

Rancho Seco
Final Status Survey Summary Report

July 4, 2008

Turbine Building (+) 0' El., Main Feed Pump Area

Survey Unit F8260032

Prepared By: S. Anderson Date: 7/4/2008
FSS Engineer

Reviewed By: Robert F. Decker Date: 11/25/08
Lead FSS Engineer

Approved By: E. J. [Signature] Date: 2-27-09
Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8260032, Turbine Building (+) 0' El., Main Feed Pump Area

Survey Unit Description:

Operating History: The reinforced concrete and steel structure contained the turbine-generator and supporting systems. The building contained five 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.

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 in the condenser pit elevation showed a mean gross activity level of 3,077 dpm/100 cm² and a maximum value of 24,900 dpm/100 cm². Direct measurements on the grade elevation showed a mean gross activity level of 2,035 dpm/100 cm² and a maximum value of 6,980 dpm/100 cm². Direct measurements on the mezzanine elevation showed a mean gross activity level of 1,566 dpm/100 cm² and a maximum value of 2,626 dpm/100 cm². Direct measurements on the +40' elevation showed a mean gross activity level of 2,843 dpm/100 cm² and a maximum value of 3,615 dpm/100 cm². Direct measurements on the building exterior showed a mean gross activity level of 1,984 dpm/100 cm² and a maximum value of 10,312 dpm/100 cm². Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the turbine building was determined to be Class 1, 2, & 3 areas and the exterior was a Class 3.

During FSS surveys of F8260032 (Turbine Building (+) 0' El., Main Feed Pump Area, Class 2), beta measurements identified activity within a 1-meter by 5-meter area that exceeded the DCGL of 43,000 dpm/100 cm². The area was subsequently removed from this survey package, remediated and reclassified as a Class 1 structure, based on the classification procedure (DSIP-0020). Final surveys of the Class 1 area will be performed under survey package F8260171.

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 100 m² were scanned for approximately 54% 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

Survey Design Parameter	Value	Comment
Survey Area:	F826	Turbine Building (+) 0' El., Main Feed Pump Area
Survey Unit:	0032	Structure Surface
Class:	2	LTP Table 5-4
SU Area (m²):	186.2	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm²):	43,000	Gross Activity DCGL
Area Factor:	N/A	Class 2
Design DCGL_{mc} (dpm/100 cm ²):	N/A	Class 2
LBGR (dpm/100 cm²):	25,030	Adjusted
Design Sigma (dpm/100 cm²):	5,990	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m²):	13.3	Class 2
Scan Area (m²):	100	
Scan Coverage (%):	54%	Class 2
Z_{1-α} :	1.645	
Z_{1-β} :	1.645	
Sign P:	0.99865	
Calculated Relative Shift:	3	
Relative Shift Used:	3	Uses 3.0 if Relative Shift is >3
N-Value:	11	
Design N-Value + 20%:	14	NUREG-1575 Table 5-5
Design Min Samples N:	14	Class 2
Grid Spacing L:	3.0	Class 2

Survey Results:

A total of 15 direct measurements were made in F8260032. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. Two of the beta scan measurements indicated areas of elevated activity. Scan activity ranged from 4,218 to 68,000 dpm/100 cm², based on a surveyor efficiency of 0.5 and no background subtracted. The scan grids indicating elevated activity were removed from the survey unit, remediated and resurveyed under FSS Package F8260171. As left beta scan measurements ranged from 4,218 dpm/100 cm² to 8,818 dpm/100 cm². 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 ²)
F8260032-C0001BD	2,552
F8260032-C0002BD	1,712
F8260032-C0003BD	1,577
F8260032-C0004BD	1,784
F8260032-C0005BD	1,644
F8260032-C0006BD	2,485
F8260032-C0007BD	2,329
F8260032-C0008BD	2,111
F8260032-C0009BD	1,930
F8260032-C0010BD	2,288
F8260032-C0011BD	2,770
F8260032-C0012BD	1,686
F8260032-C0013BD	1,924
F8260032-C0014BD	1,867
F8260032-C0015BD	2,039
Mean:	2,047
Median:	1,930
Standard Deviation:	365
Range:	1,577 – 2,770

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm²)
F8260032C0001SM	-2.24
F8260032C0002SM	-0.95
F8260032C0003SM	5.51
F8260032C0004SM	1.64
F8260032C0005SM	10.68
F8260032C0006SM	-3.53
F8260032C0007SM	-2.24
F8260032C0008SM	-3.53
F8260032C0009SM	2.93
F8260032C0010SM	-0.95
F8260032C0011SM	1.64
F8260032C0012SM	-0.95
F8260032C0013SM	-4.82
F8260032C0014SM	-0.95
F8260032C0015SM	0.34
Mean:	0.17
Median:	-0.95
Standard Deviation:	3.96
Range:	-4.82 to 10.68

Survey Unit Data Assessment:

The survey design required 15 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

Survey Results Parameter	Value	Comment
Material Background Used (dpm/100 cm ²):	N/A	Average Ambient BKG = 0
Ambient Background Used (dpm/100 cm ²):	N/A	
Actual Direct Measurements (N):	15	
Median (dpm/100 cm ²):	1,930	
Mean (dpm/100 cm ²):	2,047	
Direct Measurement Standard Deviation	365	Based on samples and backgrounds.
(dpm/100 cm ²):		
Total Standard Deviation (dpm/100 cm ²):	365	
Maximum (dpm/100 cm ²):	2,770	Background Subtract Not Applied
Material Type:	N/A	
Sign Test Final N Value:	15	Class 2
S+ Value:	15	
Critical Value:	11	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGL_{emc}:	N/A	
Total Standard Deviation <= Sigma:	Yes	
Pass the Sign Test?	Yes	
Reject the Null Hypothesis?	Yes	
Does the Survey Unit Pass All Criteria?	Yes	

Survey Unit Investigations and Results:

Two investigations (scan grids 102 and 103) were required for the scan measurements and the results are reported in Attachment 3. As a result of the investigation measurements, Grids 102 through 106 were removed from the survey unit package and will be surveyed as a Class 1 structure under F8260171.

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 2 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. Two potential areas of elevated activity were detected and evaluated as shown in Attachment 3.

Conclusion:

The FSS of this survey unit was properly designed as a Class 2 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 43,000 dpm/100 cm² and none of the removable surface activity measurements exceeded 10% of the DCGL. Two investigations were required.

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.

