

Rancho Seco

Final Status Survey Summary Report

October 20, 2008

Turbine Building High Pressure Pedestals, (+) 20' El. to (+) 40' El.

Survey Unit F8261003

Prepared By: D. Anderson Date: 10/20/2008
FSS Engineer

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

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8261003, Turbine Building High Pressure Pedestals, (+) 20' El. to (+) 40' El.

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.

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 309.8 m² 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

Survey Design Parameter	Value	Comment
Survey Area:	F826	Turbine Building High Pressure Pedestals, (+) 20' El. to (+) 40' El.
Survey Unit:	1003	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m ²):	309.8	
Evaluator:	D. Anderson	
DCGL (dpm/100 cm ²):	43,000	Gross Activity DCGL
Area Factor:	3.5	Class 1
Design DCGL _{emc} (dpm/100 cm ²):	163,400	Class 1
LBGR (dpm/100 cm ²):	25,030	Adjusted
Design Sigma (dpm/100 cm ²):	5,990	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m ²):	6.9	Class 1
Scan Area (m ²):	309.8	
Scan Coverage (%):	100%	Class 1
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:	45	Class 1
Grid Spacing L:	2.6	Class 1

Survey Results:

A total of 50 direct measurements were made in F8261003. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. None of the scan measurements indicated areas of elevated activity. The gamma scan activity ranged from < 752 dpm/100 cm² Co-60 and < 1,030 dpm/100 cm² to 2,889 dpm/100 cm² Cs-137. Beta scan activity ranged from 1,445 to 44,257 dpm/100 cm², 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 ²)
F8261003-C0001BD	1,665
F8261003-C0002BD	1,458
F8261003-C0003BD	1,644
F8261003-C0004BD	3,600
F8261003-C0005BD	1,582
F8261003-C0006BD	1,504
F8261003-C0007BD	2,101
F8261003-C0008BD	2,023
F8261003-C0009BD	1,442
F8261003-C0010BD	1,541
F8261003-C0011BD	1,297
F8261003-C0012BD	1,261
F8261003-C0013BD	1,266
F8261003-C0014BD	1,484
F8261003-C0015BD	1,717
F8261003-C0016BD	1,504
F8261003-C0017BD	1,432
F8261003-C0018BD	1,722
F8261003-C0019BD	6,733
F8261003-C0020BD	1,592
F8261003-C0021BD	908
F8261003-C0022BD	1,655
F8261003-C0023BD	2,044
F8261003-X0024BD	3,483
F8261003-C0025BD	1,598
F8261003-C0026BD	2,500
F8261003-X0027BD	3,119
F8261003-C0028BD	2,967
F8261003-C0029BD	2,075
F8261003-C0030BD	1,556
F8261003-C0031BD	1,525
F8261003-C0032BD	1,437
F8261003-C0033BD	1,546
F8261003-C0034BD	1,359
F8261003-C0035BD	1,484

Measurement ID	Gross Activity (dpm/100 cm ²)
F8261003-C0036BD	1,209
F8261003-C0037BD	2,371
F8261003-C0038BD	2,412
F8261003-C0039BD	2,355
F8261003-C0040BD	2,059
F8261003-C0041BD	2,381
F8261003-C0042BD	2,288
F8261003-C0043BD	2,547
F8261003-M0044BD	794
F8261003-M0045BD	1,067
F8261003-M0046BD	1,052
F8261003-M0047BD	1,015
F8261003-C0048BD	2,272
F8261003-C0049BD	1,945
F8261003-C0050BD	2,251
Mean:	1,917
Median:	1,621
Standard Deviation:	931
Range:	794 – 6,733

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm²)
F8261003C0001SM	9.38
F8261003C0002SM	-2.24
F8261003C0003SM	0.34
F8261003C0004SM	8.09
F8261003C0005SM	-2.24
F8261003C0006SM	-4.82
F8261003C0007SM	4.22
F8261003C0008SM	-0.95
F8261003C0009SM	-3.53
F8261003C0010SM	-2.24
F8261003C0011SM	0.34
F8261003C0012SM	-2.24
F8261003C0013SM	-2.24
F8261003C0014SM	-0.95
F8261003C0015SM	-0.95
F8261003C0016SM	-2.24
F8261003C0017SM	-2.24
F8261003C0018SM	-2.24
F8261003C0019SM	26.17
F8261003C0020SM	1.64
F8261003C0021SM	0.34
F8261003C0022SM	-3.53
F8261003C0023SM	0.34
F8261003X0024SM	-2.24
F8261003C0025SM	-4.82
F8261003C0026SM	-0.95
F8261003X0027SM	-4.82
F8261003C0028SM	1.64
F8261003C0029SM	8.09
F8261003C0030SM	-3.53
F8261003C0031SM	-2.24
F8261003C0032SM	-4.82
F8261003C0033SM	-3.53
F8261003C0034SM	0.34
F8261003C0035SM	-4.82
F8261003C0036SM	0.34
F8261003C0037SM	6.8
F8261003C0038SM	10.68
F8261003C0039SM	1.64
F8261003C0040SM	5.51
F8261003C0041SM	-2.24
F8261003C0042SM	10.68
F8261003C0043SM	5.51
F8261003M0044SM	-3.53
F8261003M0045SM	-0.95
F8261003M0046SM	0.34
F8261003M0047SM	-4.82
F8261003C0048SM	1.64

Measurement ID	Surface Beta Activity (dpm/100 cm ²)
F8261003C0049SM	13.26
F8261003C0050SM	10.68
Mean:	1.04
Median:	-0.95
Standard Deviation:	6
Range:	-4.82 to 26.17

Survey Unit Data Assessment:

The survey design required 50 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	
Ambient Background Used (dpm/100 cm ²):	N/A	Average Ambient BKG = 0
Actual Direct Measurements (N):	50	
Median (dpm/100 cm ²):	1,621	
Mean (dpm/100 cm ²):	1,917	
Direct Measurement Standard Deviation	931	
(dpm/100 cm ²):		
Total Standard Deviation (dpm/100 cm ²):	931	Based on samples and backgrounds.
Maximum (dpm/100 cm ²):	6,733	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	50	
S+ Value:	50	
Critical Value:	31	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGL_{emc}:	Yes	Class 1
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:

No investigations were required for either direct or scan measurements and no investigation results are reported.

