
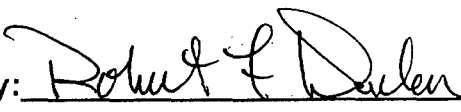


**Rancho Seco**  
**Final Status Survey Summary Report**  
**Revision 1**  
**May 1, 2008**  
**Room 41 Lower Walls and Floor**  
**Survey Unit F8130561**

Prepared By:  Date: 5-1-2008  
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Reviewed By:  Date: 6/28/08  
Lead FSS Engineer

Approved By:  Date: 2-27-09  
Dismantlement Superintendent, Radiological

## FINAL STATUS SURVEY SUMMARY REPORT

### Survey Unit:

F8130561, Room 41 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 236 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 are 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 41 Lower Walls and Floor
<b>Survey Unit:</b>	0561	Structure Surface
<b>Class:</b>	1	LTP Table 5-4
<b>SU Area (m<sup>2</sup>):</b>	236	
<b>Evaluator:</b>	Frank	
<b>DCGL (dpm/100 cm<sup>2</sup>):</b>	43000	Gross Activity DCGL
<b>Area Factor:</b>	3.3	Class 1
<b>Design DCGLemc (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 to determine area factor/emc
<b>Sample Area (m<sup>2</sup>):</b>	6.94	Class 1
<b>Scan Area (m<sup>2</sup>):</b>	236	
<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>	34	Class 1
<b>Grid Spacing L:</b>	2.6	Class 1

## Survey Results:

A total of 40 direct measurements were made in F8130561. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. One of the scan measurements indicated areas of elevated activity. Scan activity ranged from 2006 to 59501 dpm/100 cm<sup>2</sup>, based on a surveyor efficiency of 0.5 and no background subtracted. 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> )
F8130561-C0001BD	3538
F8130561-C0002BD	2526
F8130561-C0003BD	3112
F8130561-C0004BD	2848
F8130561-C0005BD	2142
F8130561-C0006BD	2495
F8130561-C0007BD	2438
F8130561-C0008BD	2500
F8130561-C0009BD	6282
F8130561-C0010BD	5530
F8130561-C0011BD	2339
F8130561-C0012BD	2298
F8130561-C0013BD	11884
F8130561-C0014BD	2630
F8130561-C0015BD	2090
F8130561-C0016BD	3455
F8130561-C0017BD	2267
F8130561-C0018BD	2397
F8130561-C0019BD	4098
F8130561-C0020BD	3315
F8130561-C0021BD	2179
F8130561-C0022BD	1764
F8130561-C0023BD	1883
F8130561-C0024BD	4020
F8130561-C0025BD	1696
F8130561-C0026BD	1535
F8130561-C0027BD	1525
F8130561-C0028BD	1675
F8130561-C0029BD	1509
F8130561-C0030BD	1577
F8130561-C0031BD	1541
F8130561-C0032BD	1790
F8130561-C0033BD	1862
F8130561-C0034BD	1909
F8130561-C0035BD	1644
F8130561-C0036BD	1769

Measurement ID	Gross Activity (dpm/100 cm <sup>2</sup> )
F8130561-C0037BD	1738
F8130561-C0038BD	1323
F8130561-C0039BD	1468
F8130561-C0040BD	1240
Mean:	2646
Median:	2160
Standard Deviation:	1849
Range:	1240 - 11884

**Table 3. Removable Surface Activity Results**

<b>Measurement ID</b>	<b>Surface Beta Activity (dpm/100 cm<sup>2</sup>)</b>
F8130561C0001SM	117.66
F8130561C0002SM	88.18
F8130561C0003SM	18.96
F8130561C0004SM	81.77
F8130561C0005SM	80.49
F8130561C0006SM	15.11
F8130561C0007SM	70.23
F8130561C0008SM	70.23
F8130561C0009SM	77.93
F8130561C0010SM	95.87
F8130561C0011SM	68.95
F8130561C0012SM	43.31
F8130561C0013SM	108.69
F8130561C0014SM	47.16
F8130561C0015SM	30.49
F8130561C0016SM	97.15
F8130561C0017SM	49.72
F8130561C0018SM	20.24
F8130561C0019SM	70.23
F8130561C0020SM	53.57
F8130561C0021SM	15.11
F8130561C0022SM	9.98
F8130561C0023SM	1.01
F8130561C0024SM	12.55
F8130561C0025SM	1.01
F8130561C0026SM	4.86
F8130561C0027SM	3.58
F8130561C0028SM	3.58
F8130561C0029SM	2.29
F8130561C0030SM	4.86
F8130561C0031SM	3.58
F8130561C0032SM	2.29
F8130561C0033SM	18.96
F8130561C0034SM	4.86
F8130561C0035SM	3.58
F8130561C0036SM	11.27
F8130561C0037SM	11.27
F8130561C0038SM	2.29
F8130561C0039SM	3.58
F8130561C0040SM	3.58
Mean:	35.75
Median:	17.03
Standard Deviation:	36.64
Range:	1.01 to 117.66