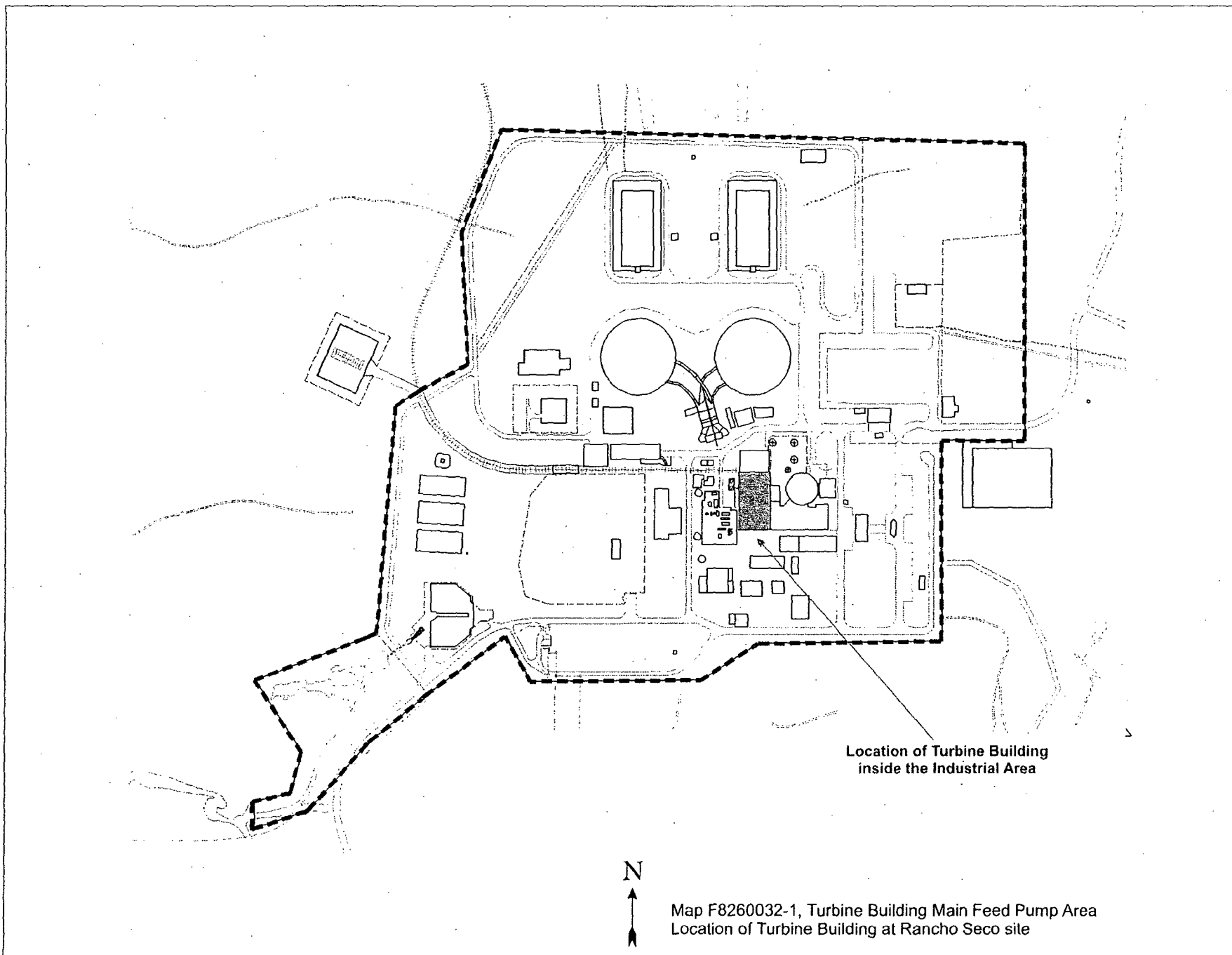
It is concluded that survey unit F8260032 meets the release criteria of 10CFR20.1402.