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. No potential areas of elevated activity were detected. 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 43,000 dpm/100 cm² and none of the removable surface activity measurements exceeded 10% of the DCGL. No 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.

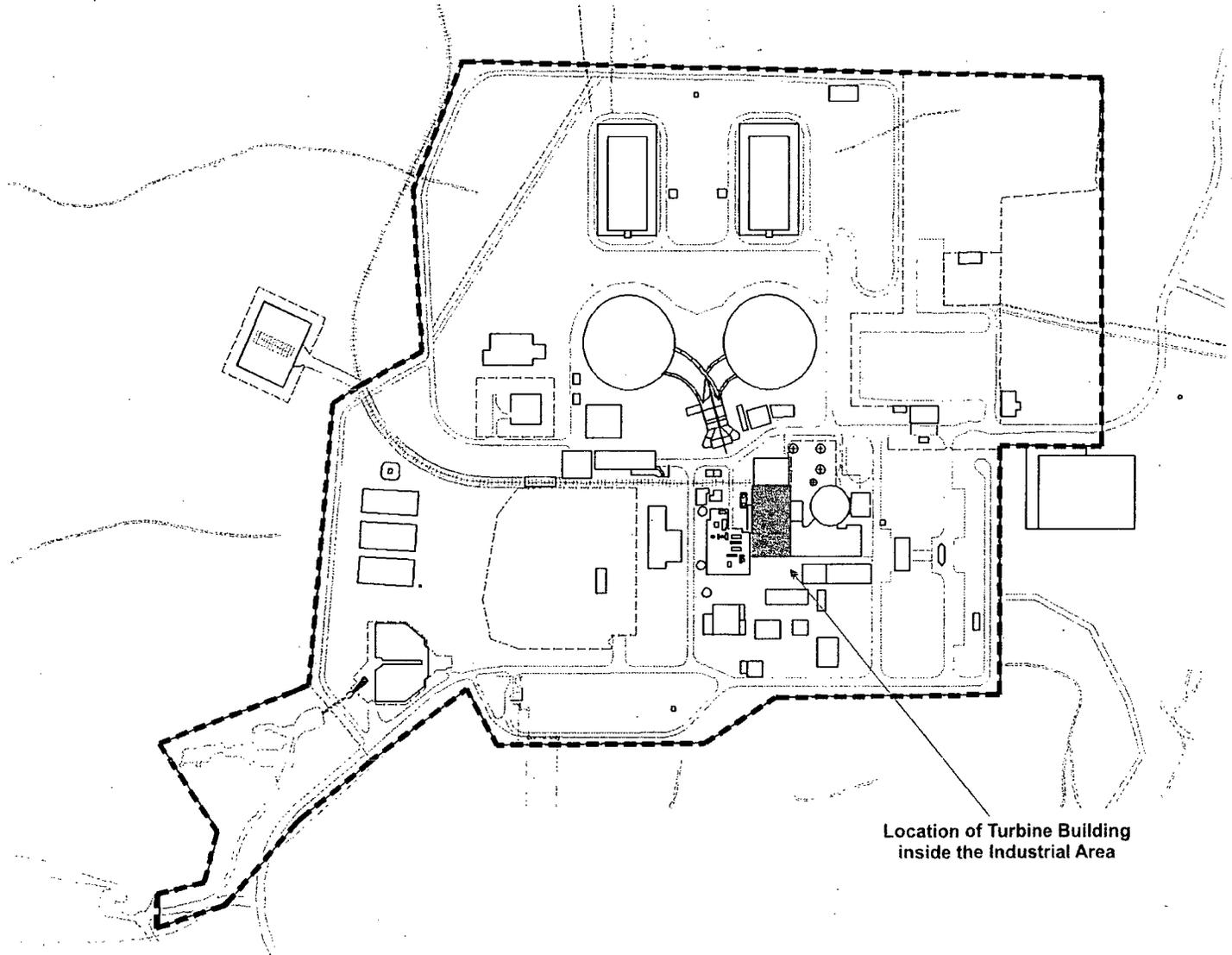
It is concluded that survey unit F8261003 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

