, 2008

**FSS Engineer**

Reviewed By:  Date: 4/21/08

**Lead FSS Engineer**

Approved By:  Date: 5-15-08

**Dismantlement Superintendent, Radiological**

## FINAL STATUS SURVEY SUMMARY REPORT

### Survey Unit:

F8130541, Room 40 Lower Walls and Floor

### Survey Unit Description:

Operating History: The reinforced concrete structure contained the RadWaste processing and supporting systems. The building contained six main elevations. Residual radioactive material was known to be present on all levels of the interior of the building. Operating records and the HSA document several events with the potential for a release of radioactivity inside this structure. One report documented contamination of the auxiliary building roof. The roof was later replaced.

Site Characterization: Direct measurements were made of each of the interior elevation surfaces as well as the exterior surfaces of the structure. These measurements confirmed the presence of plant-derived radionuclides. Direct measurements on the -47' elevation showed a mean gross activity level of 320,071 dpm/100 cm<sup>2</sup> and a maximum value of 5,720,000 dpm/100 cm<sup>2</sup>. Direct measurements on the -29' elevation showed a mean gross activity level of 544,756 dpm/100 cm<sup>2</sup> and a maximum value of 11,370,000 dpm/100 cm<sup>2</sup>. Direct measurements on the -20' elevation showed a mean gross activity level of 247,831 dpm/100 cm<sup>2</sup> and a maximum value of 10,080,000 dpm/100 cm<sup>2</sup>. Direct measurements on the grade elevation showed a mean gross activity level of 373,758 dpm/100 cm<sup>2</sup> and a maximum value of 5,800,000 dpm/100 cm<sup>2</sup>. Direct measurements on the +20' elevation showed a mean gross activity level of 85,408 dpm/100 cm<sup>2</sup> and a maximum value of 1,900,000 dpm/100 cm<sup>2</sup>. Direct measurements on the +40' elevation showed a mean gross activity level of 3,288 dpm/100 cm<sup>2</sup> and a maximum value of 24,781 dpm/100 cm<sup>2</sup>. Direct measurements on the building exterior, including the mezzanine roof, showed a mean gross activity level of 1,897 dpm/100 cm<sup>2</sup> and a maximum value of 2,990 dpm/100 cm<sup>2</sup>. (The roof had been replaced prior to the classification survey.) Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the auxiliary building was determined to be a Class 1, 2 area and the exterior was a Class 2,3.

HSA Events: HSA Report pg. 63.

### Survey Unit Design Information:

The Survey Unit Design Parameters are presented in Table 1 below. The survey unit and measurement locations are depicted on the maps in Attachment 1. Direct measurement locations were determined using a random-start, fixed grid pattern and 245 m<sup>2</sup> were scanned for 100% coverage. Samples of removable contamination were collected at each direct measurement location. The instrumentation used for the survey along with the MDC values listed in Tables 2-1 and 2-2 in Attachment 2.

**Table 1. Survey Unit Design Parameters**

<b>Survey Design Parameter</b>	<b>Value</b>	<b>Comment</b>
<b>Survey Area:</b>	F813	Room 40 Lower Walls and Floor
<b>Survey Unit:</b>	0541	Structure Surface
<b>Class:</b>	1	LTP Table 5-4
<b>SU Area (m<sup>2</sup>):</b>	245	
<b>Evaluator:</b>	Gary Frank	
<b>DCGL (dpm/100 cm<sup>2</sup>):</b>	43000	Gross Activity DCGL
<b>Area Factor:</b>	3.3	Class 1
<b>Design DCGL<sub>emc</sub> (dpm/100 cm<sup>2</sup>):</b>	141900	Class 1
<b>LBGR (dpm/100 cm<sup>2</sup>):</b>	21500	Default = 50% DCGL
<b>Design Sigma (dpm/100 cm<sup>2</sup>):</b>	10204	
<b>Type I Error:</b>	0.05	
<b>Type II Error:</b>	0.05	
<b>Predominant Nuclide:</b>	Cs-137	Co-60 used for Area Factor and emc
<b>Sample Area (m<sup>2</sup>):</b>	7	Class 1
<b>Scan Area (m<sup>2</sup>):</b>	245	
<b>Scan Coverage (%):</b>	100%	Class 1
<b>Z<sub>1-α</sub>:</b>	1.645	
<b>Z<sub>1-β</sub>:</b>	1.645	
<b>Sign P:</b>	0.97725	
<b>Calculated Relative Shift:</b>	2.1	
<b>Relative Shift Used:</b>	2.1	Uses 3.0 if Relative Shift is >3
<b>N-Value:</b>	12	
<b>Design N-Value + 20%:</b>	15	NUREG-1575 Table 5-5
<b>Design Min Samples N:</b>	35	Class 1
<b>Grid Spacing L:</b>	2.6	Class 1

## Survey Results:

A total of 35 direct measurements were made in F8130541. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. Nine scan measurements indicated areas of elevated activity resulting in an investigation documented in Attachment 3. Scan activity ranged from 5363 to 124762 dpm/100 cm<sup>2</sup>, based on a surveyor efficiency of 0.5 and no background subtracted. ISOCS measurements were performed on the lower walls with results ranging from 8630 to 33950 dpm/100cm<sup>2</sup> for Cs-137 and 995 to 1840 dpm/100cm<sup>2</sup> for Co-60. Samples for removable surface activity were all less than 10% of the DCGL as shown in Table 3. Removable surface activity samples were counted for alpha activity and none was detected at the MDC shown in Table 2-1 of Attachment 2.

**Table 2. Direct Measurement Results**

Measurement ID	Gross Activity (dpm/100 cm <sup>2</sup> )
F8130541-C0001BD	2630
F8130541-C0002BD	9851
F8130541-C0003BD	14177
F8130541-C0004BD	2723
F8130541-C0005BD	22233
F8130541-C0006BD	7563
F8130541-C0007BD	3092
F8130541-C0008BD	2843
F8130541-C0009BD	4414
F8130541-C0010BD	2537
F8130541-C0011BD	2666
F8130541-C0012BD	13938
F8130541-C0013BD	7039
F8130541-C0014BD	3294
F8130541-C0015BD	6593
F8130541-C0016BD	11064
F8130541-C0017BD	4196
F8130541-C0018BD	2469
F8130541-C0019BD	2148
F8130541-C0020BD	2391
F8130541-C0021BD	2469
F8130541-C0022BD	2594
F8130541-C0023BD	2371
F8130541-C0024BD	2236
F8130541-C0025BD	2018
F8130541-C0026BD	2090
F8130541-C0027BD	1956
F8130541-C0028BD	2054
F8130541-C0029BD	2397
F8130541-C0030BD	2215
F8130541-C0031BD	2220
F8130541-C0032BD	2189
F8130541-C0033BD	4394
F8130541-C0034BD	2350

Measurement ID	Gross Activity (dpm/100 cm <sup>2</sup> )
<b>F8130541-C0035BD</b> <b>Mean:</b> <b>Median:</b> <b>Standard Deviation:</b> <b>Range:</b>	2277 4677 2594 4517 1956 - 22233

**Table 3. Removable Surface Activity Results**

<b>Measurement ID</b>	<b>Surface Beta Activity (dpm/100 cm<sup>2</sup>)</b>
F8130541C0001SM	6.14
F8130541C0002SM	3.58
F8130541C0003SM	13.83
F8130541C0004SM	6.14
F8130541C0005SM	29.21
F8130541C0006SM	6.14
F8130541C0007SM	6.14
F8130541C0008SM	11.27
F8130541C0009SM	13.83
F8130541C0010SM	11.27
F8130541C0011SM	9.98
F8130541C0012SM	11.27
F8130541C0013SM	8.7
F8130541C0014SM	26.65
F8130541C0015SM	4.86
F8130541C0016SM	22.8
F8130541C0017SM	4.86
F8130541C0018SM	7.42
F8130541C0019SM	7.42
F8130541C0020SM	1.01
F8130541C0021SM	3.58
F8130541C0022SM	11.27
F8130541C0023SM	9.98
F8130541C0024SM	4.86
F8130541C0025SM	1.01
F8130541C0026SM	3.58
F8130541C0027SM	2.29
F8130541C0028SM	4.86
F8130541C0029SM	3.58
F8130541C0030SM	7.42
F8130541C0031SM	8.7
F8130541C0032SM	4.86
F8130541C0033SM	9.98
F8130541C0034SM	4.86
F8130541C0035SM	6.14
Mean:	8.56
Median:	6.14
Standard Deviation:	6.45
Range:	1.01 to 29.21

**Survey Unit Data Assessment:**

The survey design required 35 direct measurements for the Sign Test. The critical value and the results of the Sign Test are presented in Table 4. The sample mean and median values were less than the DCGL. The sample standard deviation was less than the design standard deviation so no additional samples were required.

**Table 4. Data Assessment Results**

<b>Survey Results Parameter</b>	<b>Value</b>	<b>Comment</b>
<b>Material Background Used</b> (dpm/100 cm <sup>2</sup> ):	N/A	
<b>Ambient Background Used</b> (dpm/100 cm <sup>2</sup> ):	N/A	Average Ambient BKG = 0
<b>Actual Direct Measurements (N):</b>	35	
<b>Median</b> (dpm/100 cm <sup>2</sup> ):	2594	
<b>Mean</b> (dpm/100 cm <sup>2</sup> ):	4677	
<b>Direct Measurement Standard Deviation</b> (dpm/100 cm <sup>2</sup> ):	4517	
<b>Total Standard Deviation</b> (dpm/100 cm <sup>2</sup> ):	4517	Based on samples and backgrounds.
<b>Maximum</b> (dpm/100 cm <sup>2</sup> ):	22233	
<b>Material Type:</b>	N/A	Background Subtract Not Applied
<b>Sign Test Final N Value:</b>	35	
<b>S+ Value:</b>	35	
<b>Critical Value:</b>	22	
<b>Sufficient Samples Collected:</b>	Yes	
<b>Maximum Value &lt; DCGL:</b>	Yes	
<b>Median Value &lt; DCGL:</b>	Yes	
<b>Mean Value &lt; DCGL:</b>	Yes	
<b>Maximum Value &lt; DCGL<sub>emc</sub>:</b>	Yes	Class 1
<b>Total Standard Deviation &lt;= Sigma:</b>	Yes	
<b>Pass the Sign Test?</b>	Yes	
<b>Reject the Null Hypothesis?</b>	Yes	
<b>Does the Survey Unit Pass All Criteria?</b>	Yes	



### **Survey Unit Investigations and Results:**

Nine investigations (C0013BS, C0015BS, C0053BS, C0055BS; NE Corner, West Wall Junction, West Wall Corner, South Wall Juncture, and North Wall 7" Up) were required for the scan measurements and the results are reported in Attachment 3. The EMC unity rule was not exceeded as shown in Table 3-1.

### **ALARA Statement:**

As stated in Chapter 4 of the LTP, as long as the residual activity within the survey unit is less than the DCGL (i.e. the survey unit average activity is less than the DCGL and the EMC criterion has been met), the ALARA criterion has been met.

### **Changes in Initial Survey Unit Assumptions:**

The survey unit was designed as a Class 1 structure survey and the sample results are consistent with that classification. The variability of the survey results was less the characterization data used for survey design. Potential areas of elevated activity were detected and evaluated as shown in Attachment 3. Therefore the EMC criterion was met.

### **Conclusion:**

The FSS of this survey unit was properly designed as a Class 1 survey based on Table 5-4 of the LTP. The required number of direct measurements was made and the scan coverage met the requirement of Table 5-6 of the LTP. No direct measurements exceeded the DCGL of 43000 dpm/100 cm<sup>2</sup> and none of the removable surface activity measurements exceeded 10% of the DCGL. The four investigation results while exceeding in three out of four the DCGL are less than 20% of DCGL<sub>emc</sub> and pass unity.

The direct measurement data support rejection of the null hypothesis, providing high confidence that the survey unit satisfied the release criteria and that the data quality objectives were met.

It is concluded that survey unit F8130541 meets the release criteria of 10CFR20.1402.