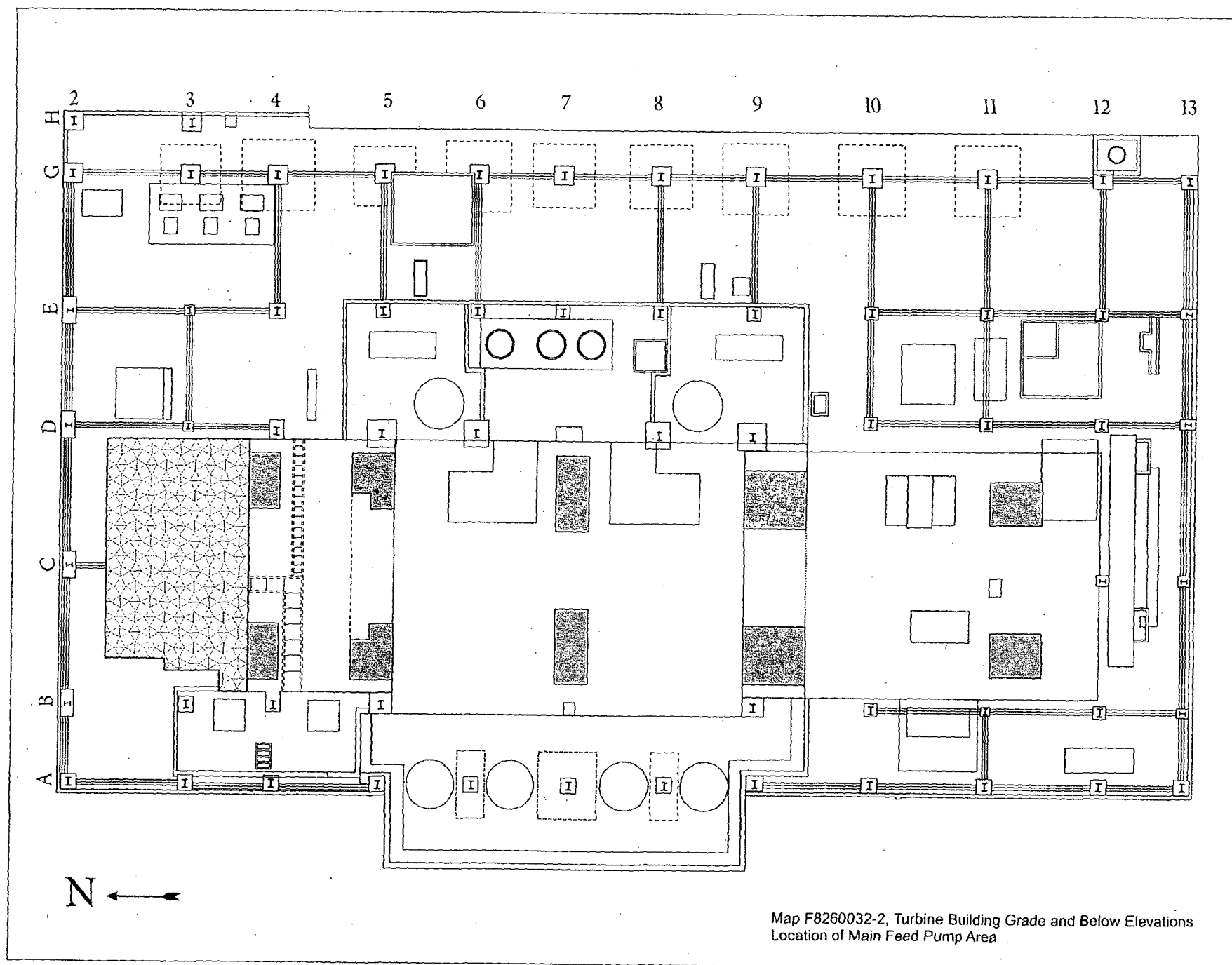
Attachment 1

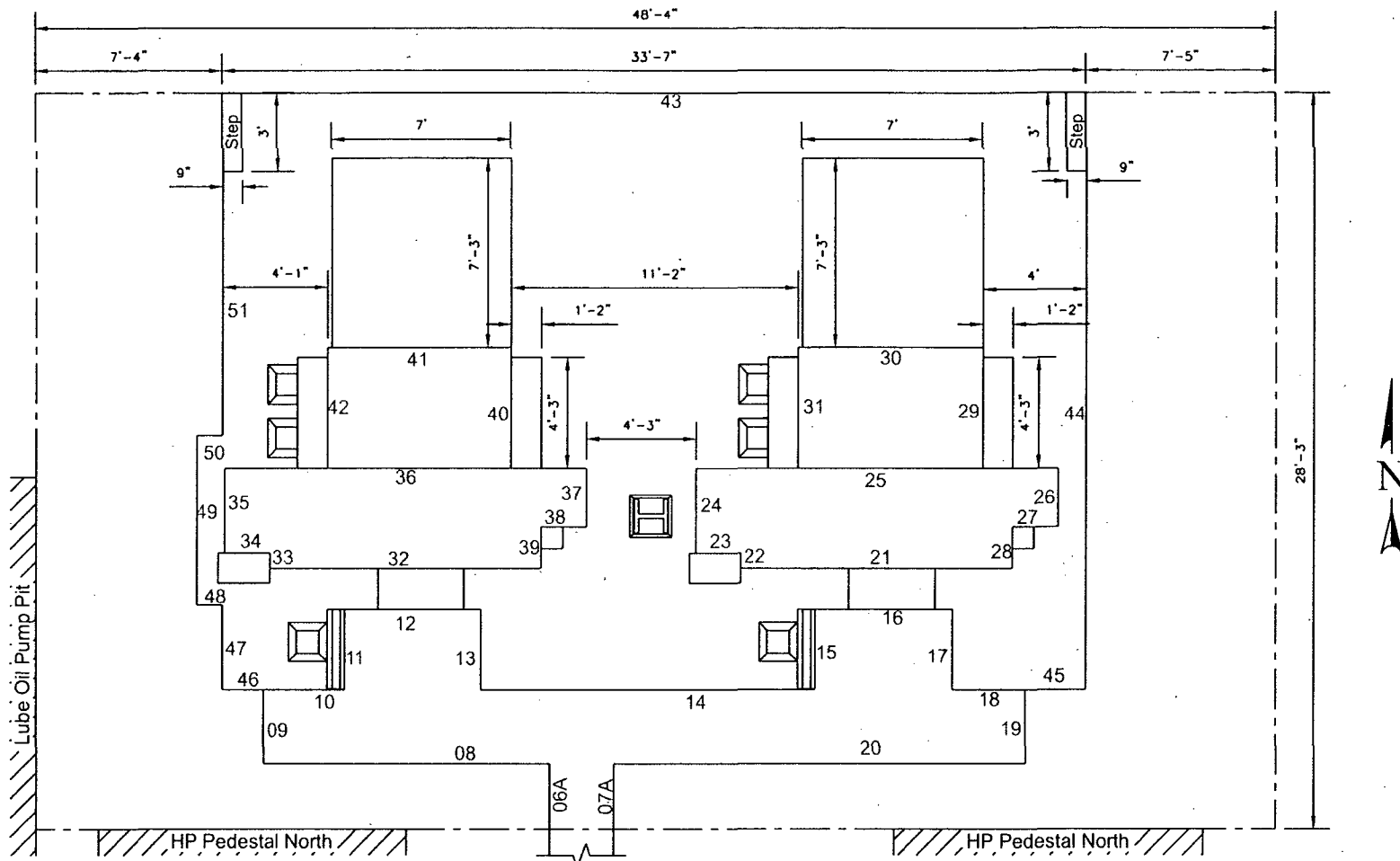
Maps

July 4, 2008

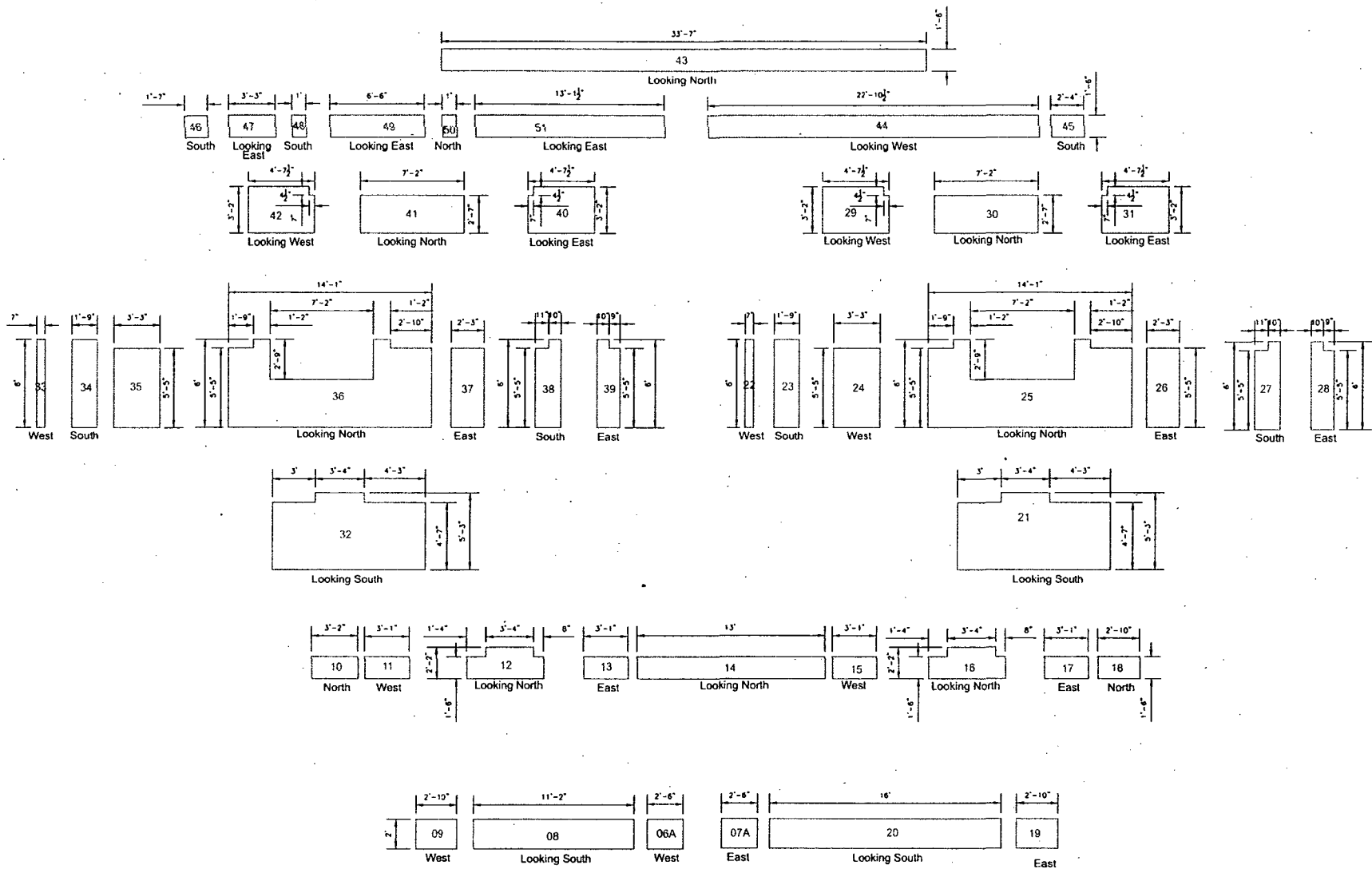
Survey Unit F8260032