October 20, 2008

Survey Unit F8261003

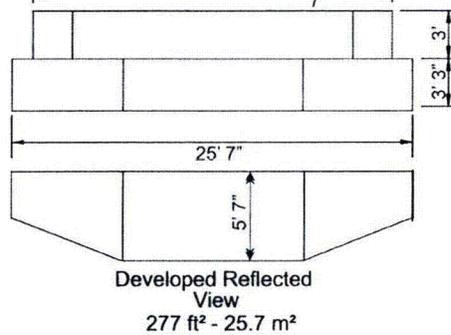
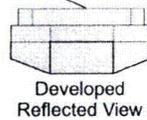
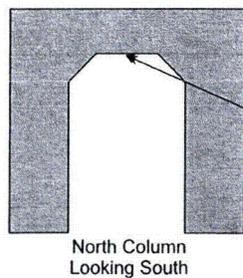
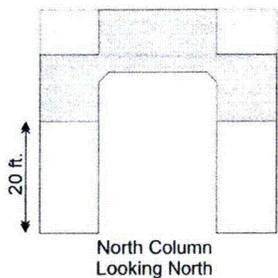
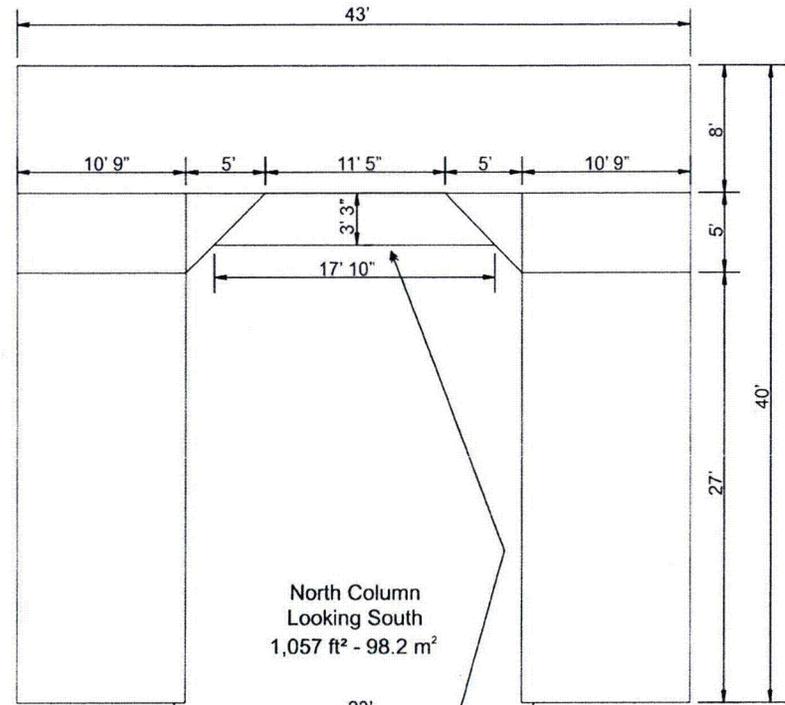
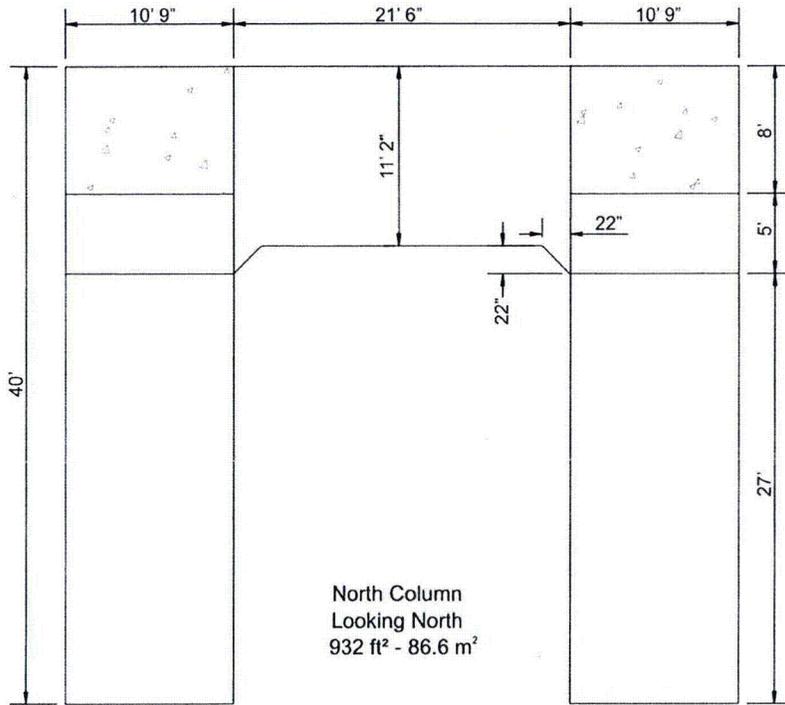


Location of Turbine Building
inside the Industrial Area

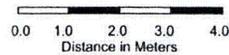
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Map F8261003-1, Location of Turbine Building at Rancho Seco site



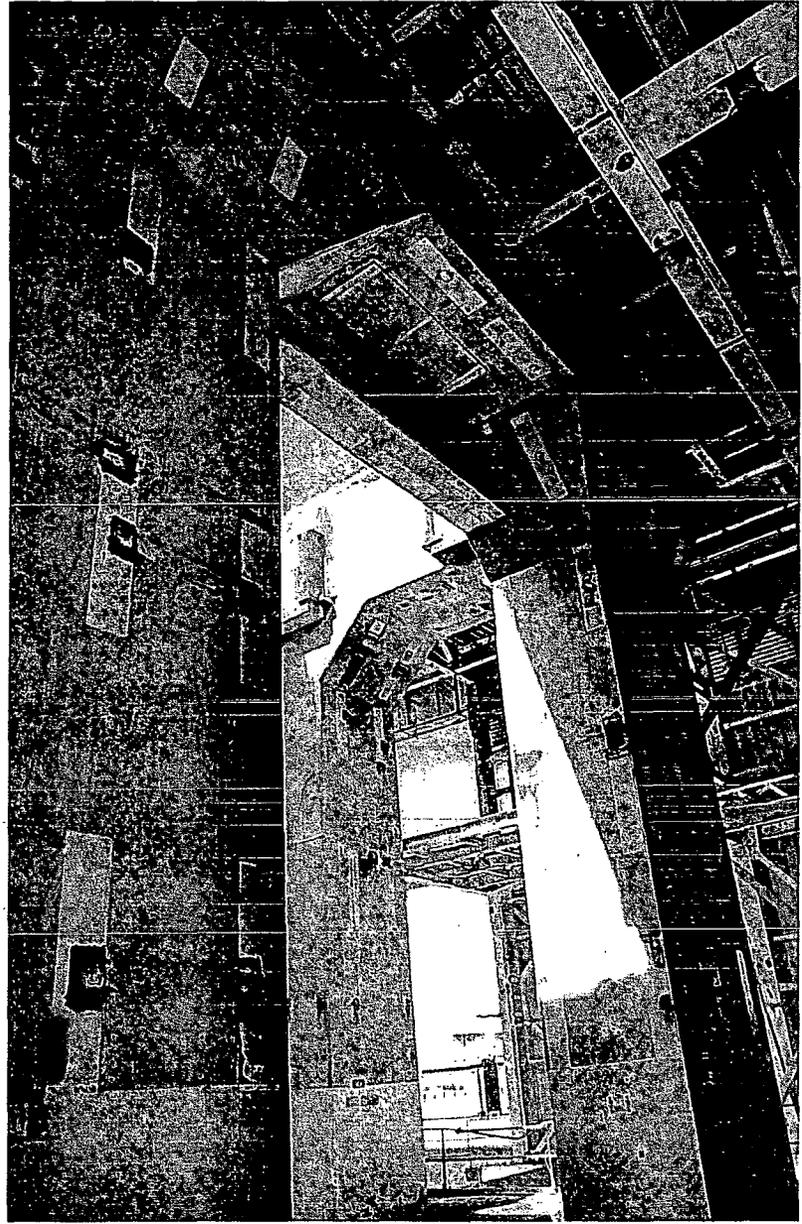
- F8261003, Class 1
- F8261004, Class 1
- F8261005, Class 2