**Survey Unit Data Assessment:**

The survey design required 40 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	Average Ambient BKG = 0
<b>Ambient Background Used</b> (dpm/100 cm <sup>2</sup> ):	N/A	
<b>Actual Direct Measurements (N):</b>	40	
<b>Median</b> (dpm/100 cm <sup>2</sup> ):	2160	
<b>Mean</b> (dpm/100 cm <sup>2</sup> ):	2646	
<b>Direct Measurement Standard Deviation</b> (dpm/100 cm <sup>2</sup> ):	1849	Based on samples and backgrounds.
<b>Total Standard Deviation</b> (dpm/100 cm <sup>2</sup> ):	1849	
<b>Maximum</b> (dpm/100 cm <sup>2</sup> ):	11884	
<b>Material Type:</b>	N/A	Background Subtract Not Applied
<b>Sign Test Final N Value:</b>	40	
<b>S+ Value:</b>	40	
<b>Critical Value:</b>	25	
<b>Sufficient Samples Collected:</b>	Yes	
<b>Maximum Value &lt; DCGL:</b>	Yes	Class 1
<b>Median Value &lt; DCGL:</b>	Yes	
<b>Mean Value &lt; DCGL:</b>	Yes	
<b>Maximum Value &lt; DCGL<sub>emc</sub>:</b>	Yes	
<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:**

One investigation (Grid 89) is required as a result of particle scans performed with NaI detector with results 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 than 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. Investigations results while exceeding the DCGL are less than 5% 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 F8130561 meets the release criteria of 10CFR20.1402.

**Attachment 1**

**Revision 1**

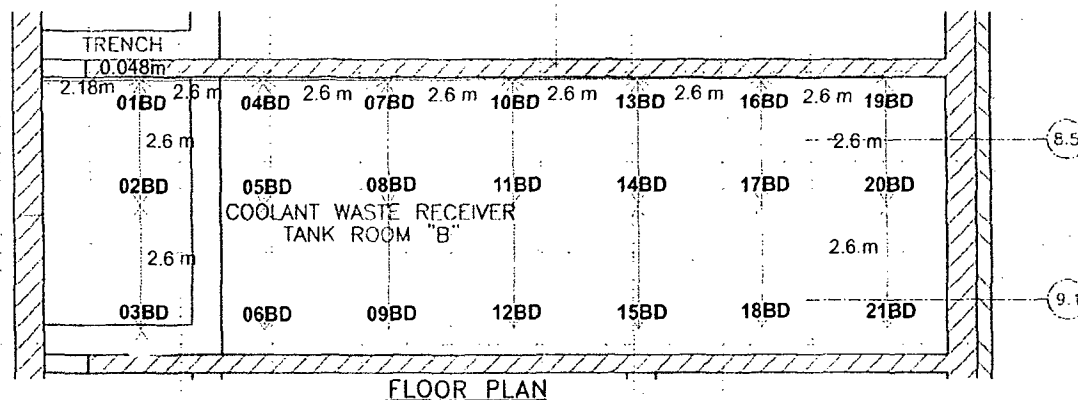
**Maps**

**May 1, 2008**

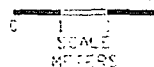
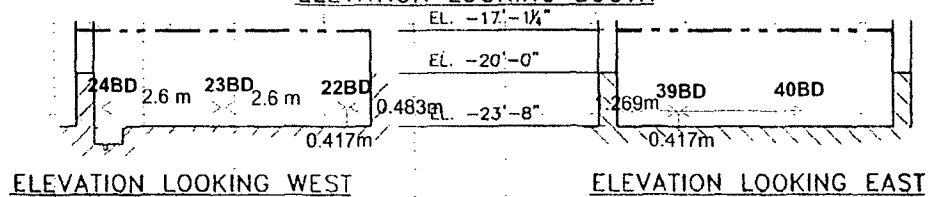
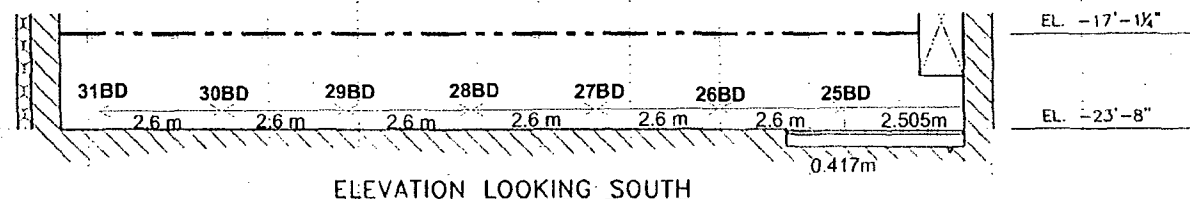
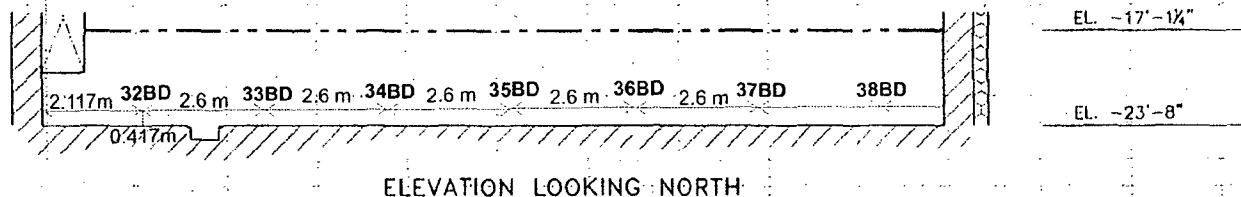
**Survey Unit F8130561**