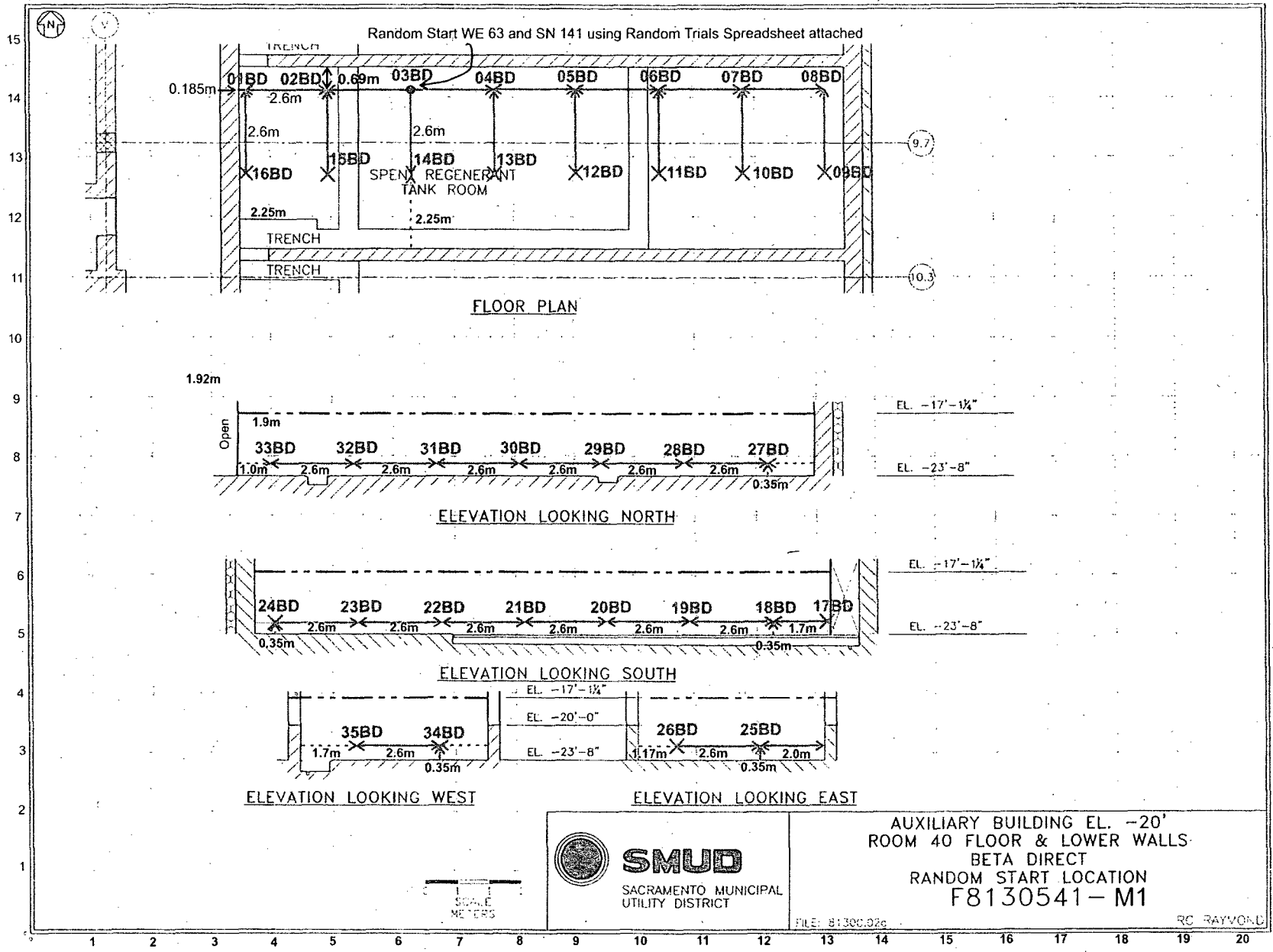
**Attachment 1**

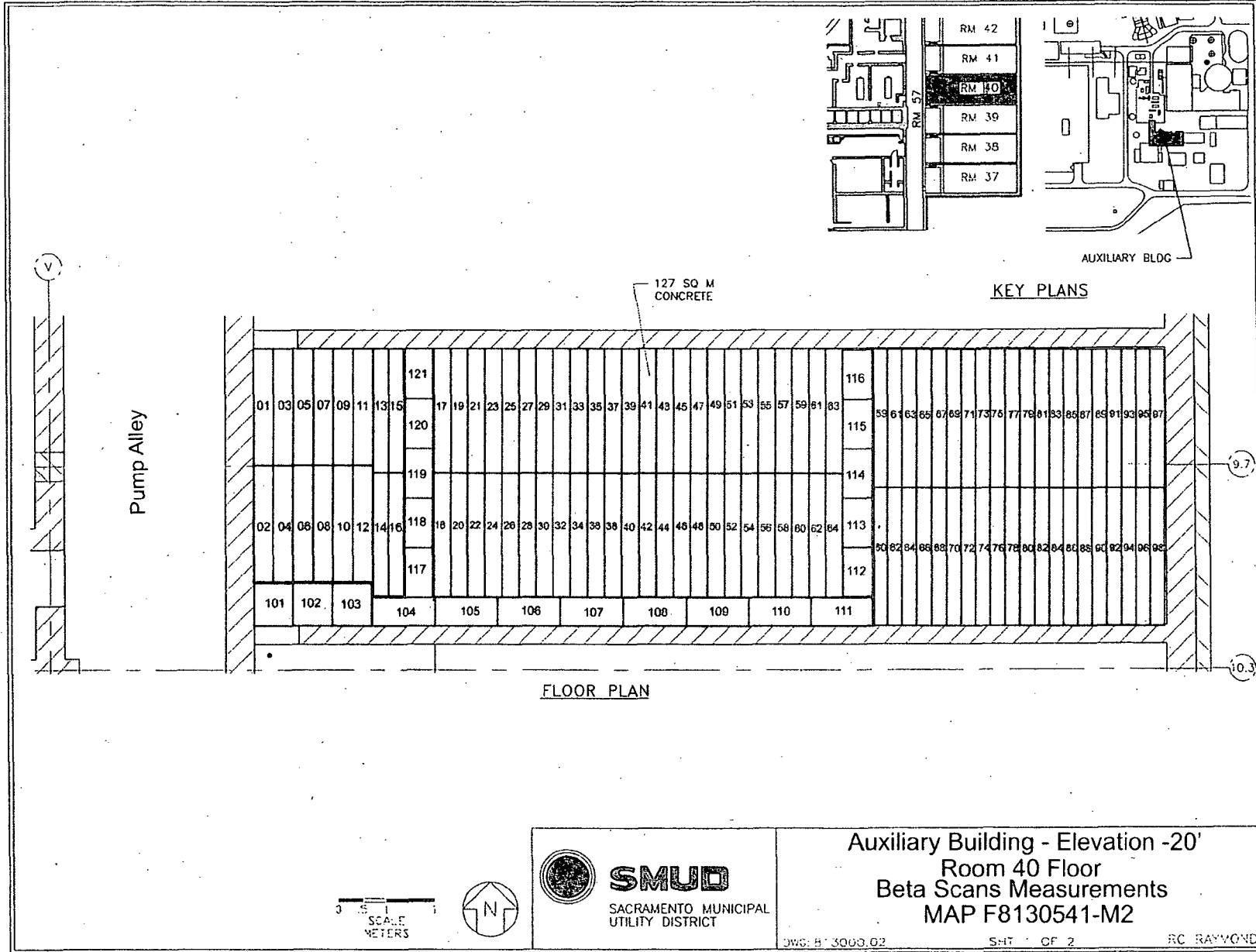
**Revision 1**

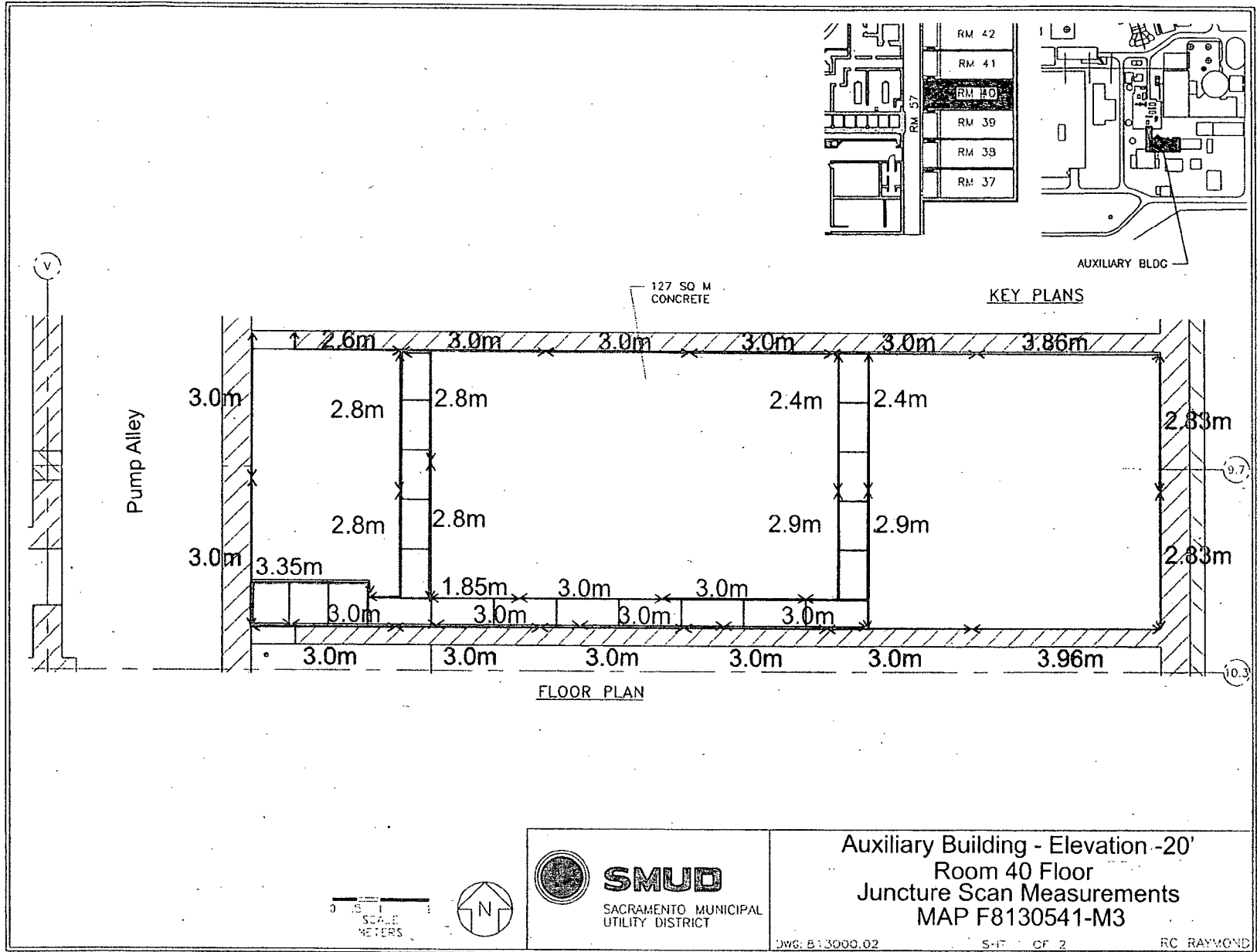
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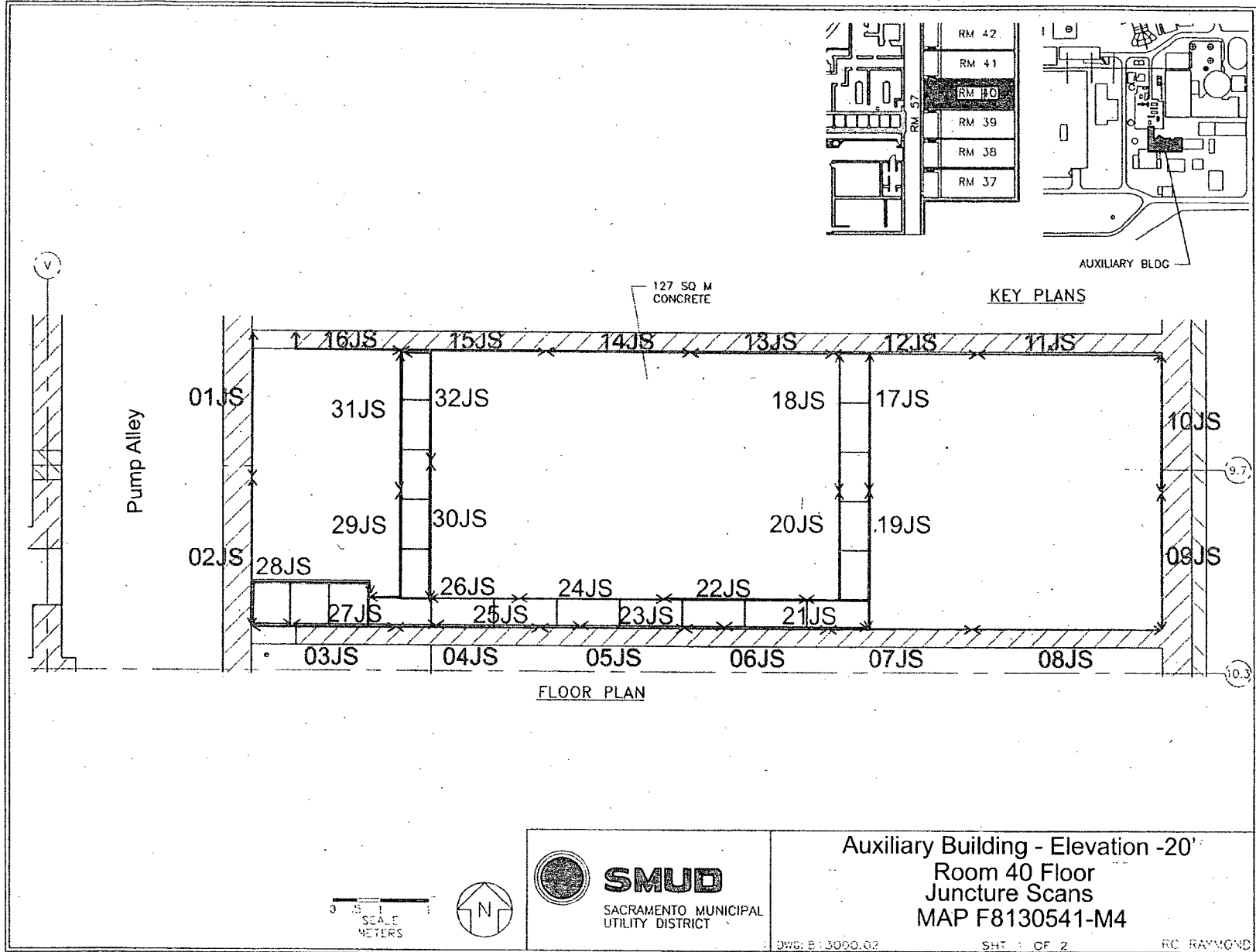
**April 17, 2008**