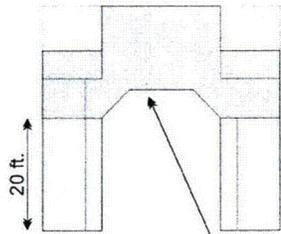
Map F8261003-2, Turbine Building (+) 0' El. to (+) 40' El.
 High Pressure Turbine Pedestals - North Column
 Area Estimate: 2,266 sq. ft. - 210.5 sq. meters
 F8261003 Area Estimate: 112.3 sq. meters
 F8261004 Area Estimate: 40.0 sq. meters
 F8261005 Area Estimate: 98.2 sq. meters



North High Pressure Turbine Pedestal Looking North



North High Pressure Turbine Pedestal Looking South

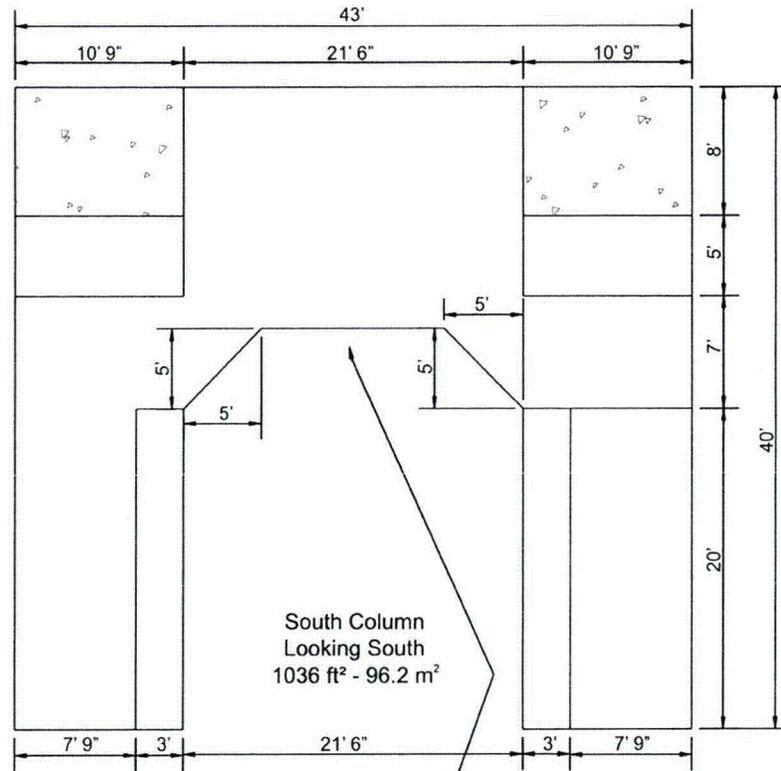
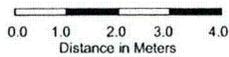