Random Starting Point is 0.048m from the north wall  
and 2.18 m from the west wall - 01BD



Direct Beta locations are 2.6m from the random start point



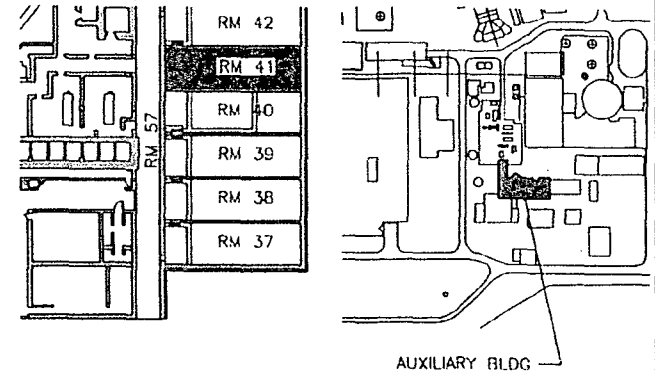
**SMUD**  
SACRAMENTO MUNICIPAL  
UTILITY DISTRICT

AUXILIARY BUILDING EL. - 29'  
ROOM 41 FLOOR & LOWER WALLS  
BETA DIRECT  
RANDOM START LOCATION  
F8130561-M1

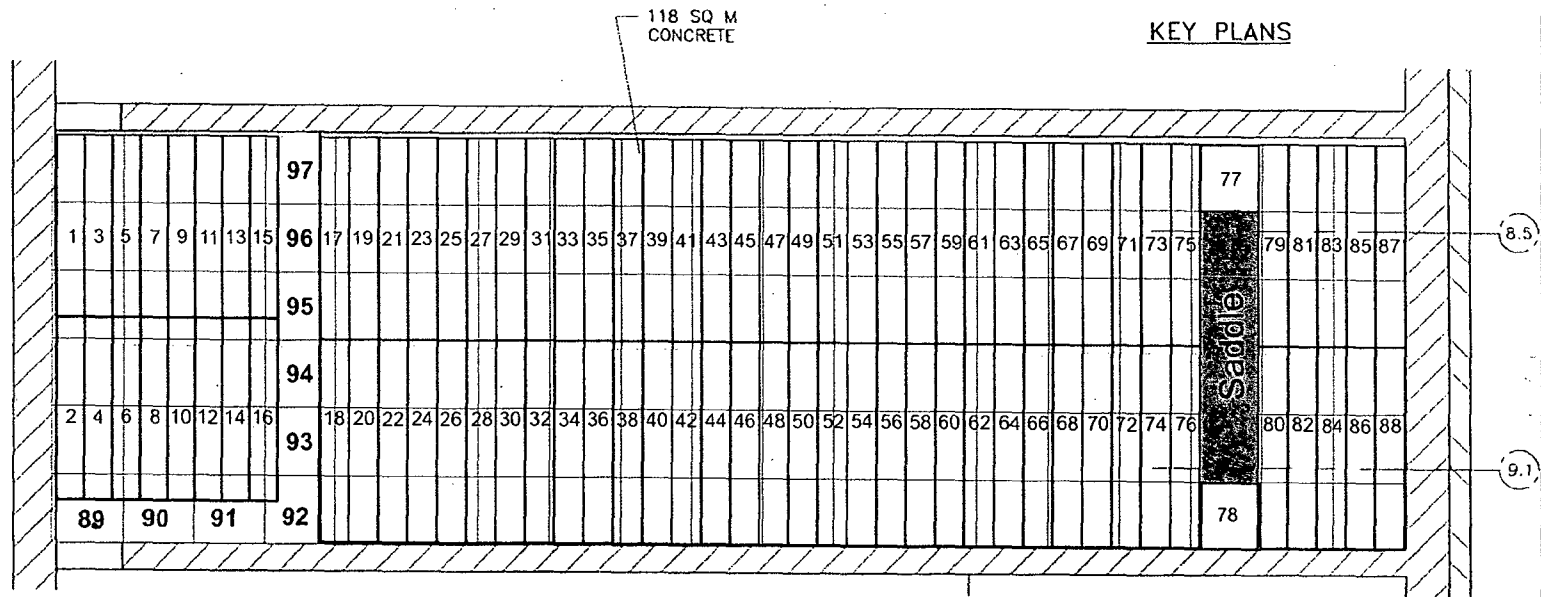
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RC RAYMOND