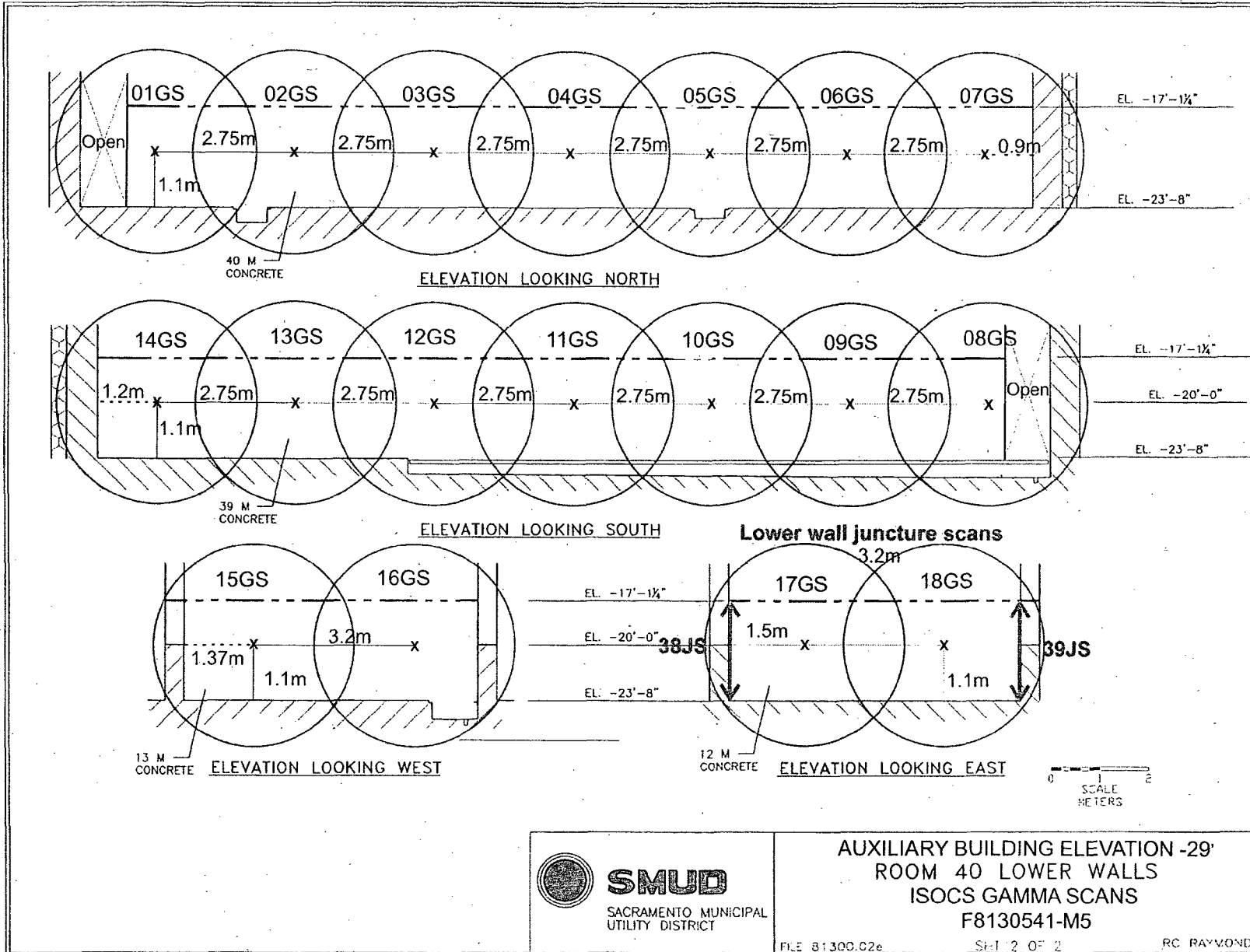
**Survey Unit F8130541**

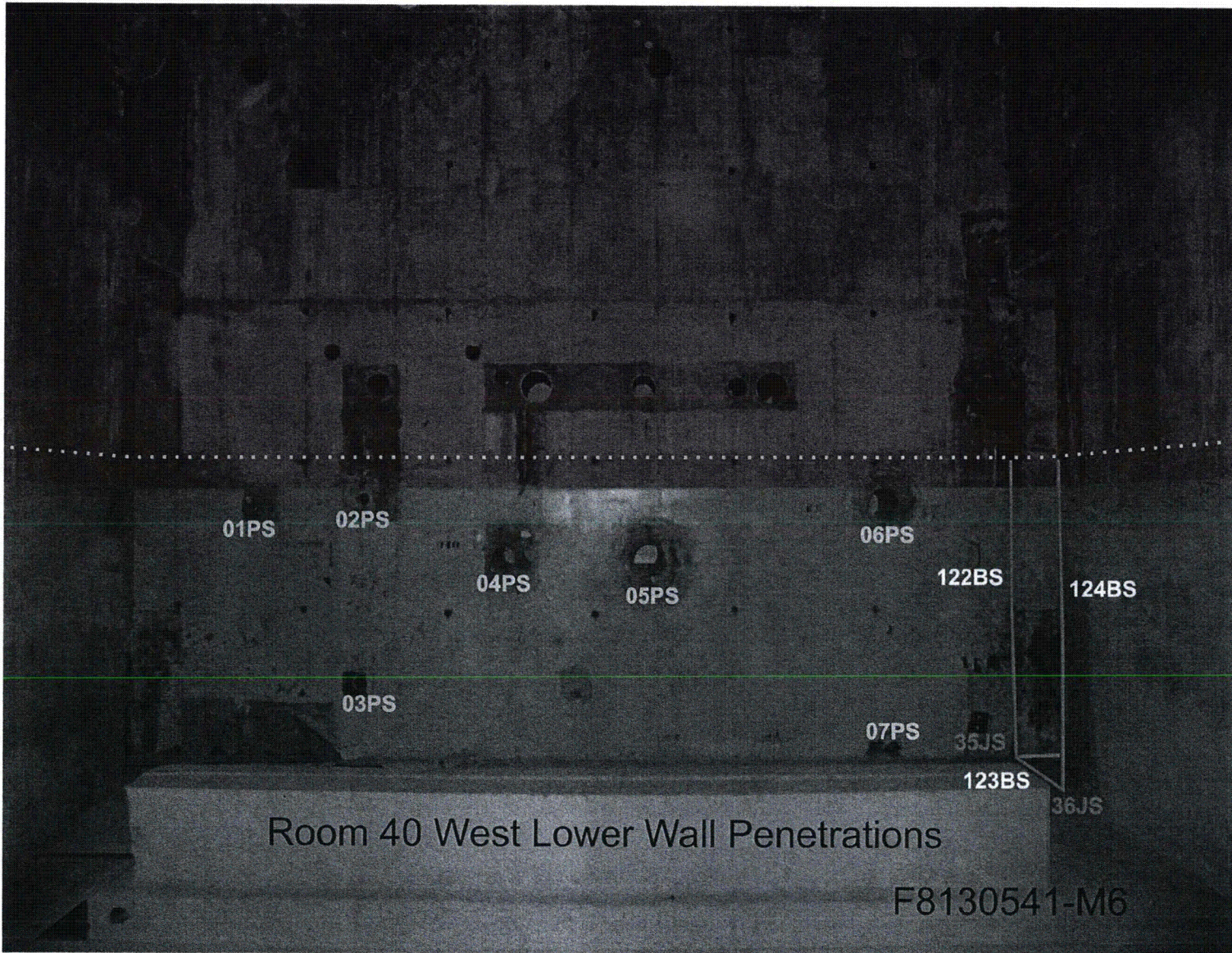




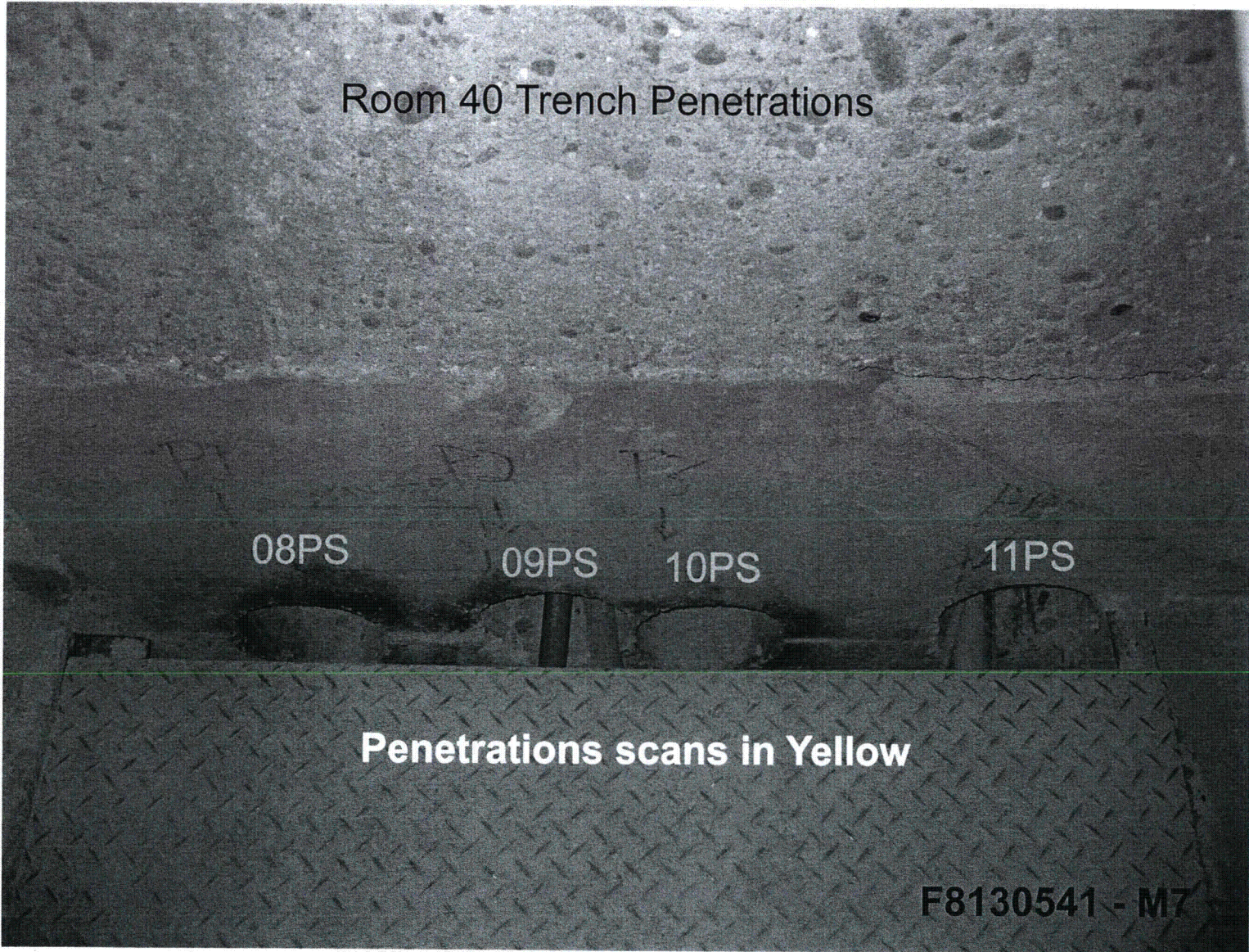


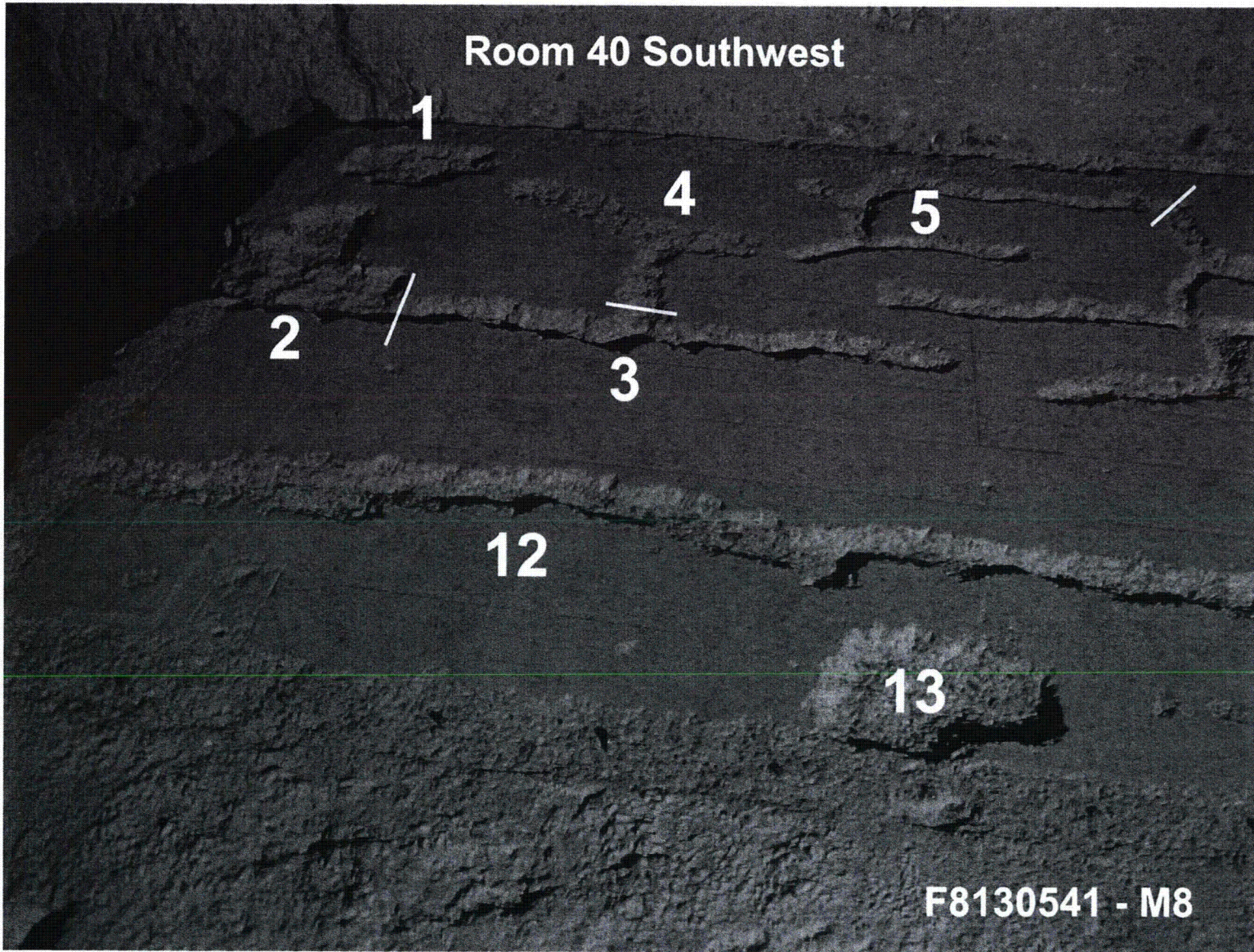


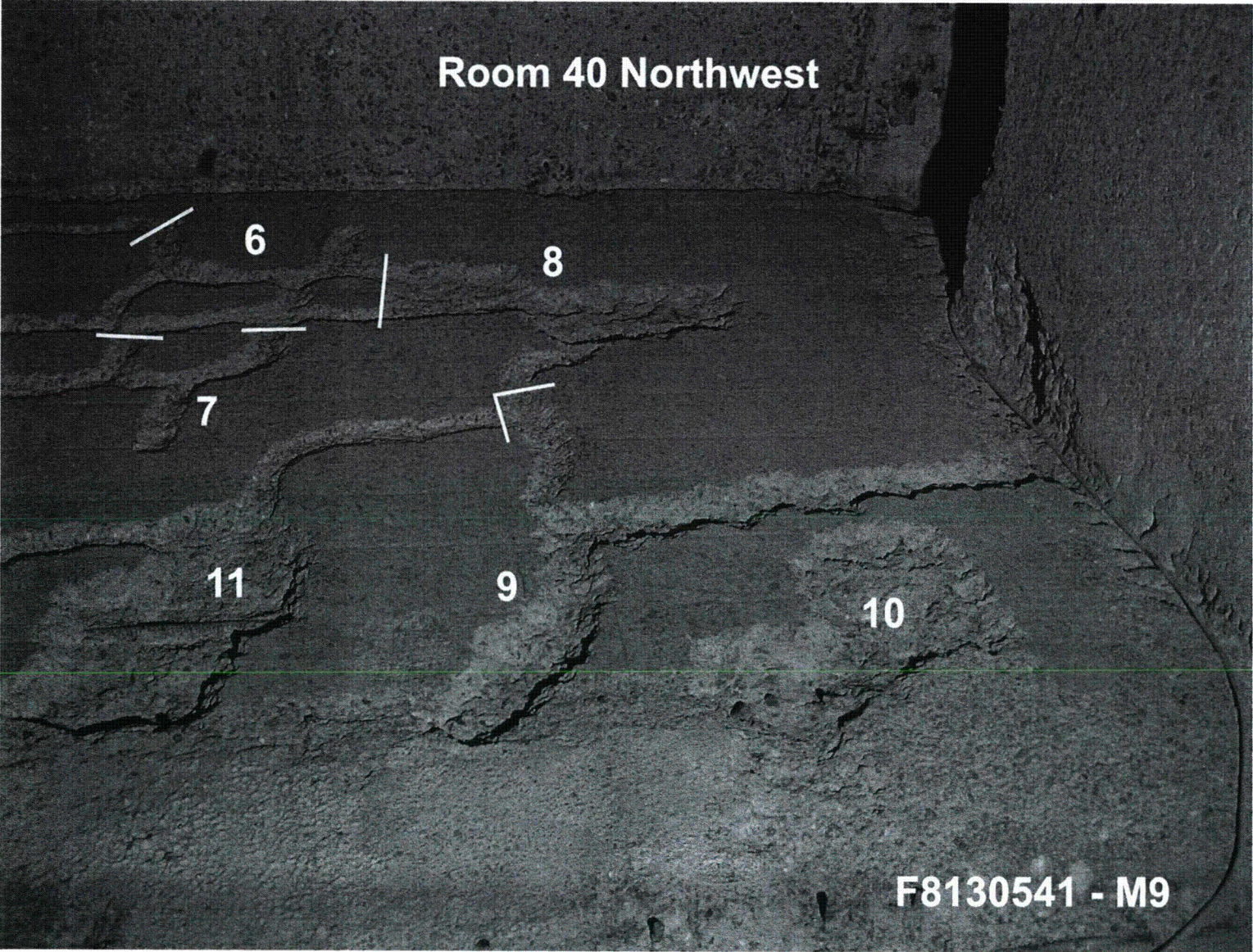




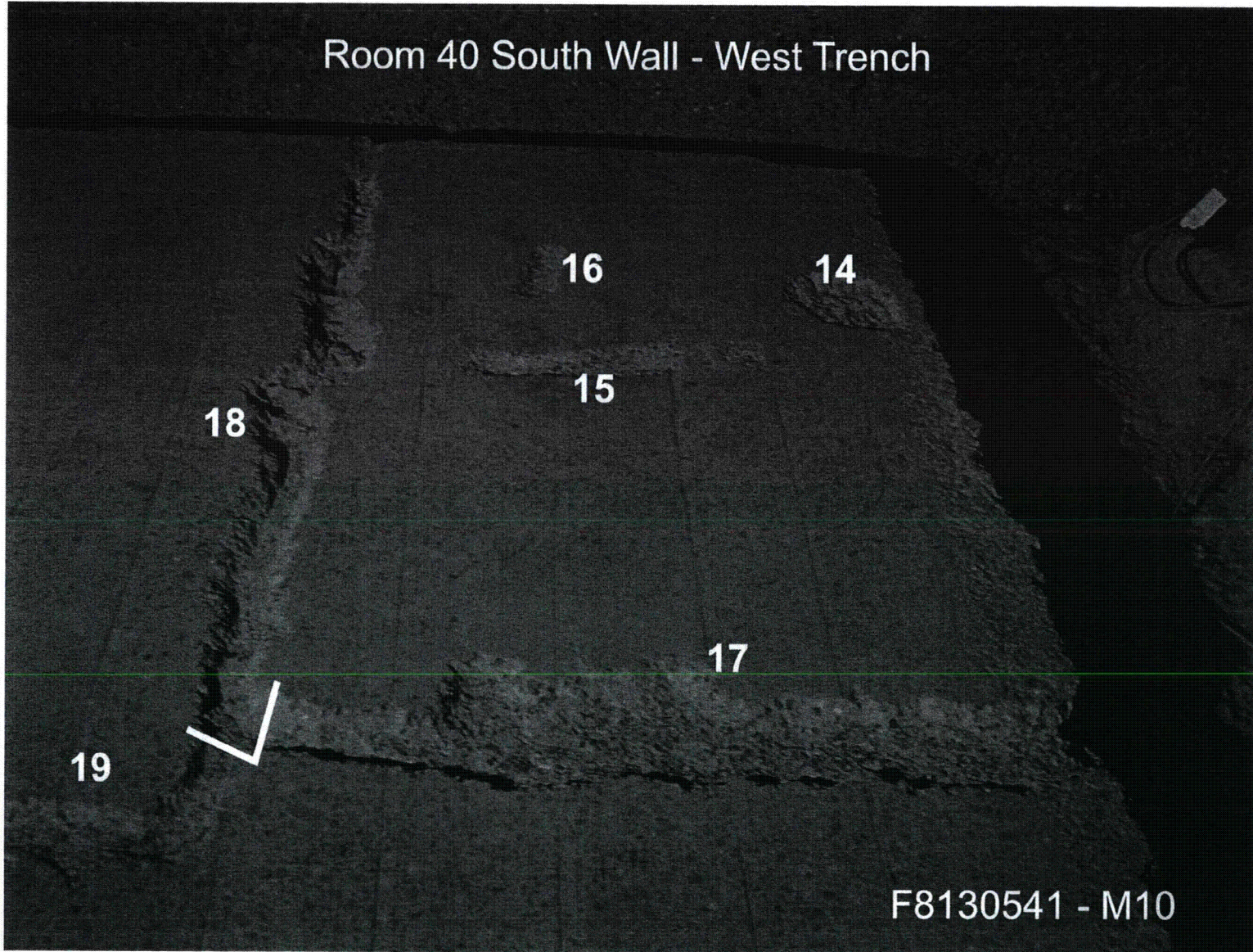




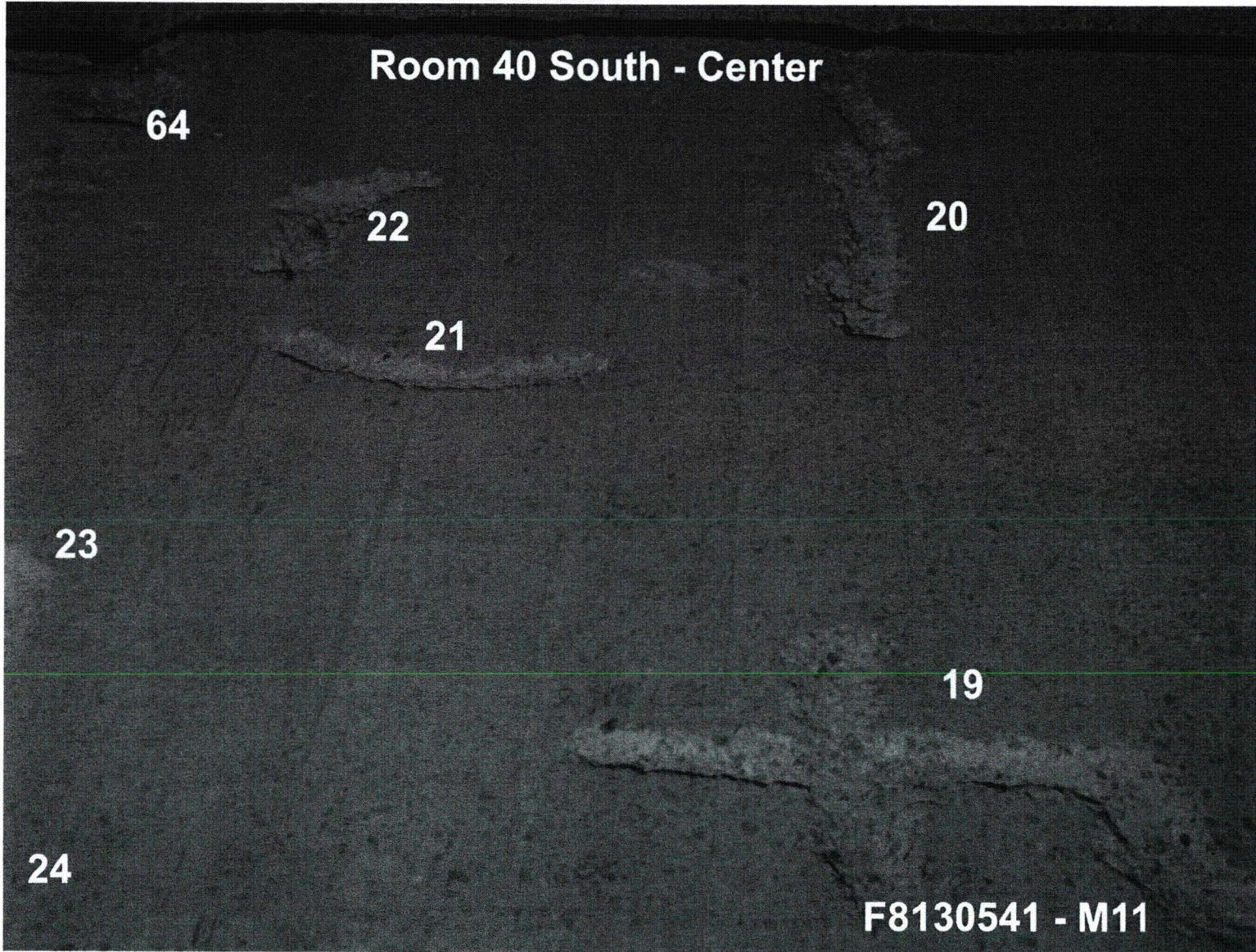


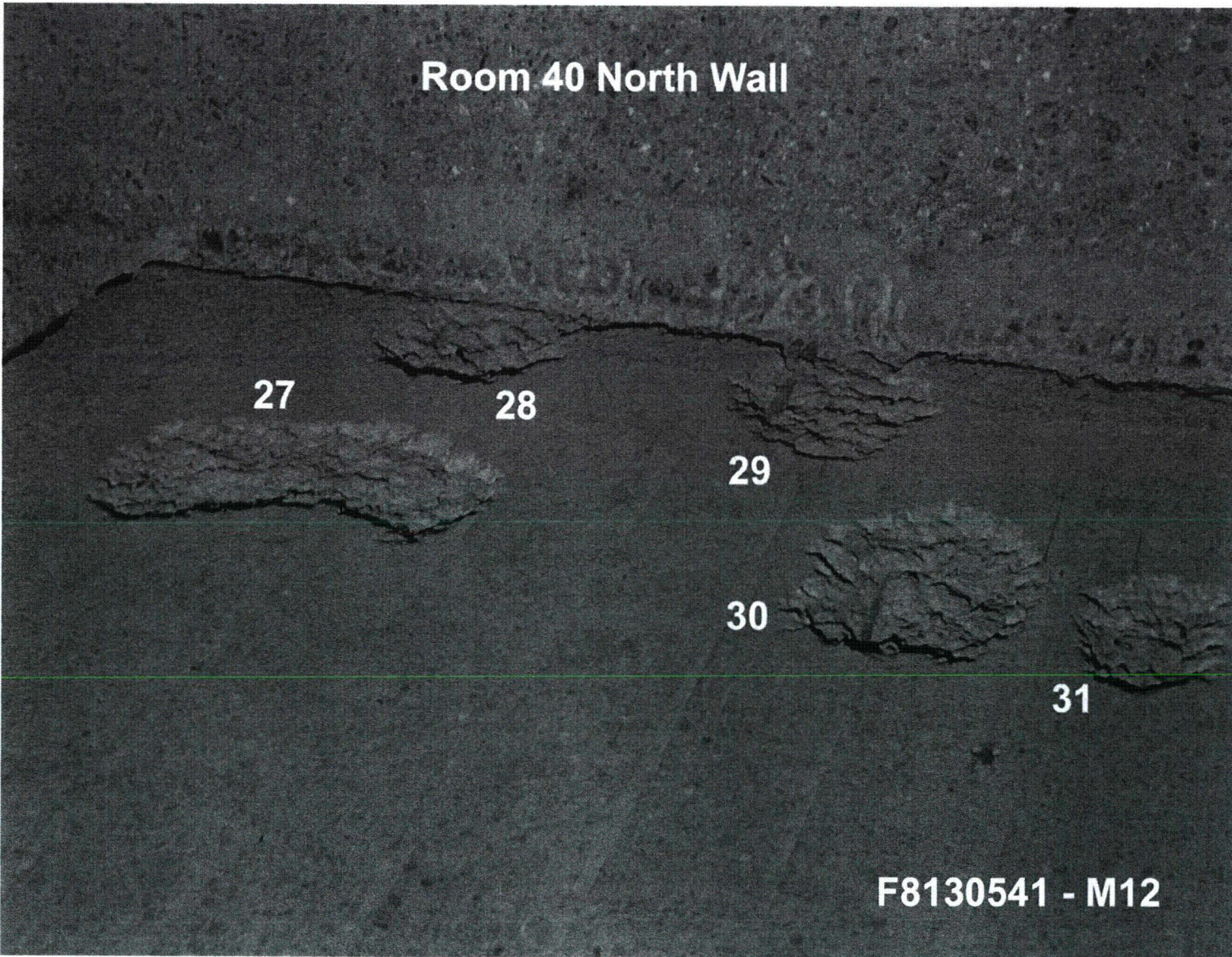


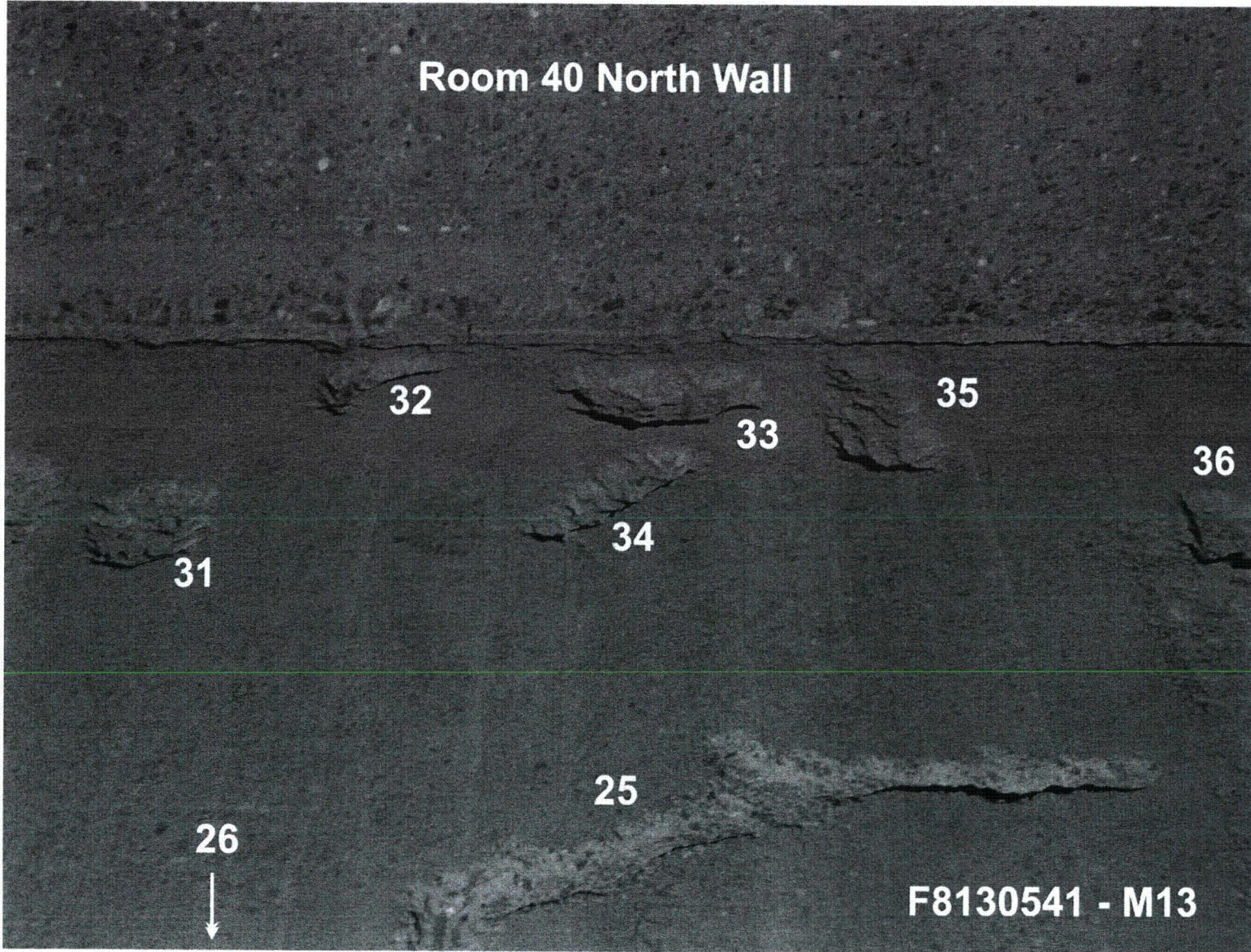
Room 40 South Wall - West Trench



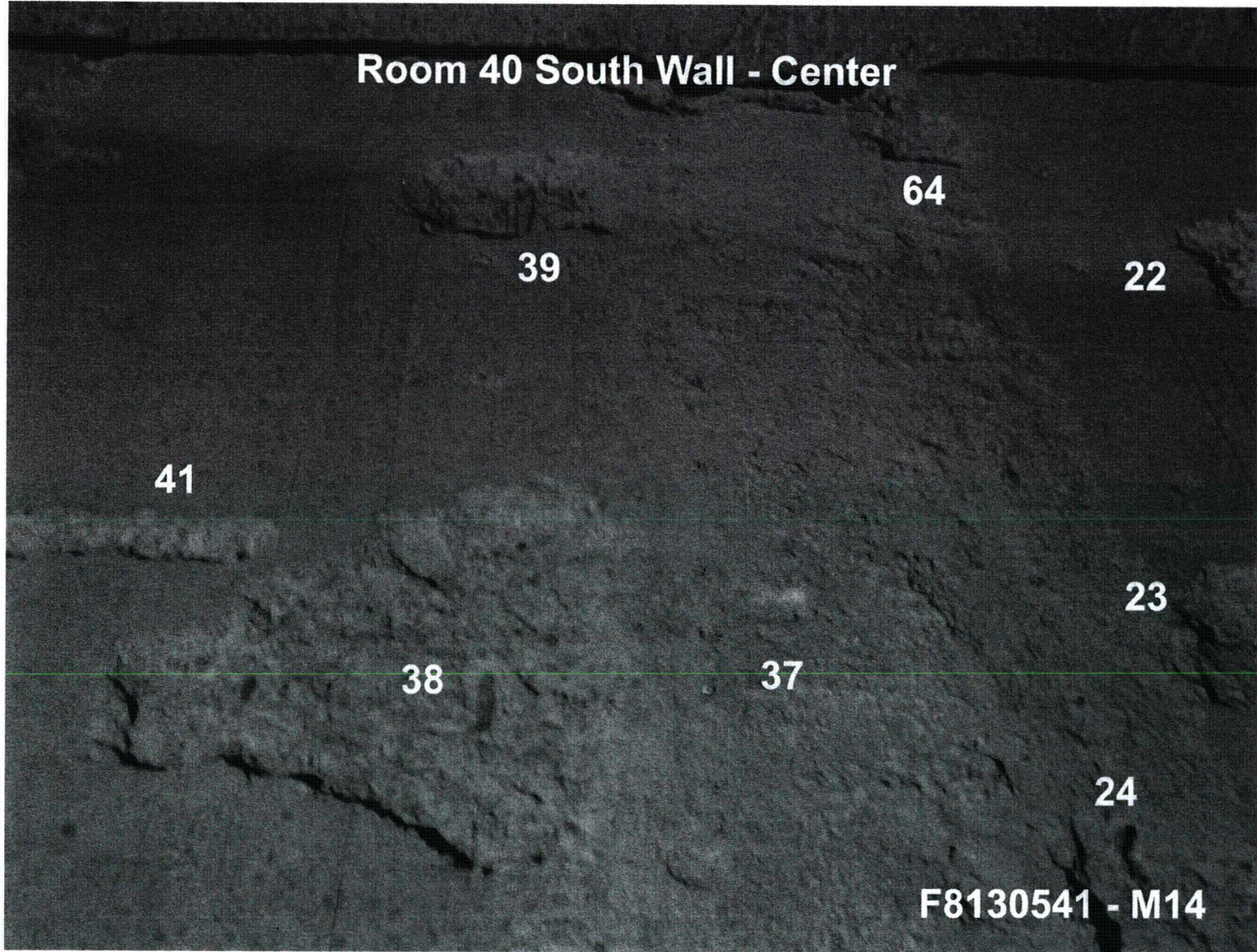
F8130541 - M10



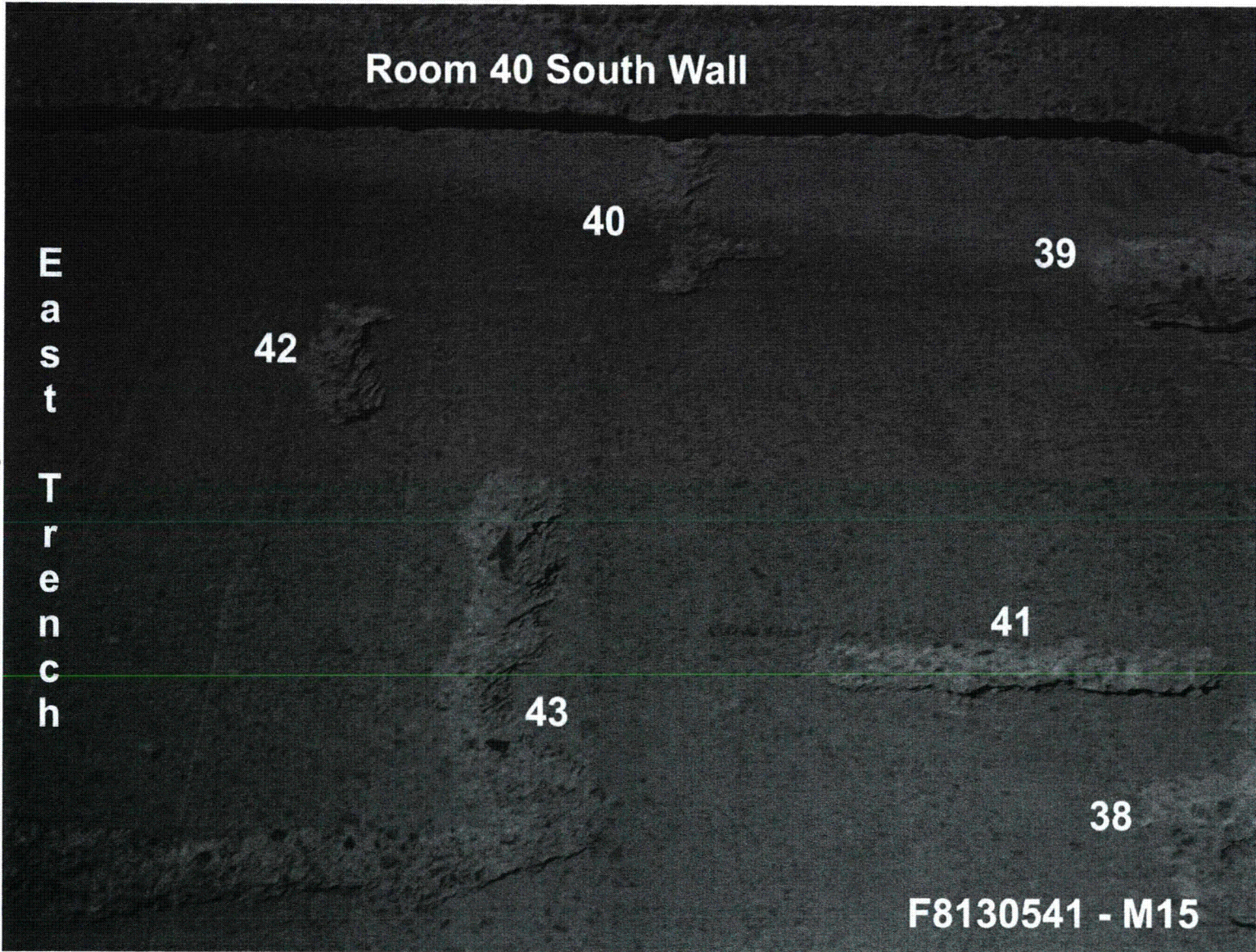


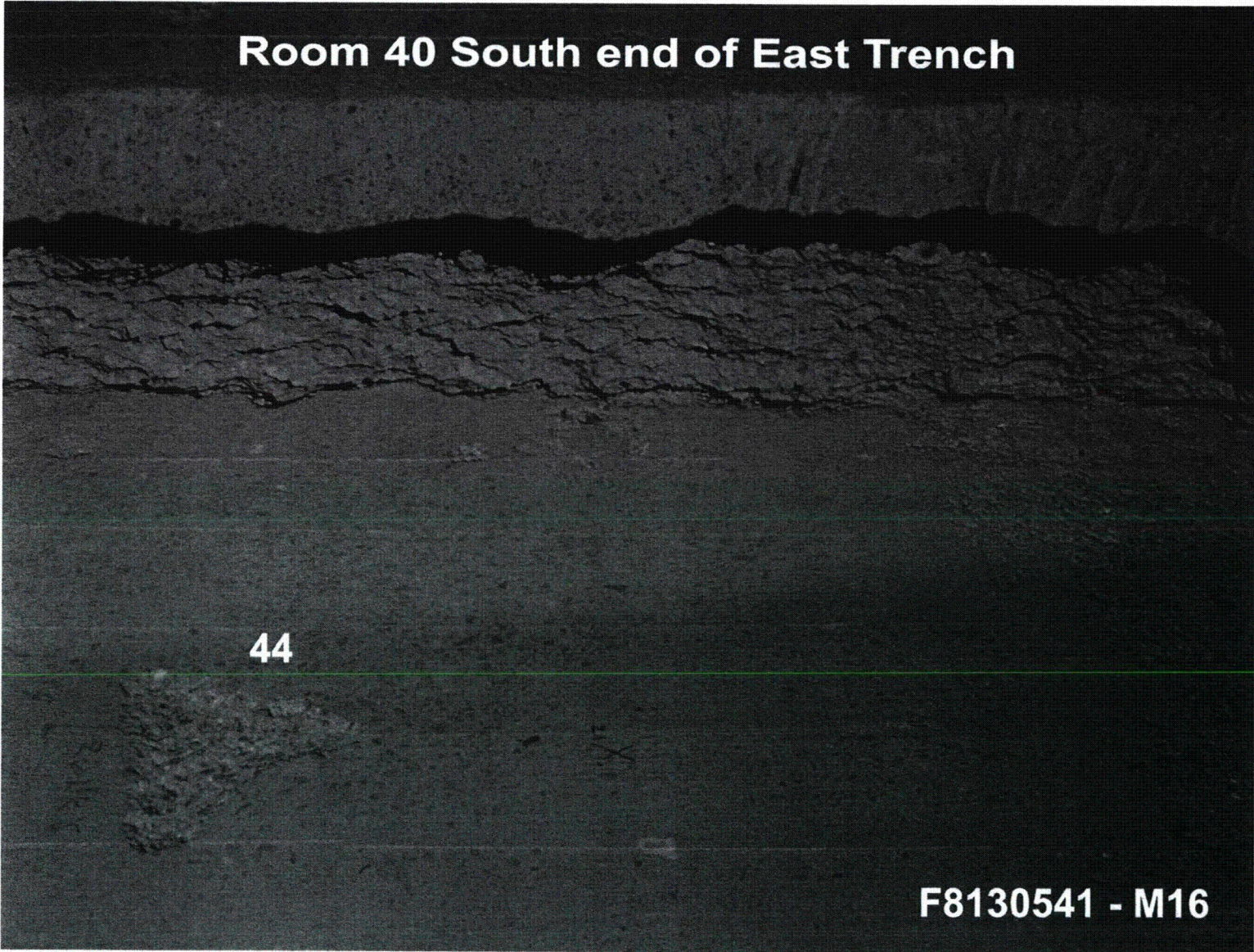


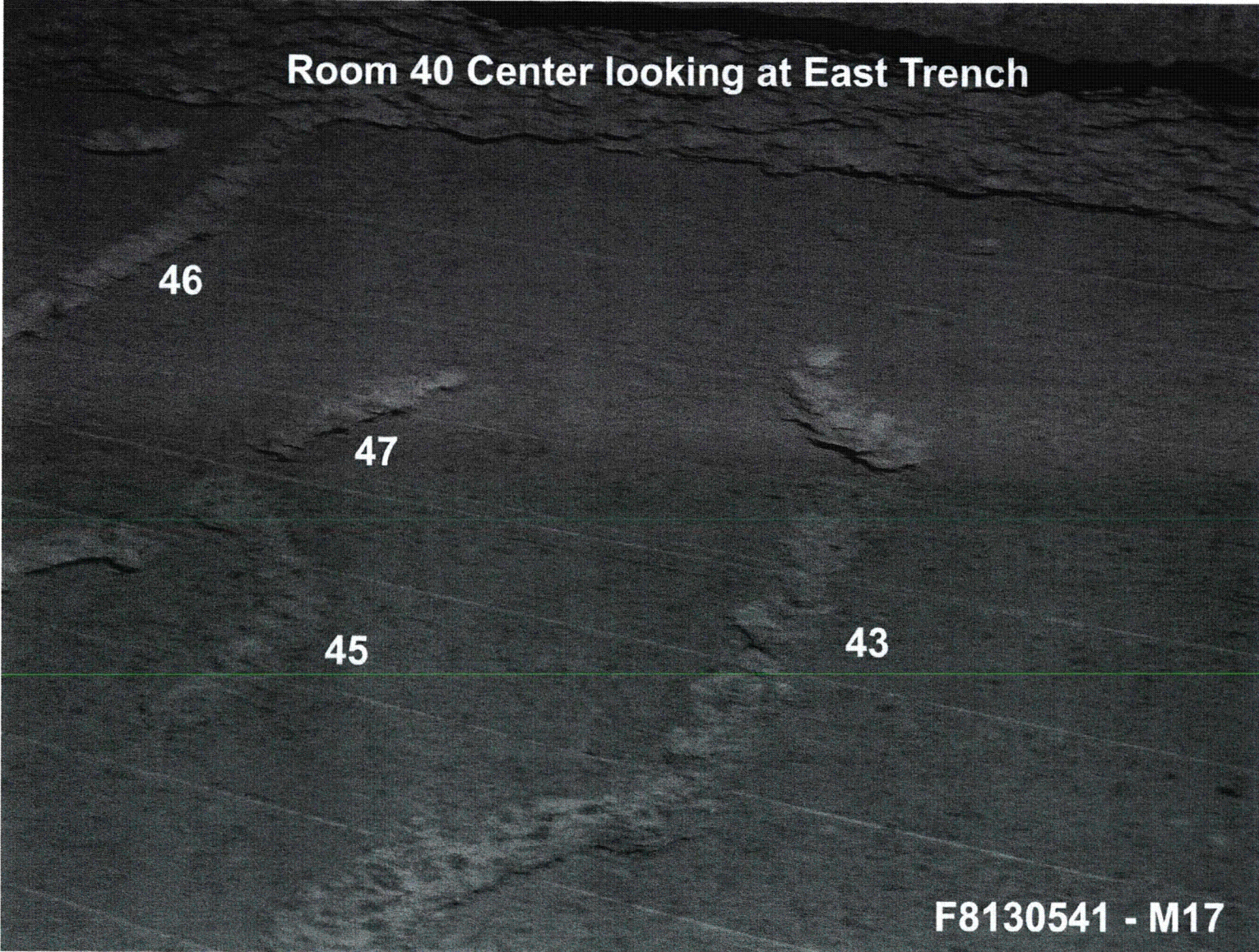
Room 40 South Wall - Center

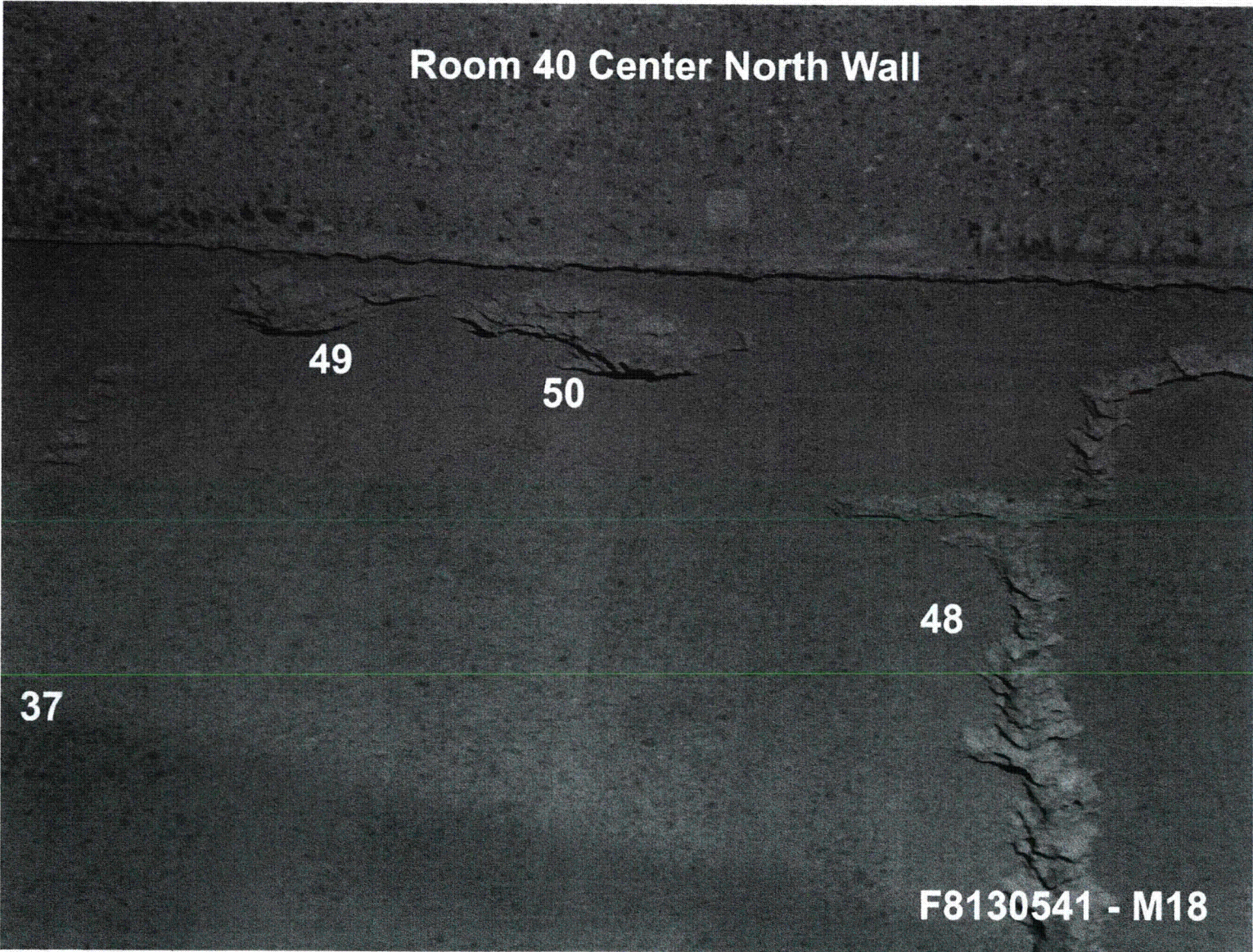


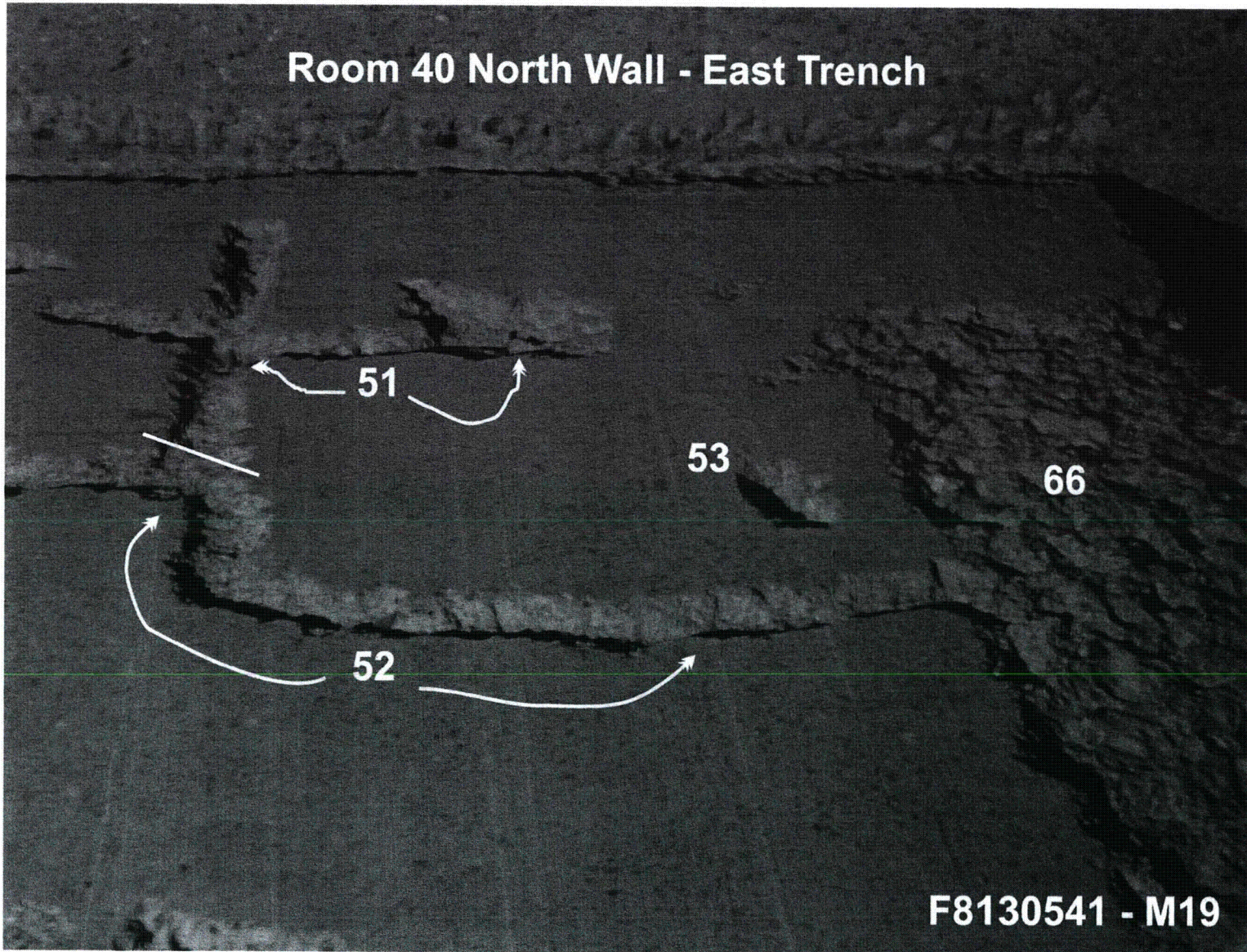


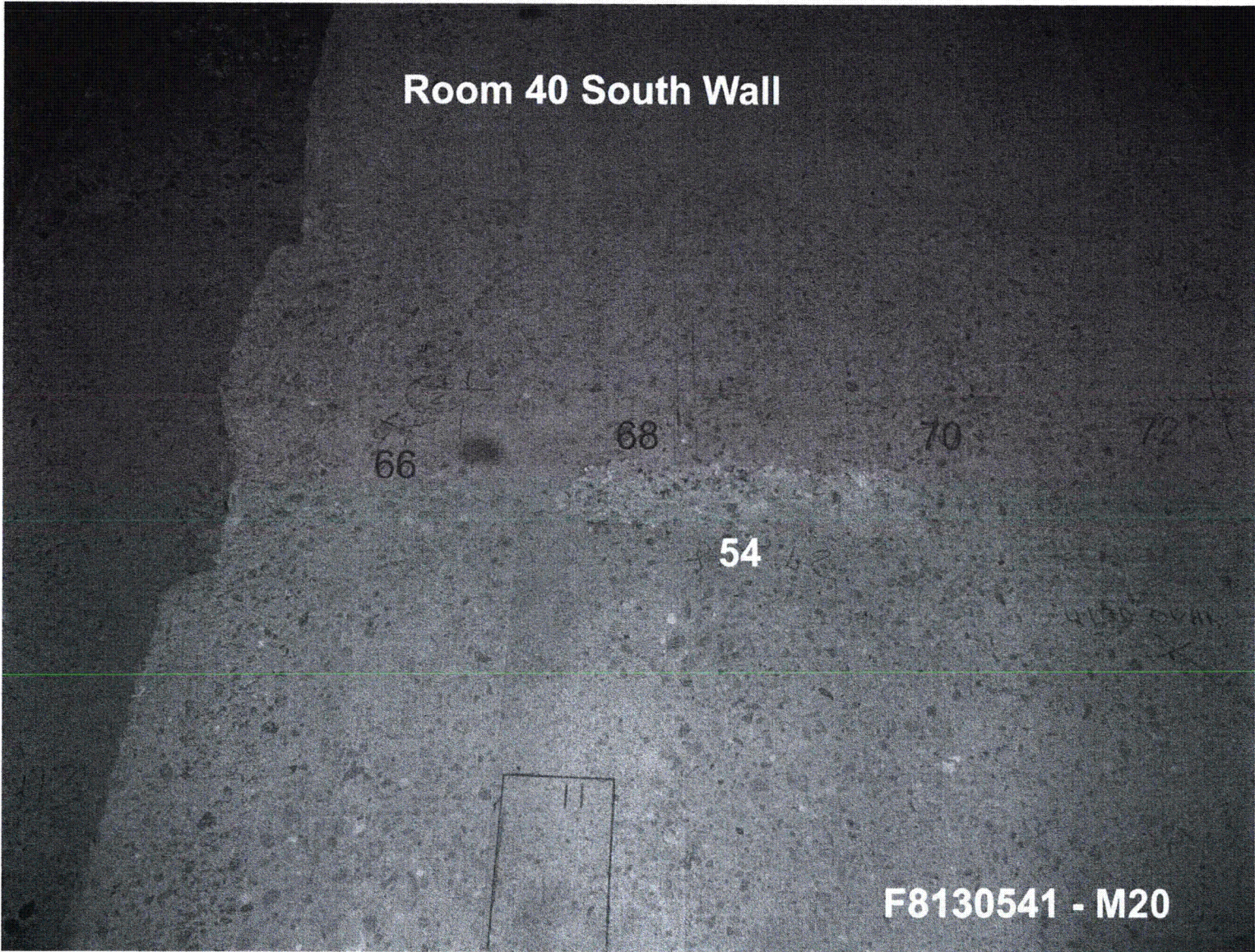


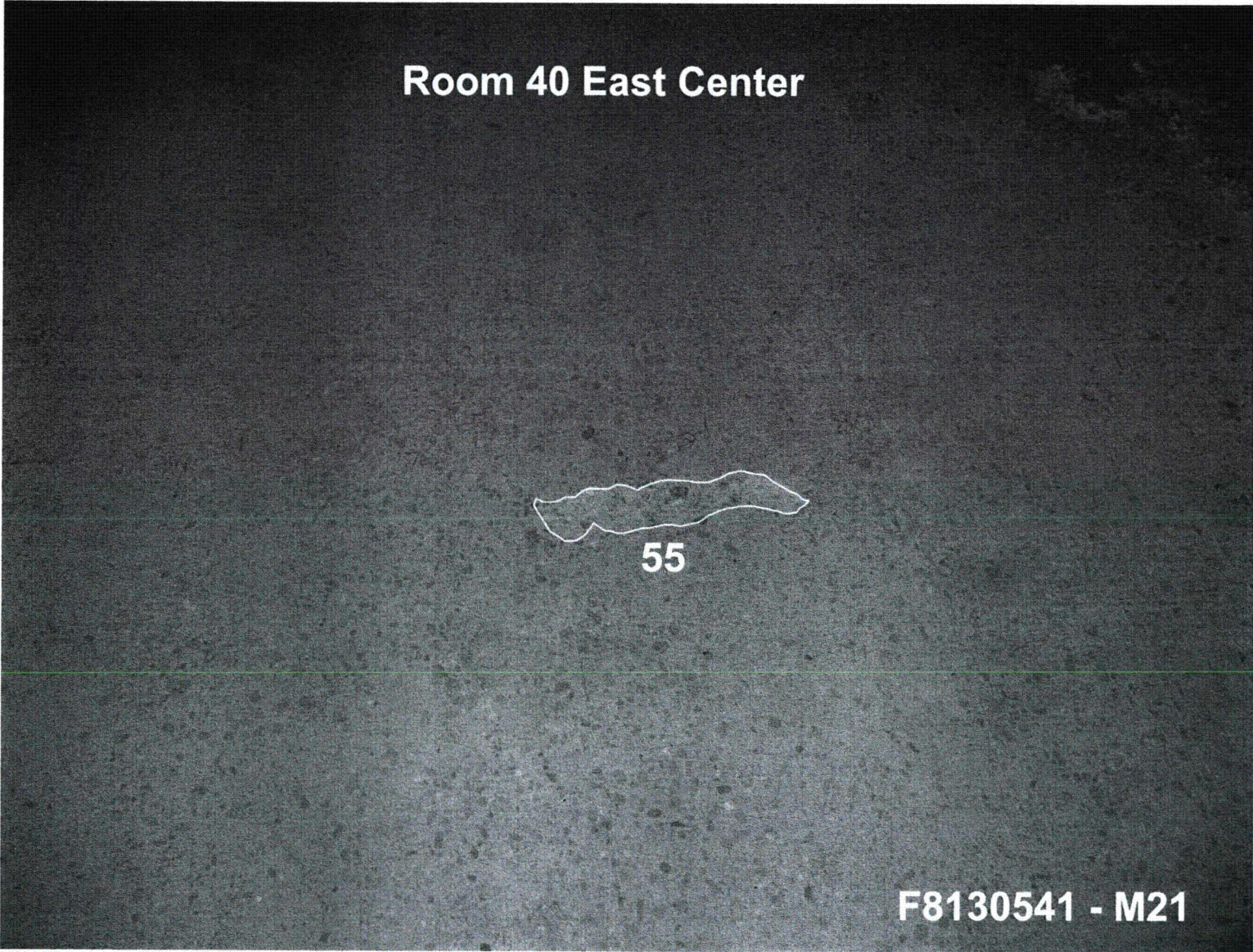