South Column Looking South

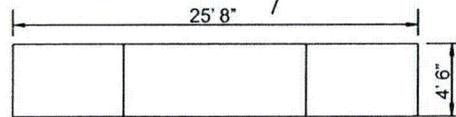


Developed Reflected View

- F8261003, Class 1
- F8261004, Class 1
- F8261005, Class 2

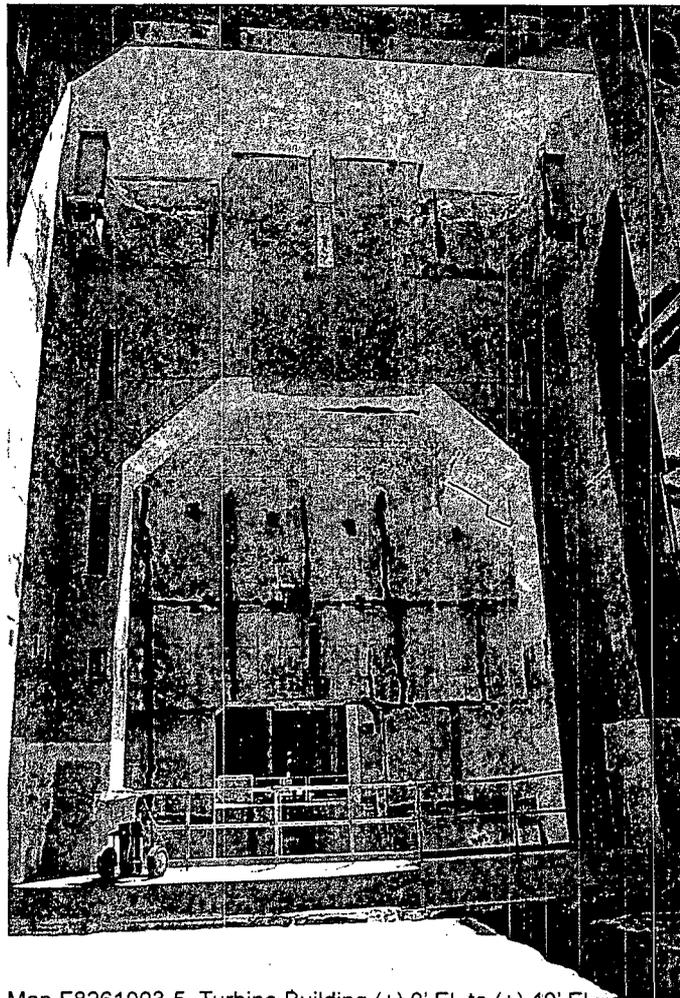
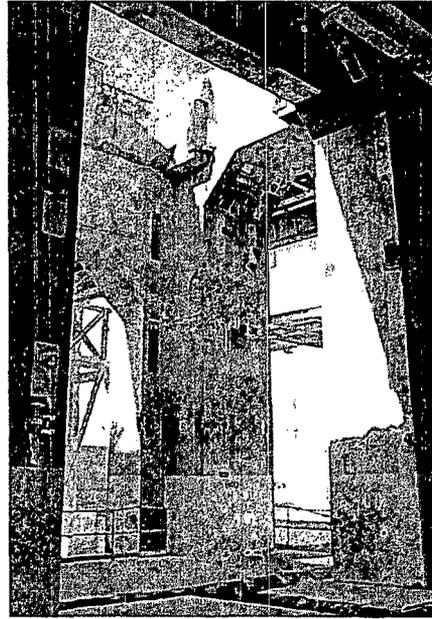
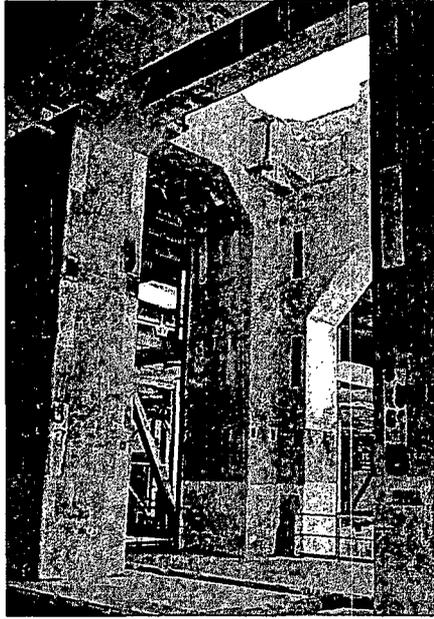


South Column Looking South
1036 ft² - 96.2 m²

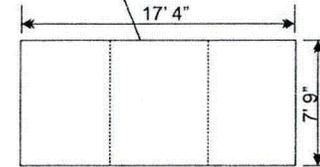
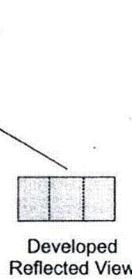
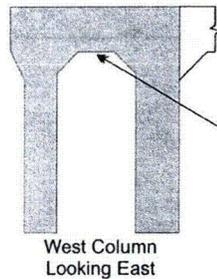
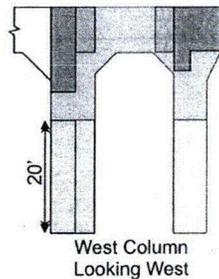
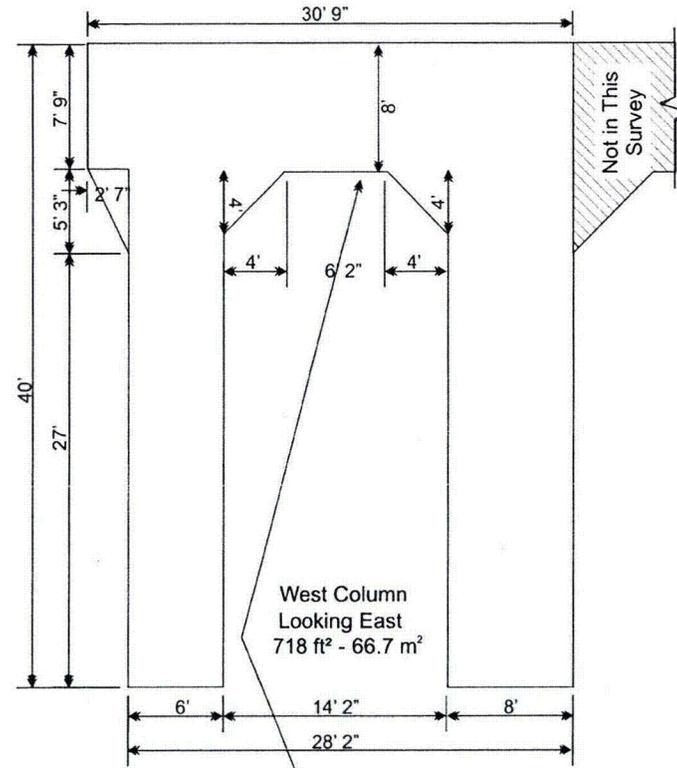
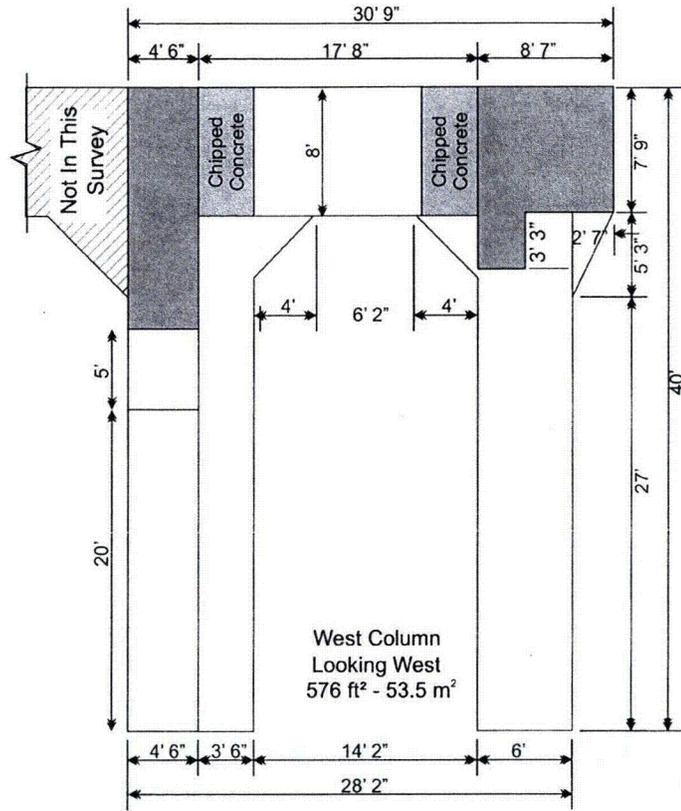