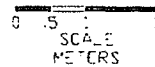
# Room 41 Floor and Trench Scans



KEY PLANS



FLOOR PLAN



**SMUD**

SACRAMENTO MUNICIPAL  
UTILITY DISTRICT

AUXILIARY BUILDING EL. -20'  
ROOM 41 FLOOR & LOWER WALLS

Beta Scans

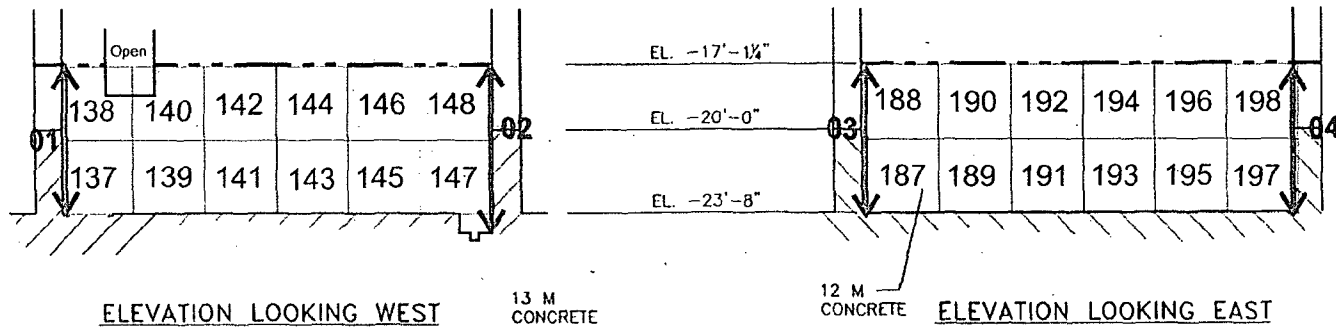
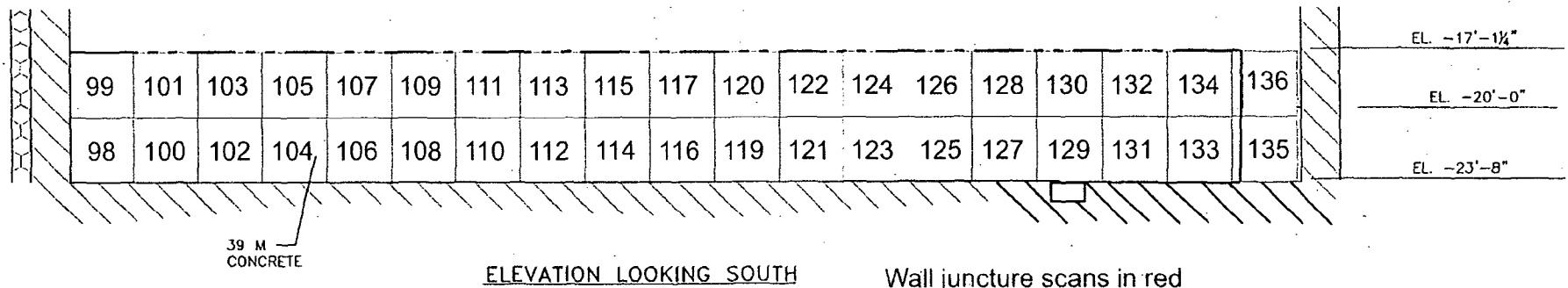
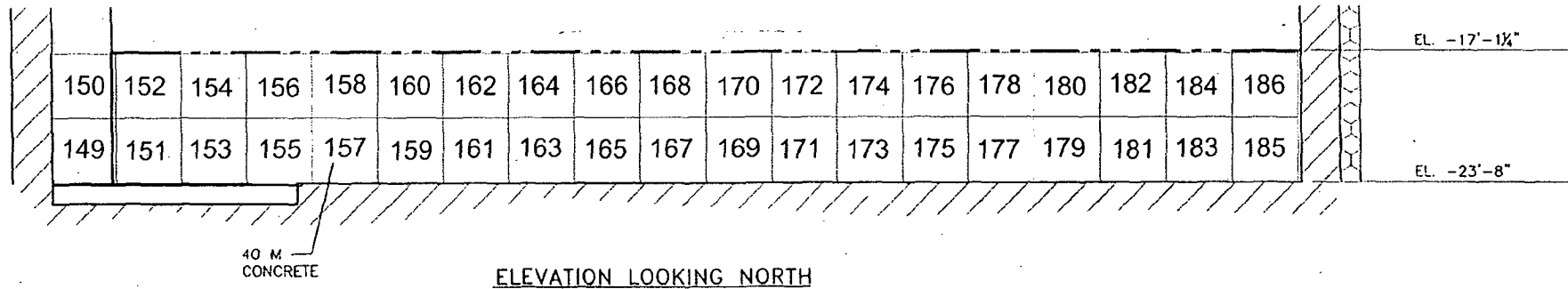
MAP F8130561 - M2