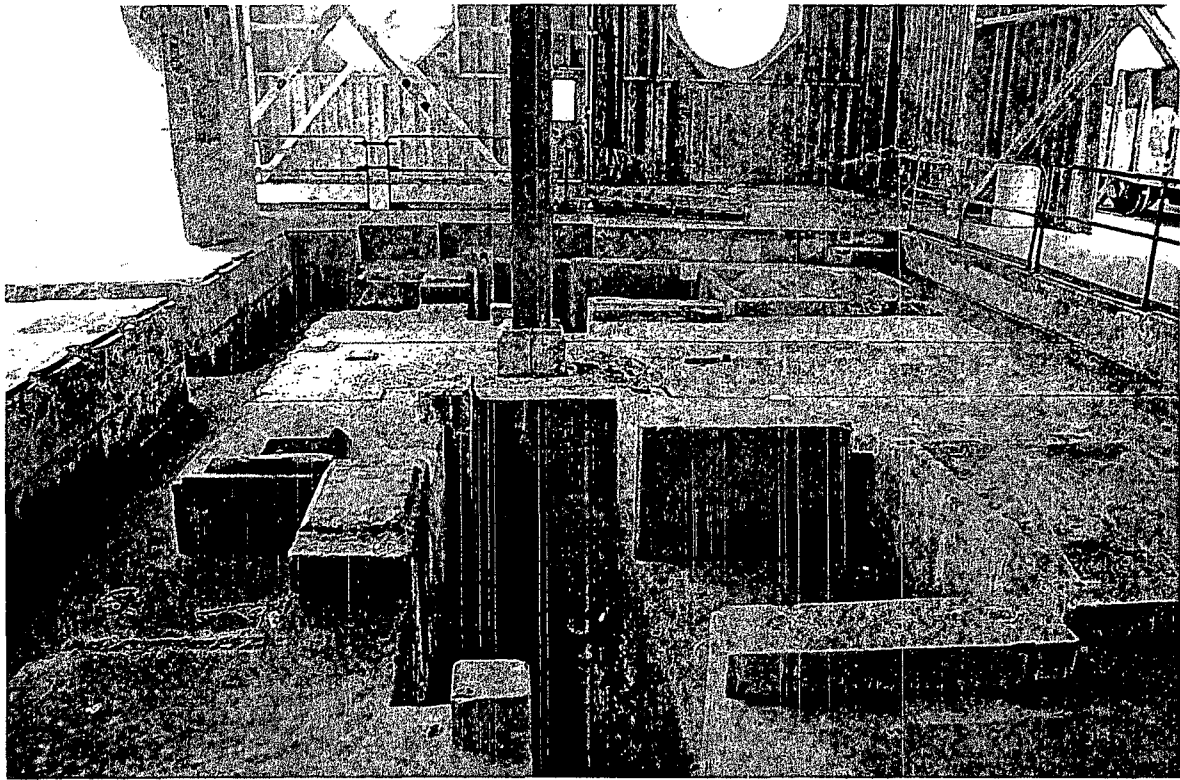


Map F8260032-3, Turbine Building Main Feed Pump Area
Horizontal Surfaces
Area Estimate: 1,363 sq. ft. - 126.6 sq. meters