Developed Reflected View
115 ft² - 10.7 m²

Map F8261003-4, Turbine Building (+) 0' El. to (+) 40' El.
High Pressure Turbine Pedestals - South Column
Area Estimate: 1,151 sq ft. - 106.9 sq. meters
F8261003 Area Estimate: 67 sq. meters
F8261004 Area Estimate: 40 sq. meters

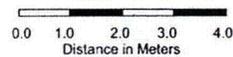


Map F8261003-5, Turbine Building (+) 0' El. to (+) 40' El.—
High Pressure Turbine Pedestals - South Column Looking South

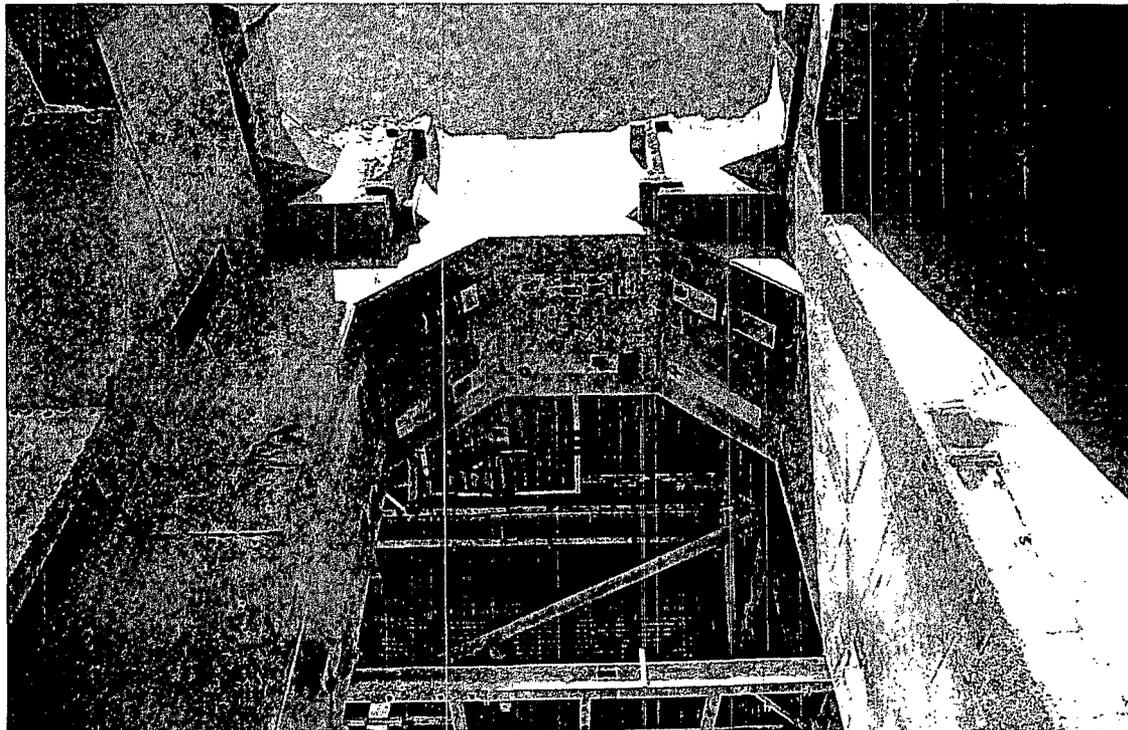
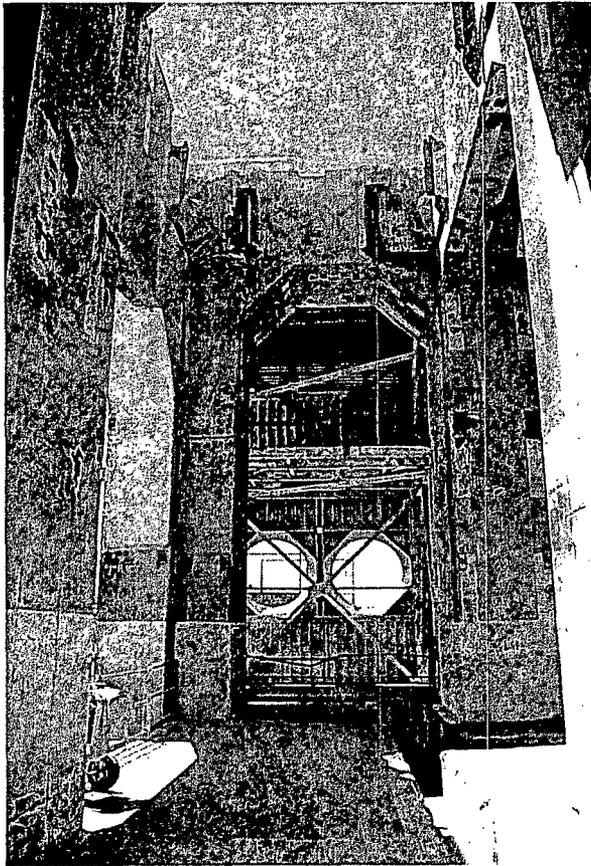