DWG. 813000.02

SHT 1 OF 2

RC RAYMOND

# Room 41 Wall Beta Scans



SCALE  
METERS



**SMUD**

SACRAMENTO MUNICIPAL  
UTILITY DISTRICT

AUXILIARY BUILDING EL. -20  
ROOM 41 LOWER WALLS

Beta Scans

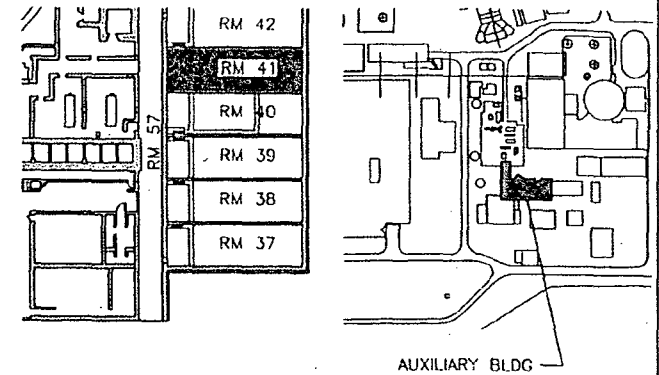
F8130561 - M3

FILE B1300.02e

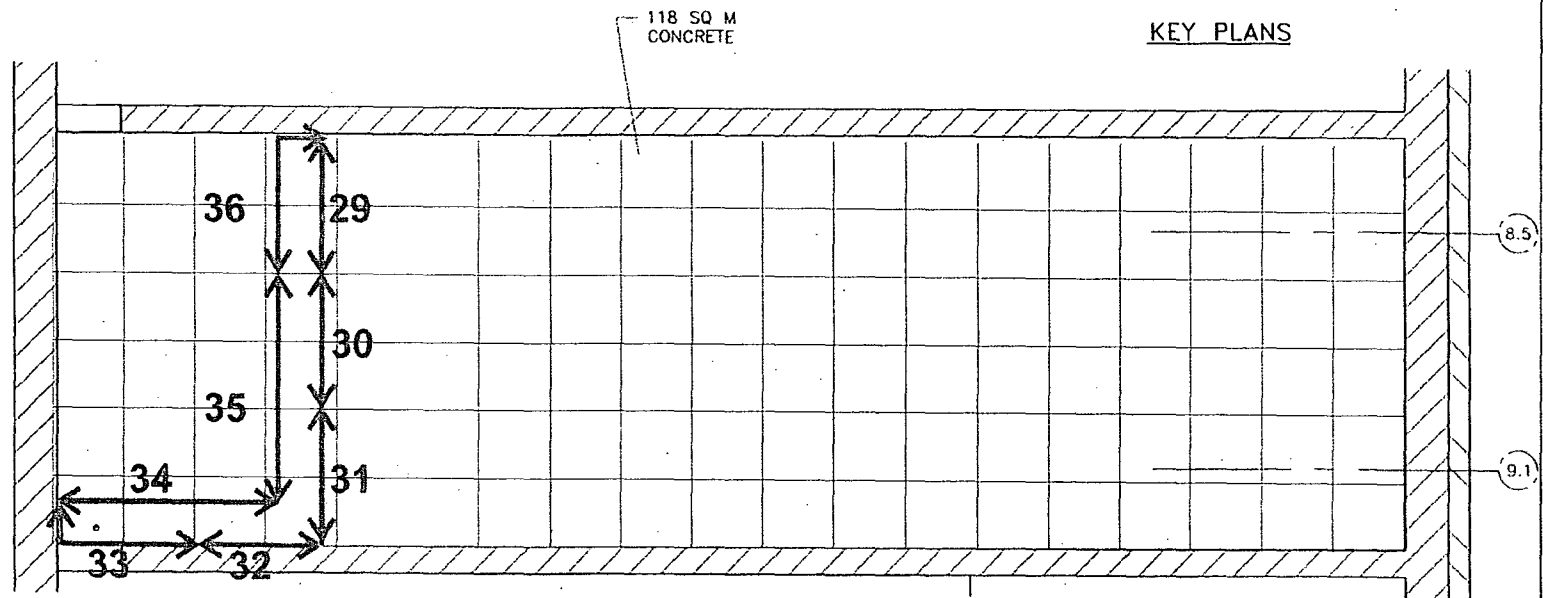