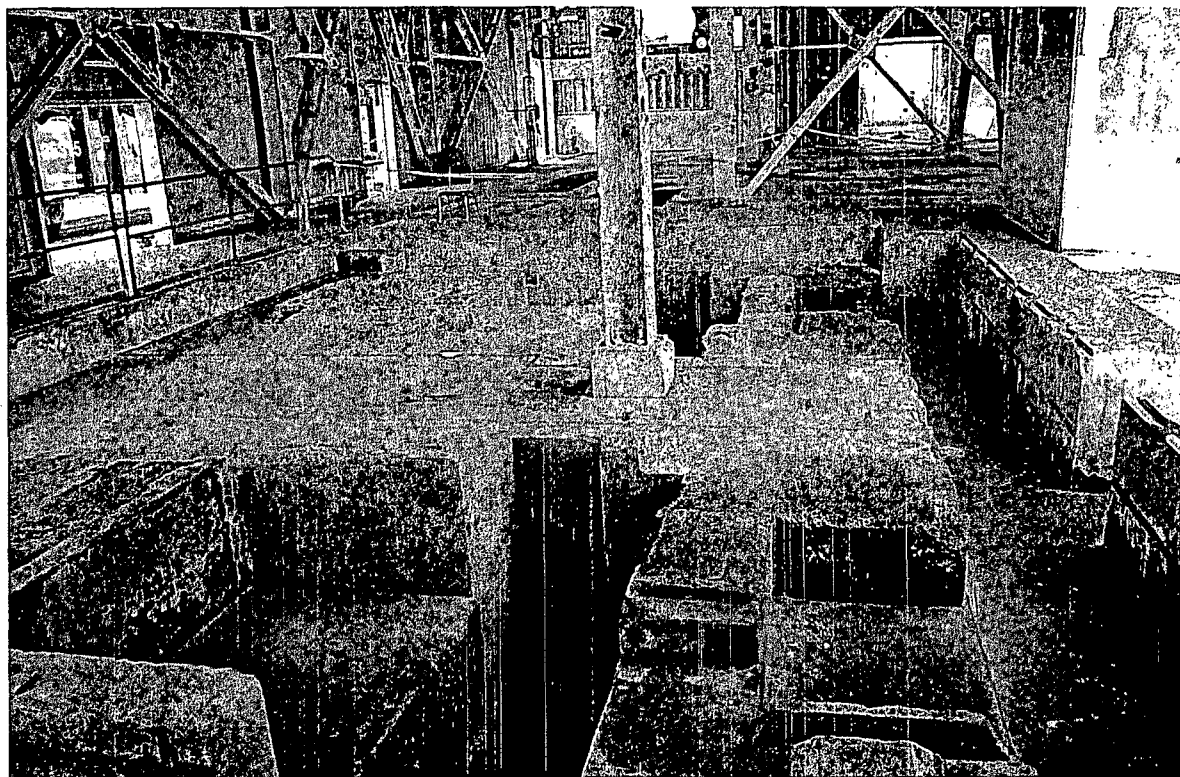


0 0.5 1.0 1.5 2.0
Distance in Meters

Map F8260032-4, Turbine Building Main Feed Pump Area
Vertical Surfaces
Area Estimate: 641 sq. ft. - 59.6 sq. meters