Developed Reflected View
134.3 ft² - 12.5 m²

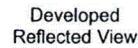
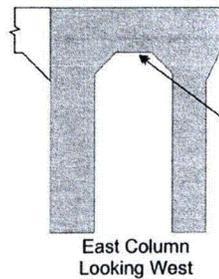
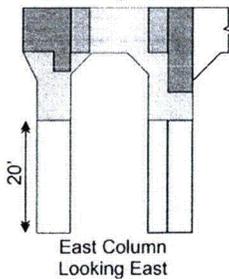
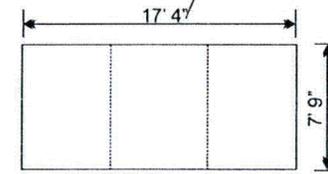
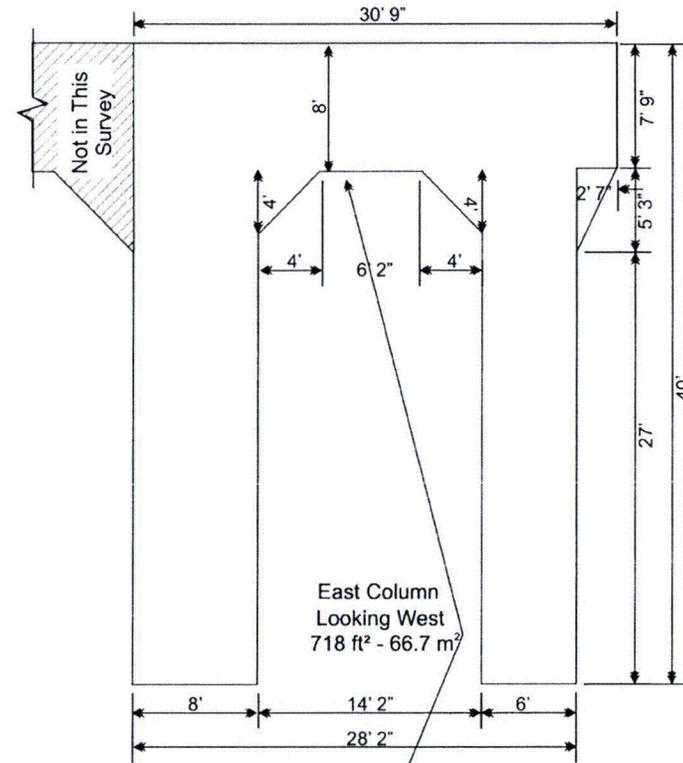
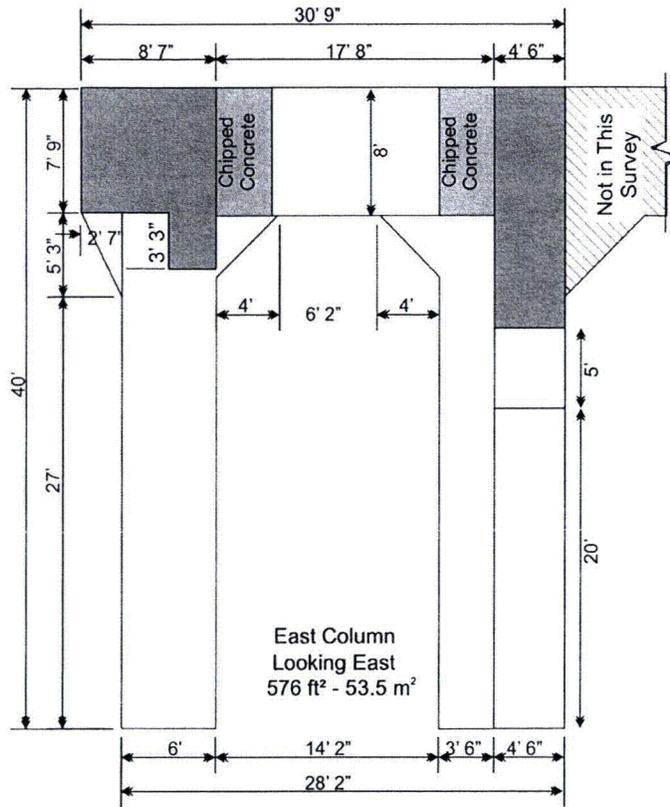
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- F8261004, Class 1
- F8261005, Class 2



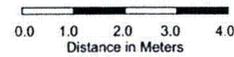
Map F8261003-6, Turbine Building (+) 0' El. to (+) 40' El.
 High Pressure Turbine Pedestals - West Column
 Area Estimate: 1,428.3 sq ft. - 132.7 sq. meters
 F8261003 Area Estimate: 40.0 sq. meters
 F8261004 Area Estimate: 26.0 sq. meters
 F8261005 Area Estimate: 66.7 sq. meters