SHEET 2 OF 2

RC RAYMOND

# Room 41 Trench Juncture Scans



KEY PLANS



FLOOR PLAN

0 5  
SCALE  
METERS



**SMUD**

SACRAMENTO MUNICIPAL  
UTILITY DISTRICT

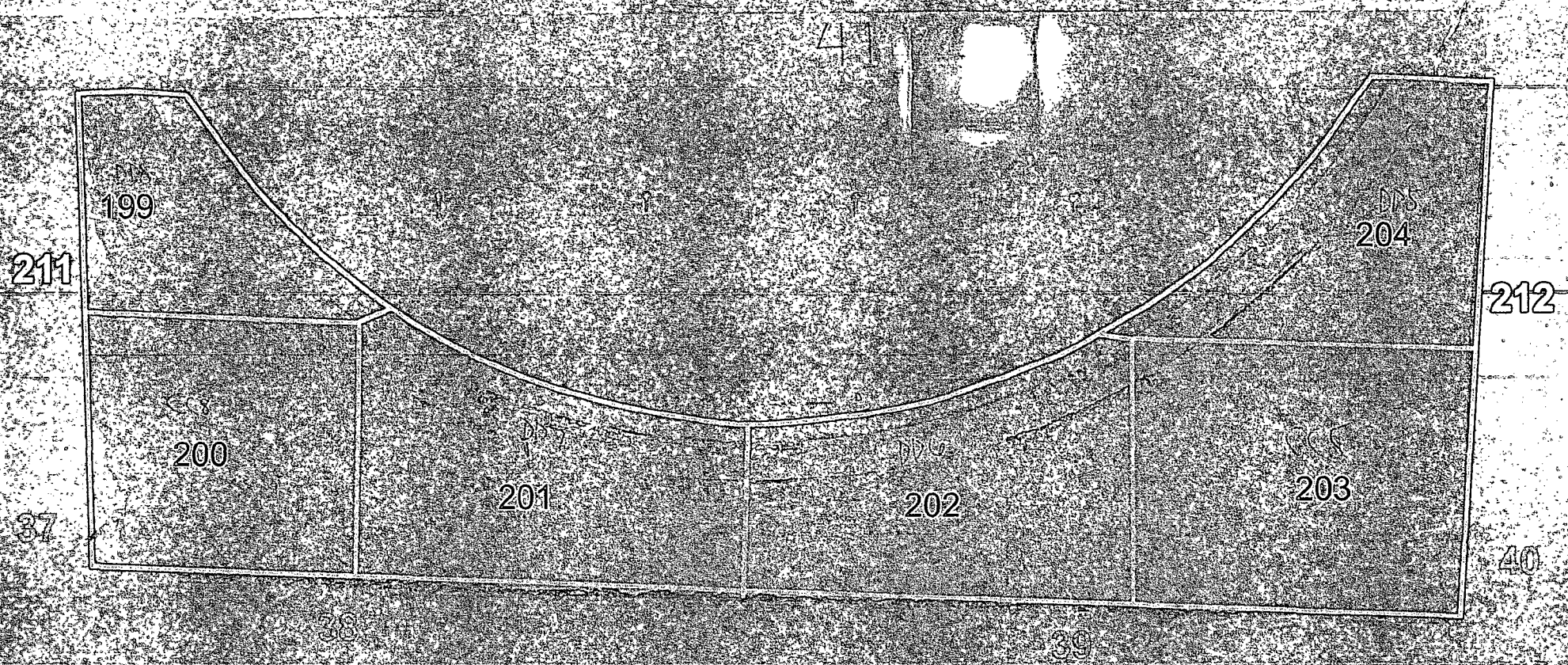
AUXILIARY BUILDING EL. -20'  
ROOM 41 FLOOR & LOWER WALLS  
Trench Juncture Scans  
MAP F8130561-M5