Main Feed Pump Area Looking West

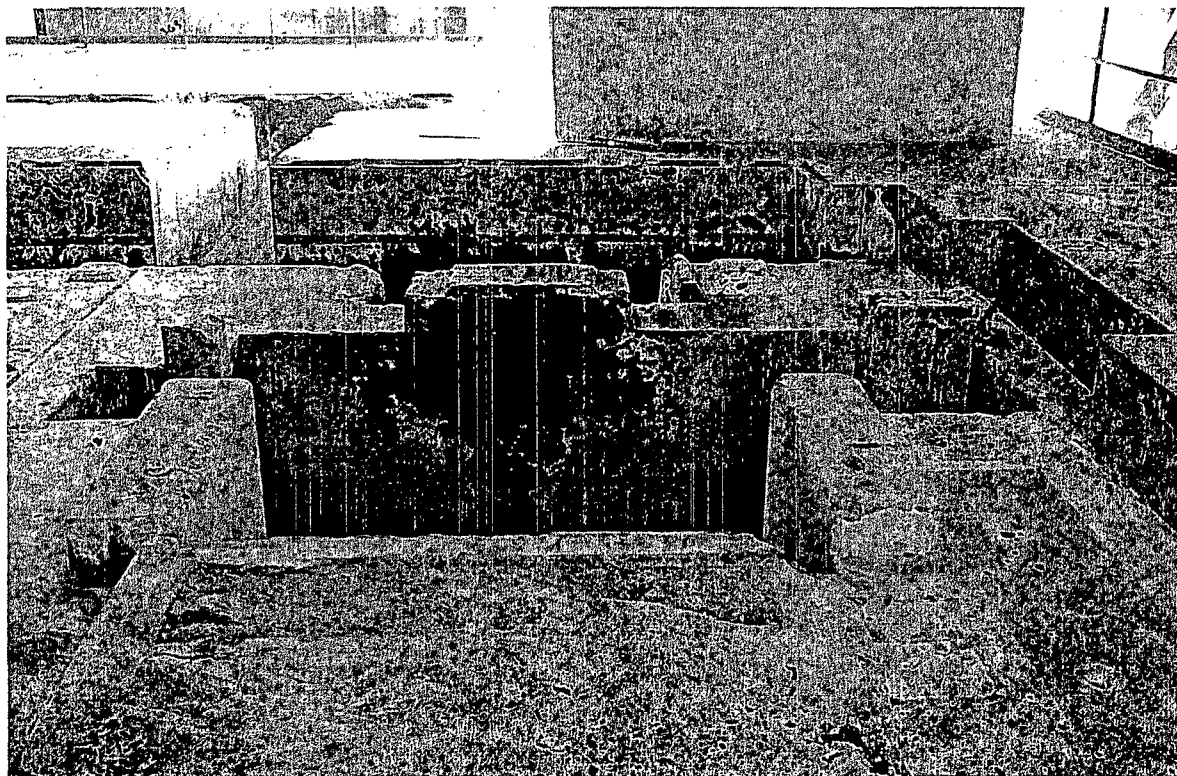


Main Feed Pump Area Looking East

Map F8260032-5, Turbine Building Main Feed Pump Area
Views looking West and East

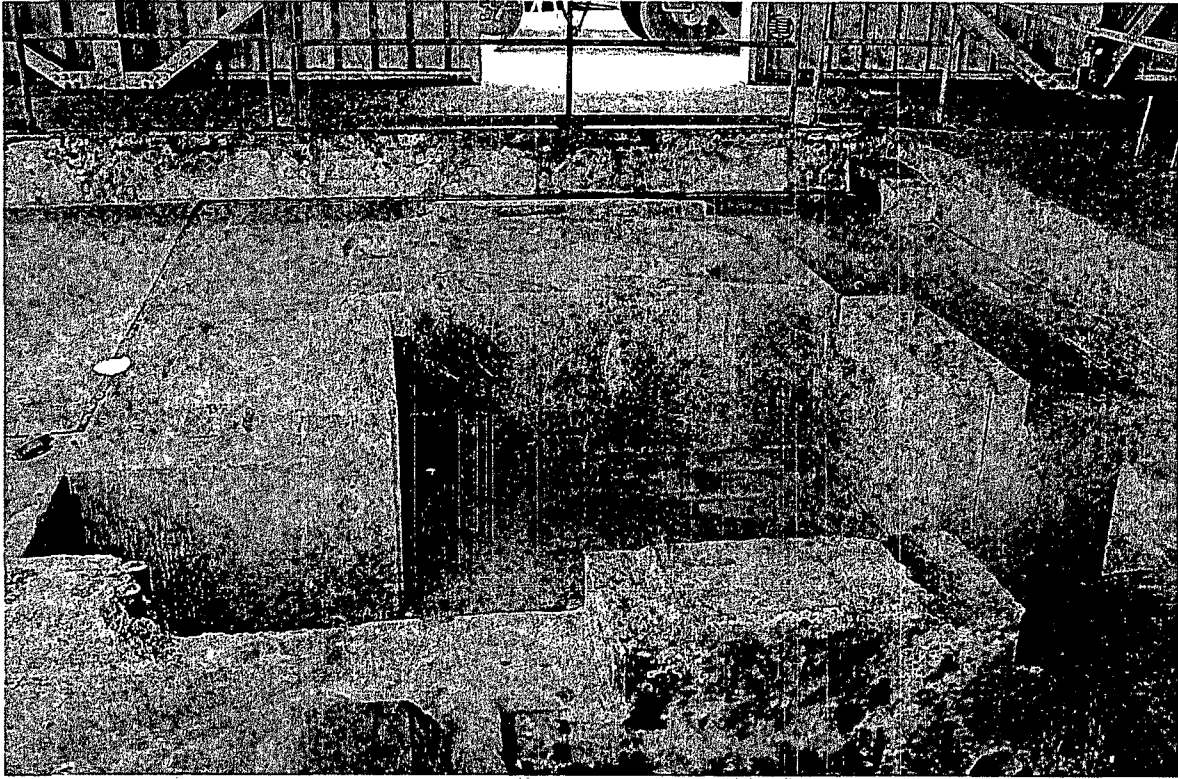


Main Feed Pump Area Looking North (NW Corner)

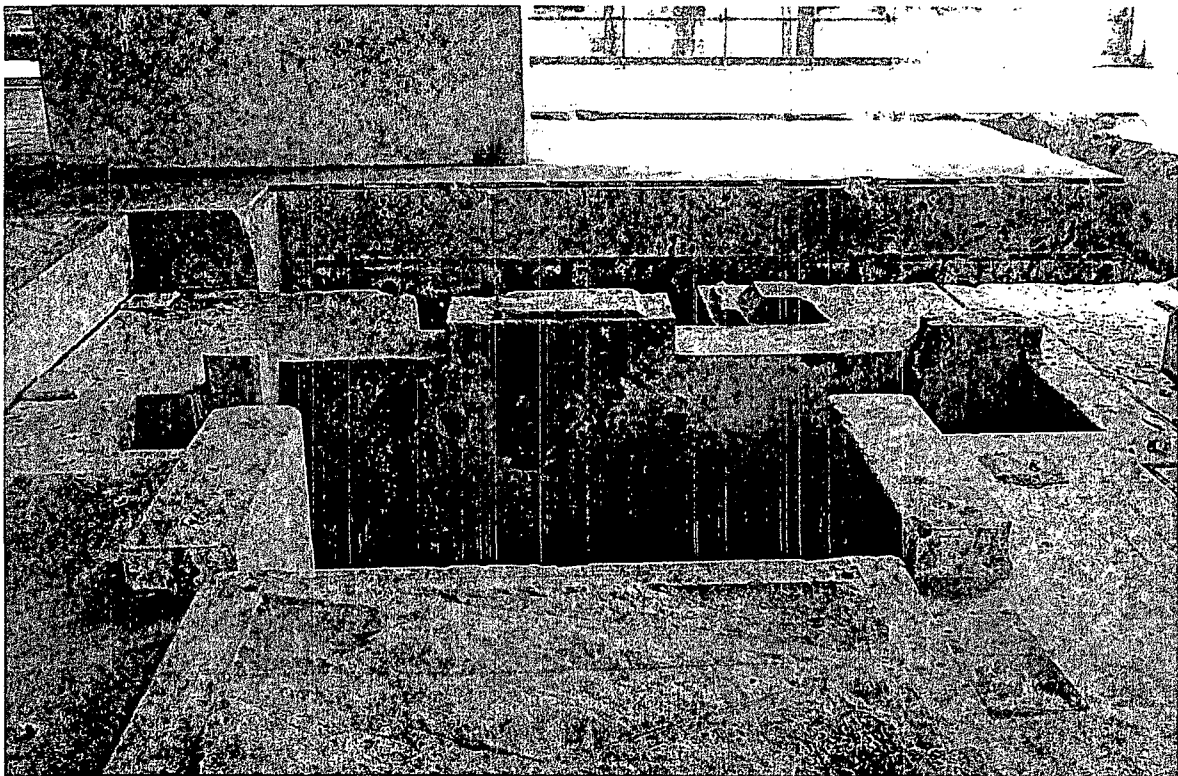


Main Feed Pump Area Looking South (SW Corner)