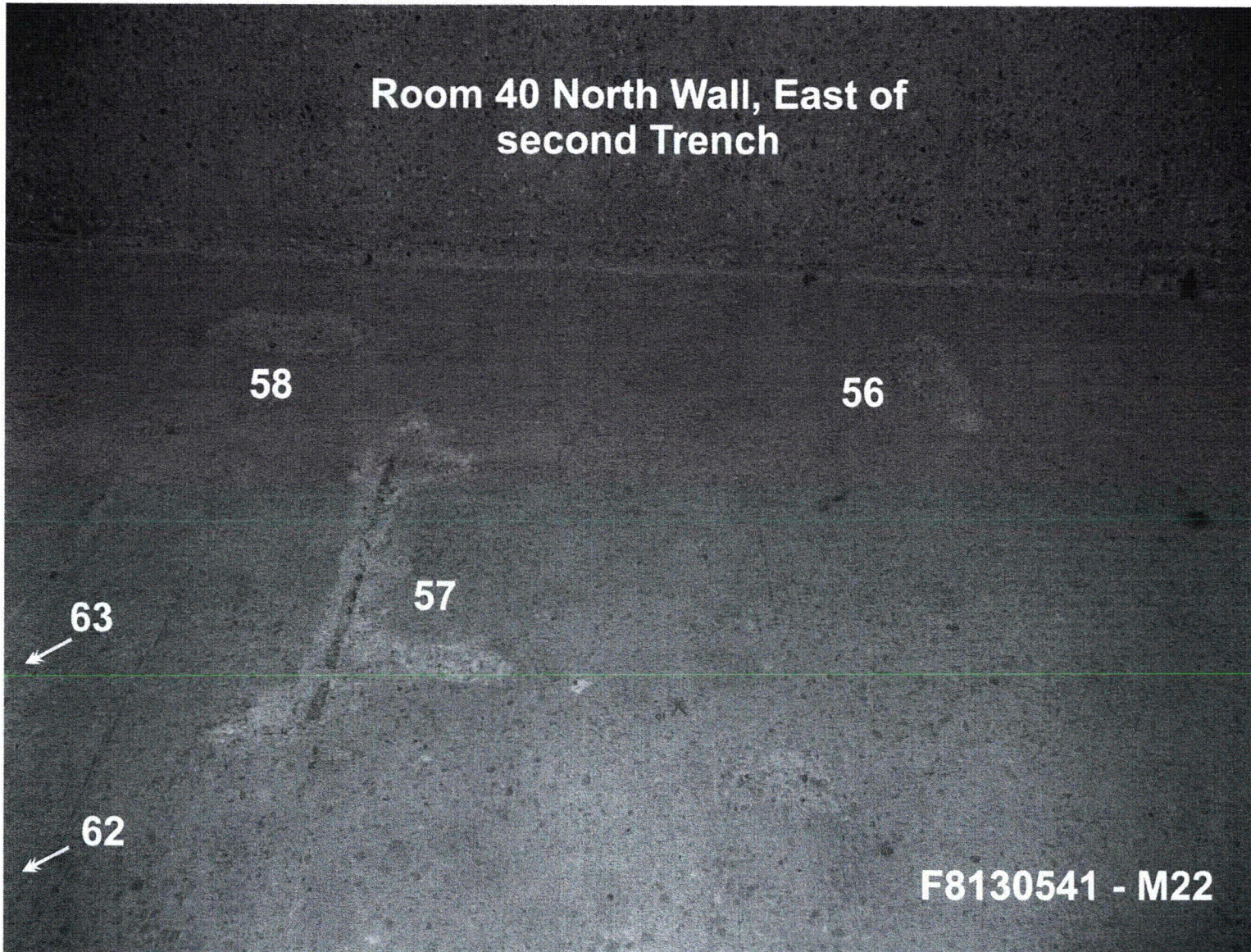




Room 40 East Center

55

F8130541 - M21



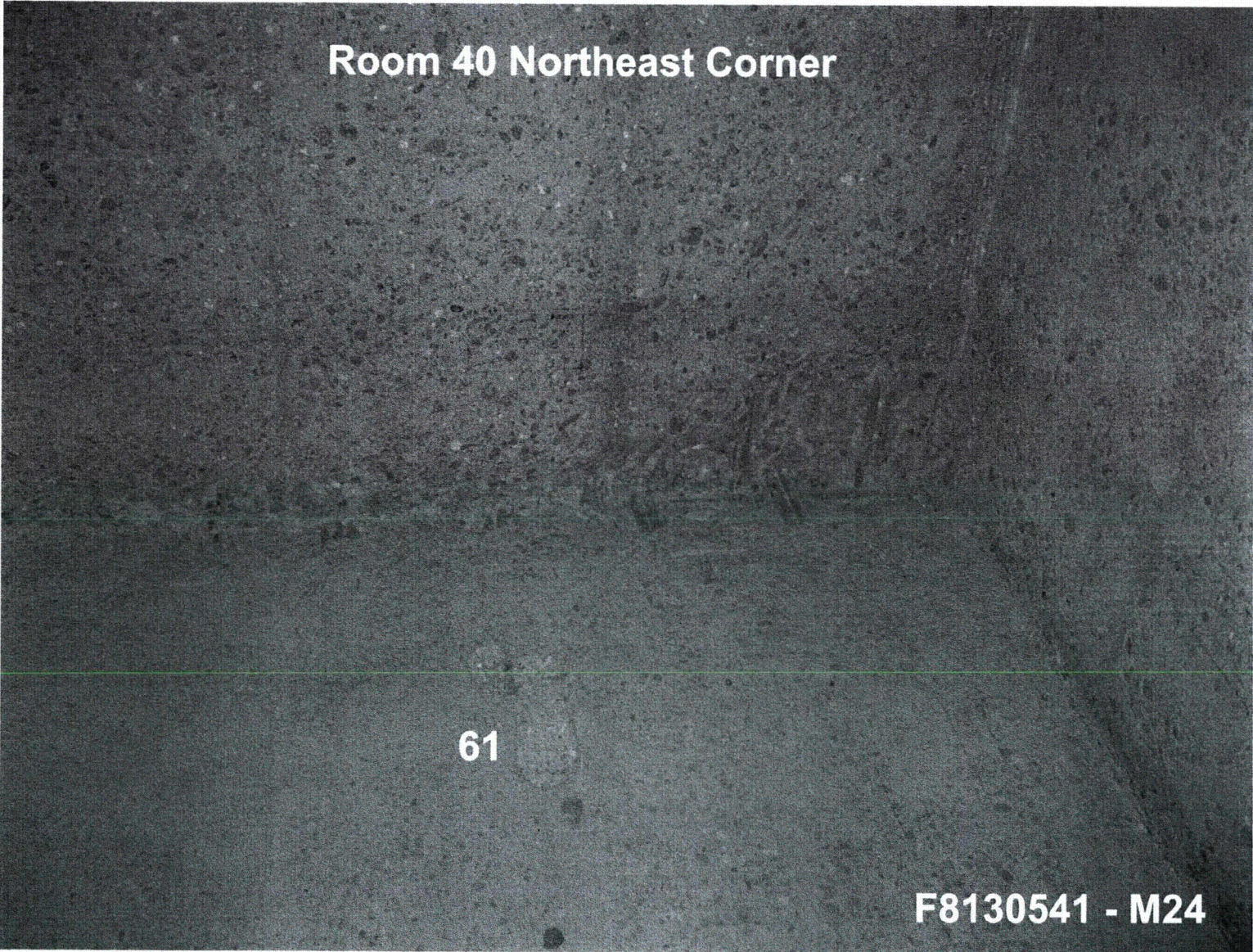


Room 40 Northeast Corner

59

60

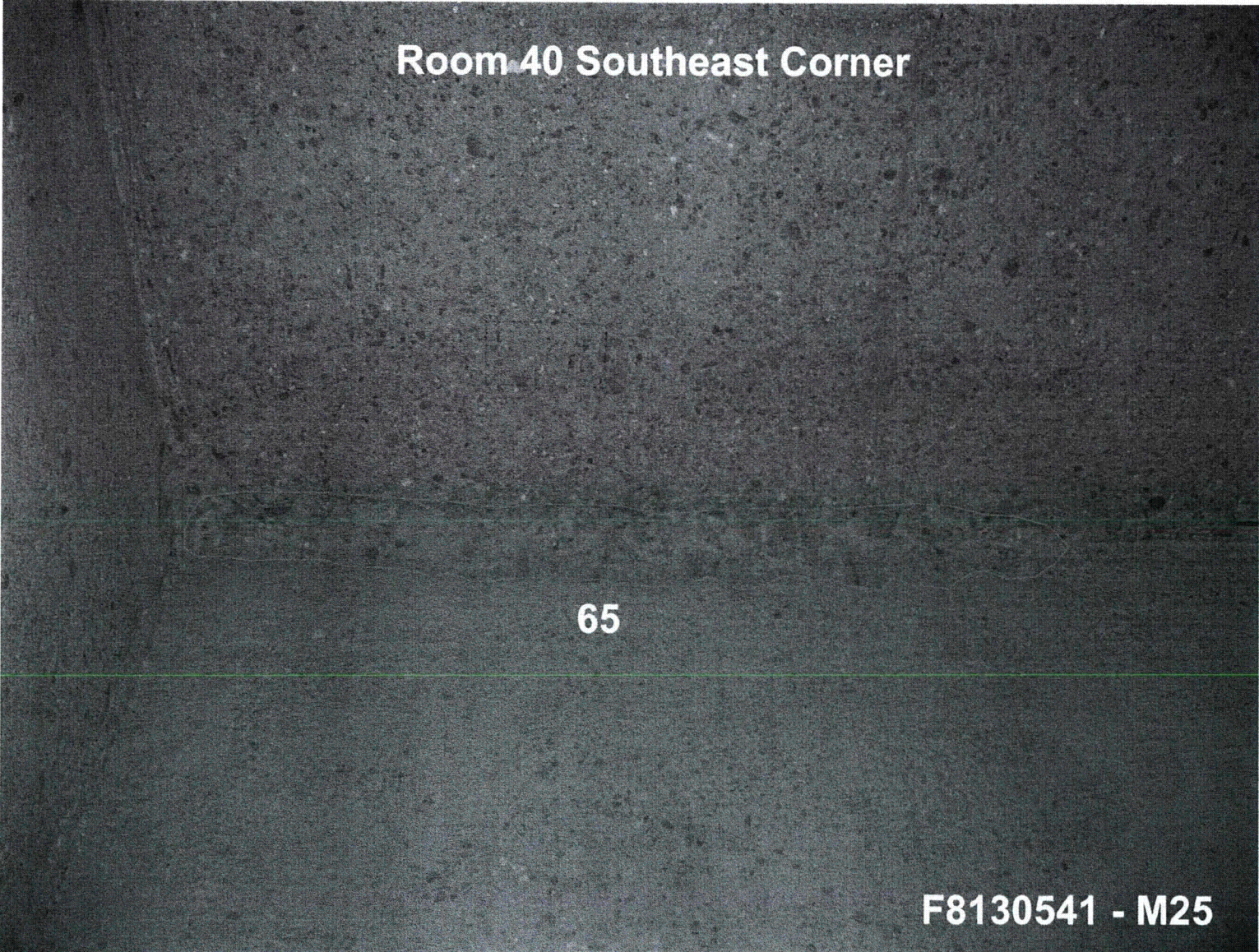
F8130541 - M23



Room 40 Northeast Corner

61

F8130541 - M24



Room 40 Southeast Corner

65

F8130541 - M25

**Attachment 2**

**Revision 1**

**Instrumentation**

**April 17, 2008**

**Survey Unit F8130541**

**Table 2-1. Survey Unit Instrumentation**

<b>Instrument Model; Serial No.</b>	<b>Detector Model; Serial No.</b>	<b>MDC Static (dpm/100 cm<sup>2</sup>)</b>	<b>MDC Scan (dpm/100 cm<sup>2</sup>)</b>
M2350; 180733	43-98B; 148638 <sup>3</sup>	590	1070
M2350; 203481	43-68B; 161405 <sup>1</sup>	433	1033
M2350; 142507	43-68B; 160781 <sup>1</sup>	433	1033
M2350; 149794	43-68/5B; 149103 <sup>1</sup>	433	1033
M2350; 142499	43-37; 148502 <sup>2</sup>	198	616