DWG. 813000.02

SHT 1 OF 2

RC RAYMOND

# Room 41 East Saddle West View



Uncluttered scans marked in red

F8130561-M6



205

# Room 41 East Saddle Southeast View

206

207

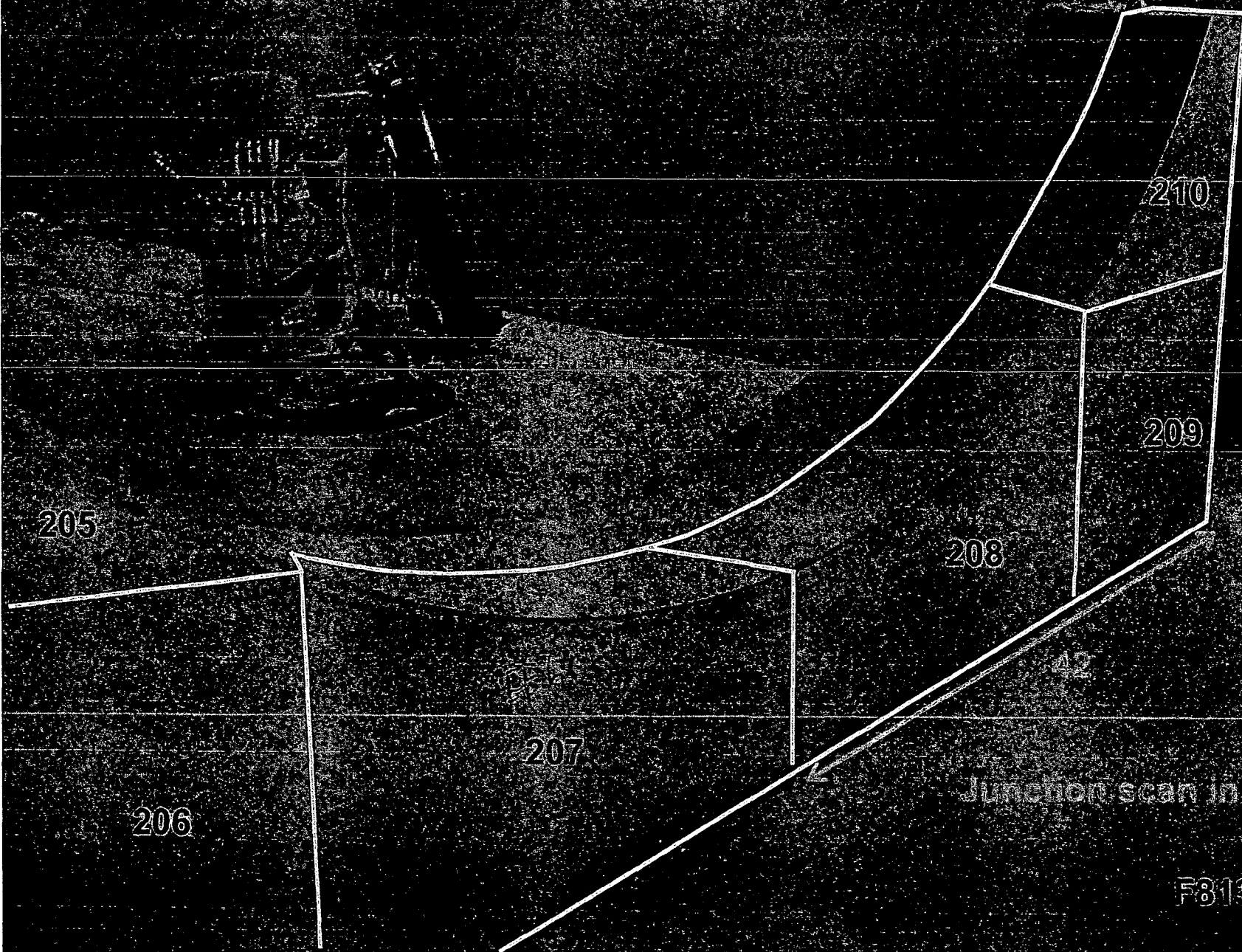
208

Juncture scan marked in red

F813056-0007

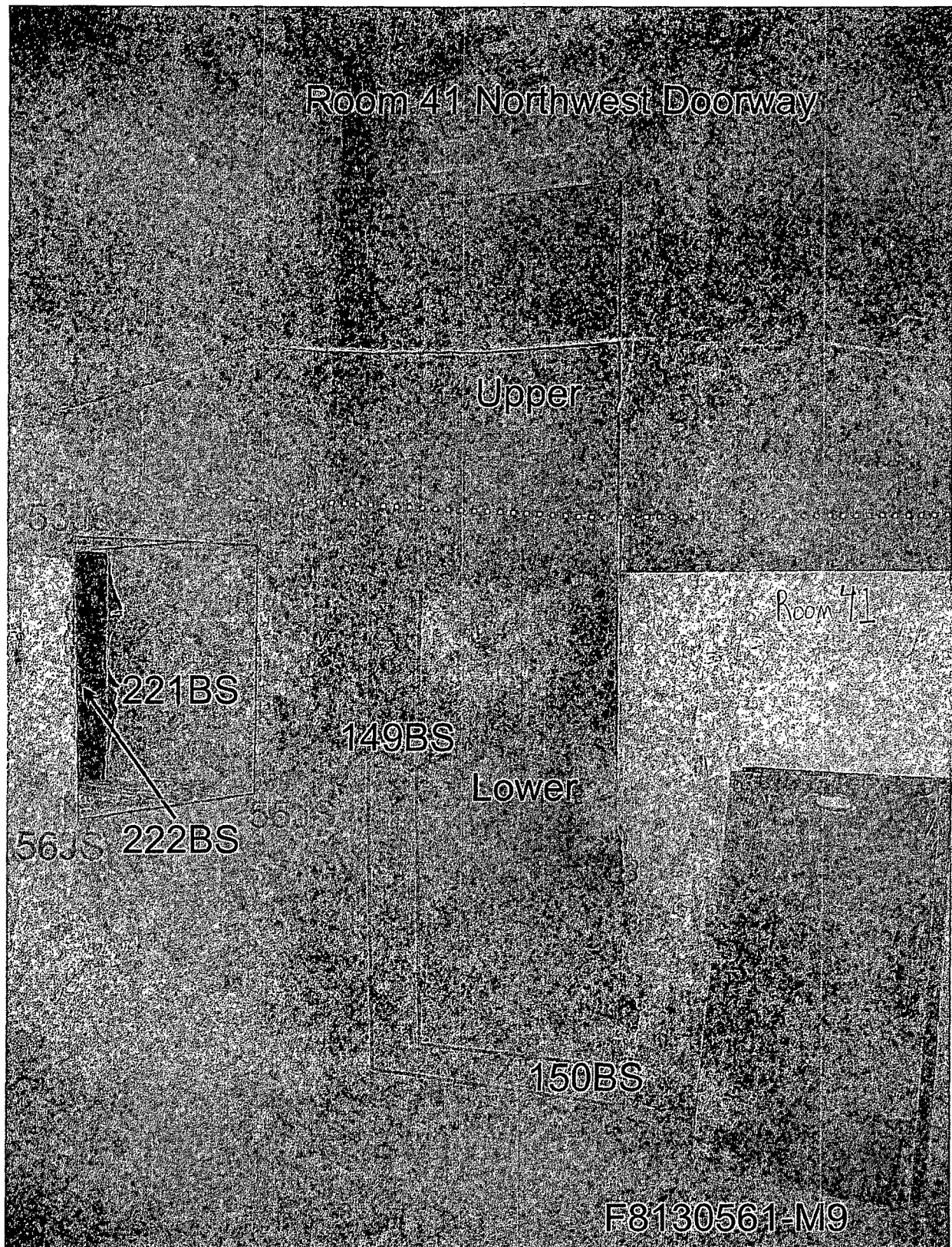


# Room 41 East Saddle - Northeast View



Junction scan in red

F8130561-M18





# Room 41 West Wall-Center

Lower

201  
041

215

216

213

214

SCANS IN BLUE

F8130561-M10



# Room 41 Lower West Wall - Northwest

219

218

217

220

221

F8130561-M11



Room 41 Lower Penetrations on southwest wall in trench



F8130561-M12



Room 41 Lower Opening in West Wall on Floor

F8130561-M13

**Attachment 2**

**Revision 1**

**Instrumentation**

**May 1, 2008**

**Survey Unit F8130561**

**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; 203482	43-68B; 178510	433	1033
M2350; 142499	43-37; 148502	198	616
M2350; 203465	43-116-1B; 216073 Concrete Juncture	491	739
M2350, 203465	43-116-1B, 216073 Metal Pipe	472	3492
M2350, 203481	44-10, 171992	N/A	5.2 pCi/g
Tennelec; 0401171	N/A	6 dpm $\alpha$ , 12 dpm $\beta$	N/A

<b>Instrument</b>	<b>Detector Serial No.</b>	<b>MDC (dpm/100cm<sup>2</sup>)</b>
InSpector 1000	10054579	7400 Cs-137 3140 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>)</b>
InSpector 1000	DCGL <sub>emc</sub> for 0.01 m <sup>2</sup>	5.55e7



**Attachment 3**

**Revision 1**

**Investigation**

**May 1, 2008**

**Survey Unit F8130561**

**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>
*(1) Grid 89	36000	43958	N/A	.01	1290	5.55e7	3.33e5	0.0060
Survey Unit Remainder						DCGL = 43,000	SU Mean = 2646	0.0615
EMC Unity Sum								0.0675

Gamma scans were performed to complete the particle survey and one elevated area was identified. The identified area was further bounded and analyzed with InSpector 1000.

\*Locations on map attached to Download 08-231

The results are shown in Table 3-1 with results less than unity.

**Attachment 4**

**Revision 1**

**Data Assessment**

**May 1, 2008**

**Survey Unit F8130561**