Map F8260032-6. Turbine Building Main Feed Pump Area
NW Corner and SW Corner

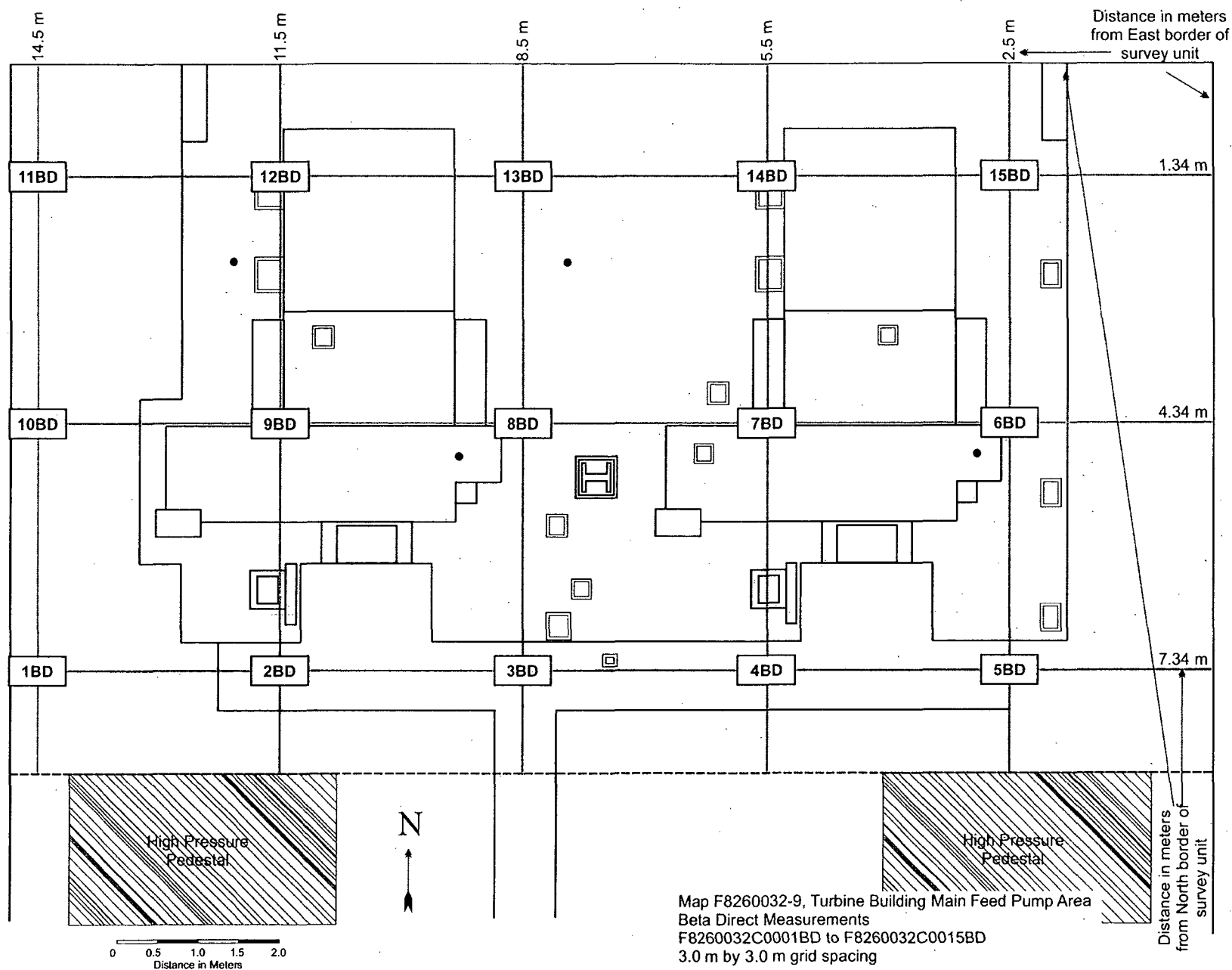


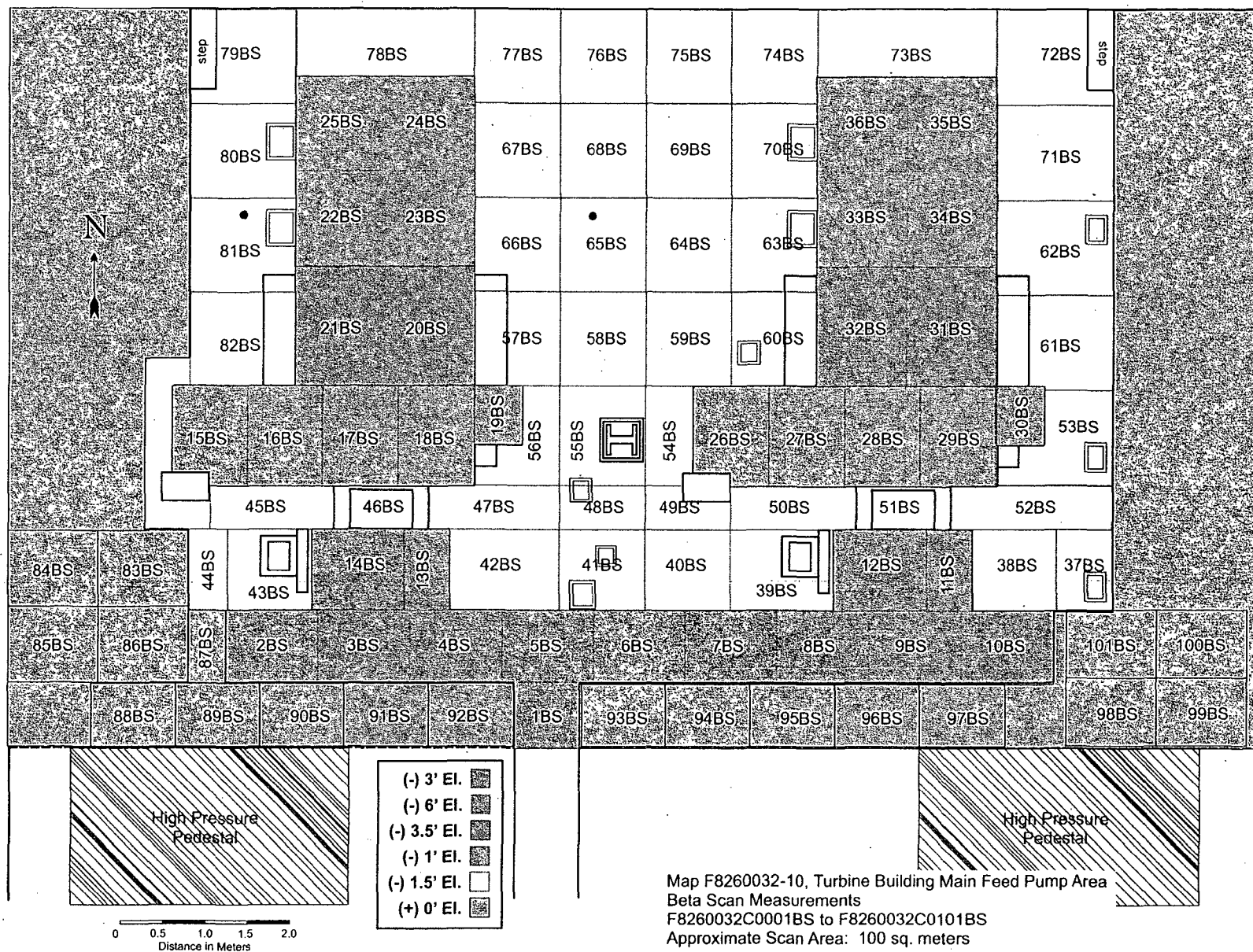
Main Feed Pump Area Looking North (NE Corner)