M2350; 142515	43-116-1B; 256007 <sup>4</sup>	491	739
M2350; 142515	43-116-1B; 256007 <sup>5</sup>	796	5895
Tennelec; 0401171	N/A	5 dpm α, 11 dpm β	N/A

<sup>1</sup>43-68 Surface Concrete

<sup>2</sup>43-37B Surface Concrete

<sup>3</sup>43-98B 2" Concrete

<sup>4</sup>43-116-1B Juncture Concrete

<sup>5</sup>43-116-1B Surface Concrete

**Table 2-1, Survey Unit Instrumentation**

<b>Instrument</b>	<b>Detector Serial No.</b>	<b>MDC (dpm/100cm<sup>2</sup>)</b>
ISOCS	1983920	934 Cs-137 1410 Co-60

**Table 2-2. Investigation Criteria and DCGL**

<b>Parameter</b>	<b>Value (dpm/100 cm<sup>2</sup>)</b>
Investigation Criteria - Direct	141900
Investigation Criteria – Scan	141900
DCGL <sub>W</sub>	43000
DCGL <sub>EMC</sub>	141900

<b>Instrument</b>	<b>Parameter</b>	<b>Value (dpm/100cm<sup>2</sup>) To detect a 100 cm<sup>2</sup> hot spot at the EMC Criterion within the detector field of view</b>