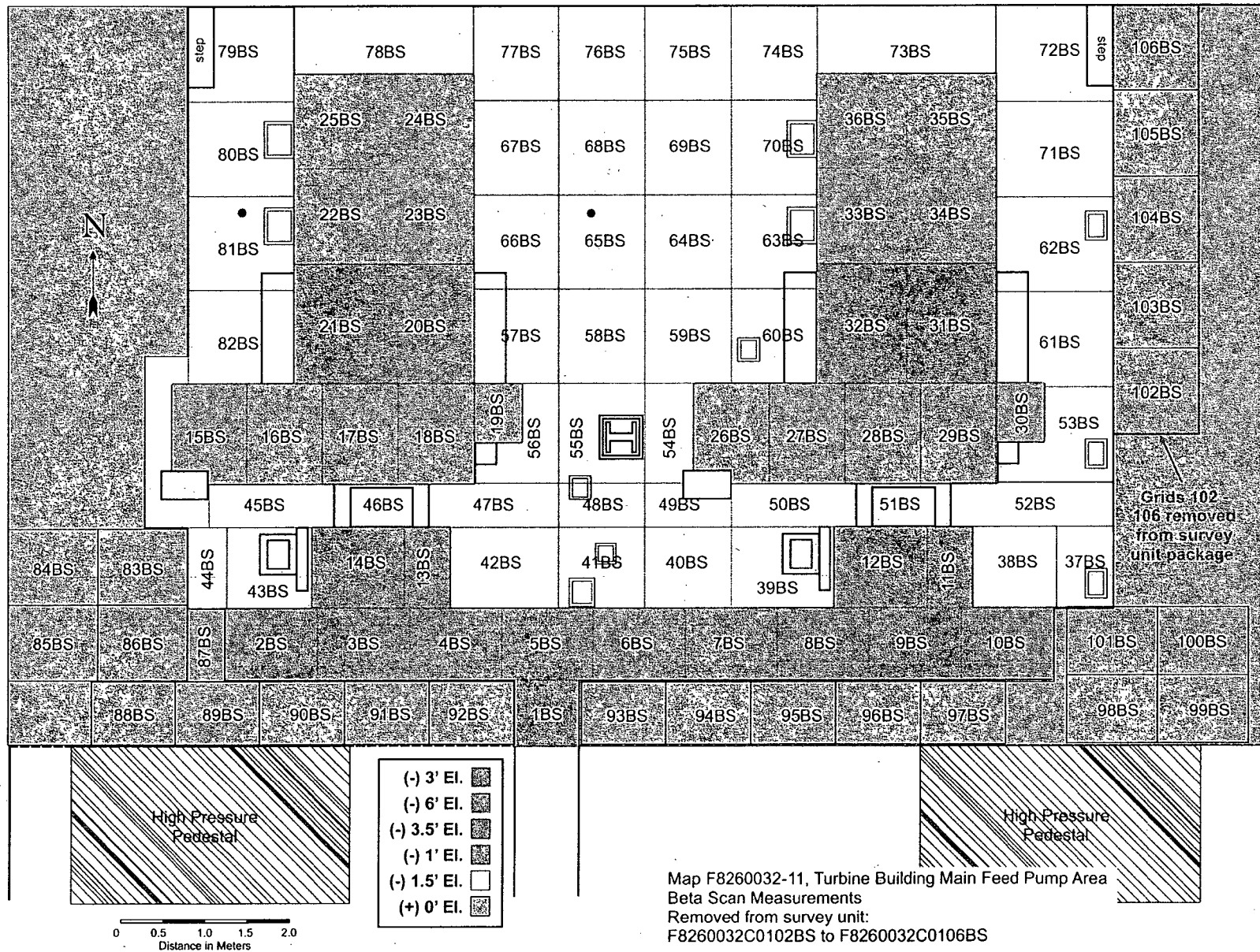


Main Feed Pump Area Looking South (SE Corner)

Map F8260032-7, Turbine Building Main Feed Pump Area
NE Corner and SE Corner







Attachment 2

Instrumentation

July 4, 2008

Survey Unit F8260032

Table 2-1. Survey Unit Instrumentation

Instrument Model; Serial No.	Detector Model; Serial No.	MDC Static (dpm/100 cm²)	MDC Scan (dpm/100 cm²)
M2350; 193700	43-68B; 190294	433	1,033
Tennelec; 0401171	N/A	5.88 dpm α , 11.71 dpm β	N/A

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	43,000
Investigation Criteria – Scan	43,000
DCGL _w	43,000
DCGL _{EMC}	N/A

Attachment 3

Investigation

July 4, 2008

Survey Unit F8260032

Table 3-1 Survey Unit Investigation

<i>Grid</i>	<i>Investigation Level (cpm)</i>	<i>Initial Value (cpm)</i>	<i>Investigation Result (cpm)</i>	<i>Elevated Area (m²)</i>	<i>Area Factor</i>	<i>DCGL_{emc}</i>	<i>Investigation Result (dpm/100cm²)</i>	<i>DCGL_{emc} Unity Fraction</i>
102	5,860	9,278	8,633	0.1	N/A	N/A	44,780	N/A ¹
103	5,860	6,653	7,107	0.1	N/A	N/A	36,865	N/A ¹
Survey Unit Remainder						DCGL = 43,000	SU Mean = 2,047	0.05
EMC Unity Sum								0.05

¹Investigation measurements indicated activity exceeding the DCGL of 43,000 dpm/100 cm² for a Class 2 area. Grids 102 through 106 were deleted from the survey unit and will be surveyed under FSS package F8260171.

Attachment 4

Data Assessment

July 4, 2008

Survey Unit F8260032