ISOCS	Investigation Criteria – Scan	Concrete 190,000 Cs-137 64,000 Co-60

**Attachment 3**

**Revision 1**

**Investigation**

**April 17, 2008**

**Survey Unit F8130541**

**Attachment 3**

**Revision 1**

**Investigation**

**May 1, 2008**

**Survey Unit F8130541**



**Table 3-1 Survey Unit Investigation**

<i>Grid/Location</i>	<i>Investigation Level (cpm)</i>	<i>Initial Value (cpm)</i>	<i>Investigation Result (cpm)</i>	<i>Elevated Area (m<sup>2</sup>)</i>	<i>Area Factor</i>	<i>DCGL<sub>emc</sub></i>	<i>Investigation Result (dpm/100cm<sup>2</sup>)</i>	<i>DCGL<sub>emc</sub> Unity Fraction</i>
<sup>1</sup> C0013BS	14200	20765	17007	.01	1290	5.55e7	124760	0.0023
<sup>1</sup> C0015BS	14200	27896	3273	.01	1290	5.55e7	70542	0.0013
<sup>1</sup> C0053BS	14200	22202	16106	.01	1290	5.55e7	118170	0.0021
<sup>1</sup> C0055BS	14200	18026	13062	.01	1290	5.55e7	95836	0.0017
<sup>2</sup> Grid 95 NE Corner	36000	67000	N/A	.01	1290	5.55e7	2.18e6	0.0393
<sup>2</sup> Grid 02 W Wall Junction	36000	125000	N/A	.01	1290	5.55e7	3.11e6	0.0560
<sup>2</sup> Grid 101 W Wall Corner	36000	54000	N/A	.01	1290	5.55e7	2.44e5	0.0044
<sup>2</sup> Grid 104 S Wall Juncture	36000	58000	N/A	.01	1290	5.55e7	1.34e6	0.0024
<sup>2</sup> Grid 07 N Wall 7" Up	36000	75000	N/A	.01	1290	5.55e7	6.16e5	0.0111
<sup>2</sup> Grid 113 Surface	36000	37211	N/A	.01	1290	5.55e7	1.65e5	0.0030
<sup>2</sup> Grid 61 Juncture	36000	40380	N/A	.01	1290	5.55e7	1.22e6	0.0220
<sup>2</sup> Grid 107 Surface	36000	36371	N/A	.01	1290	5.55e7	1.94e5	0.0035
Survey Unit Remainder						DCGL = 43,000	SU Mean = 4677	0.1088
EMC Unity Sum								0.2564

<sup>1</sup>Scans were performed with 2350-1 w/43-37B and the investigation level was determined using 100 cm<sup>2</sup> versus the actual area of the probe of 584 cm<sup>2</sup>.

<sup>1</sup>The investigation was performed using a 43-68B with an investigation level of 19,200 cpm. Grid C0015BS was remediated and final scan was performed with 43-116-1B with an investigation level of 3630 cpm.

<sup>2</sup>The investigation level was determined with the 44-10 detector in contact with the floor resulting in an investigation level of 36000 cpm.

<sup>2</sup>Gamma scans were performed to complete confirmatory surveys performed following completion of remediation in the adjacent areas to identify any potential particle contamination and eight elevated areas were identified. The identified areas were further bounded and analyzed with InSpector 1000.

**Attachment 4**

**Revision 1**

**Data Assessment**

**April 17, 2008**

**Survey Unit F8130541**