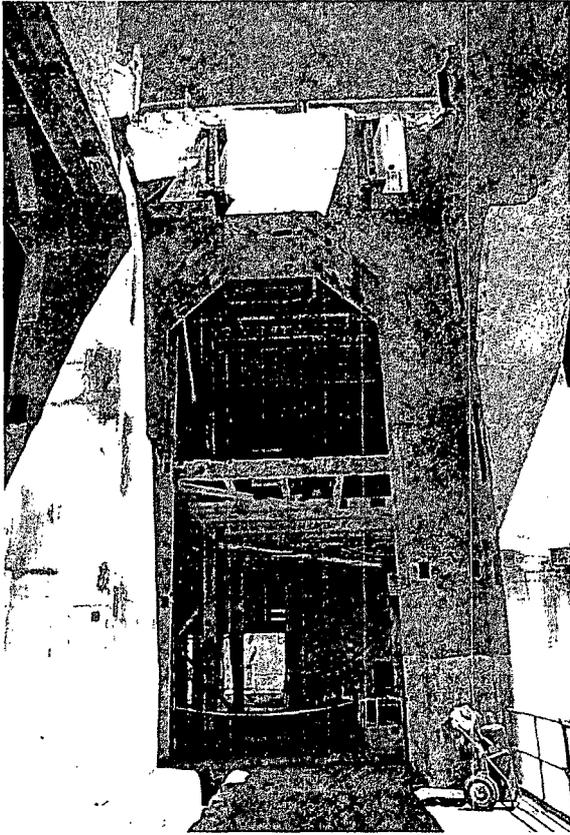
Map F8261003-7, Turbine Building (+) 0' El. to (+) 40' El.
High Pressure Turbine Pedestals West Column Looking West



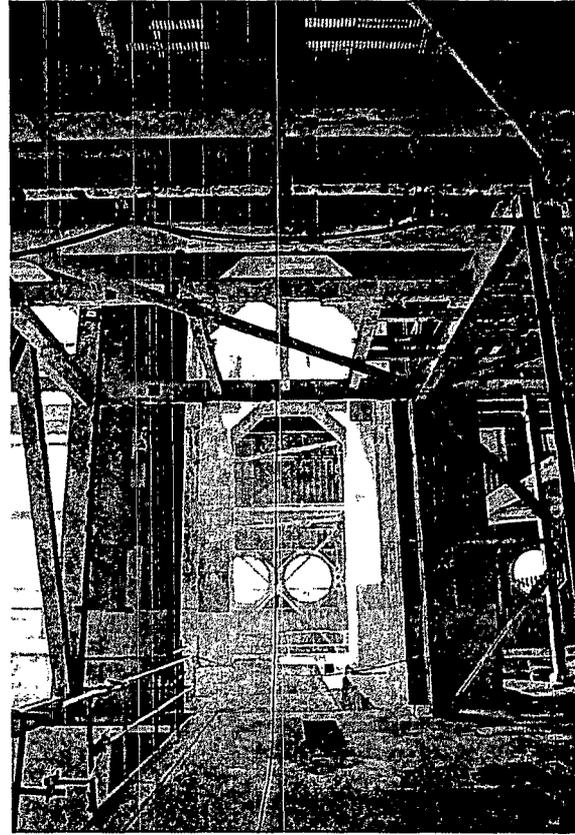
- F8261003, Class 1
- F8261004, Class 1
- F8261005, Class 2



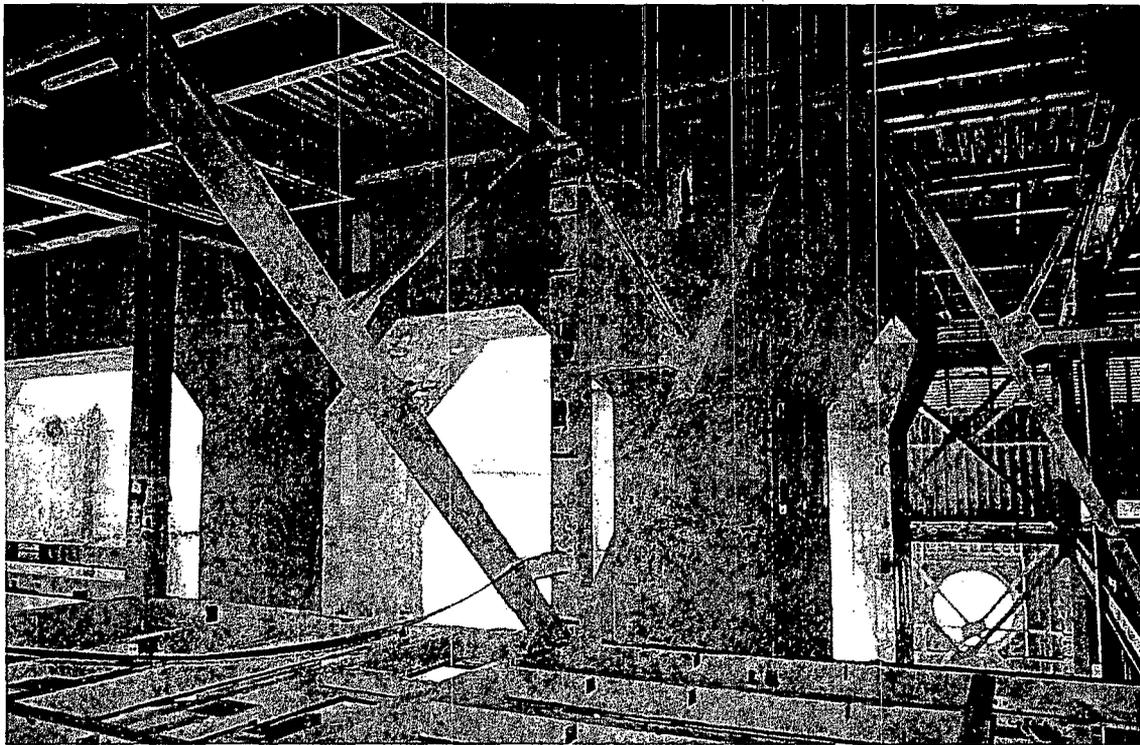
Map F8261003-8, Turbine Building (+) 0' El. to (+) 40' El.
 High Pressure Turbine Pedestals - East Column
 Area Estimate: 1,428.3 sq. ft. - 132.7 sq. meters
 F8261003 Area Estimate: 40.0 sq. meters
 F8261004 Area Estimate: 26.0 sq. meters
 F8261005 Area Estimate: 66.7 sq. meters



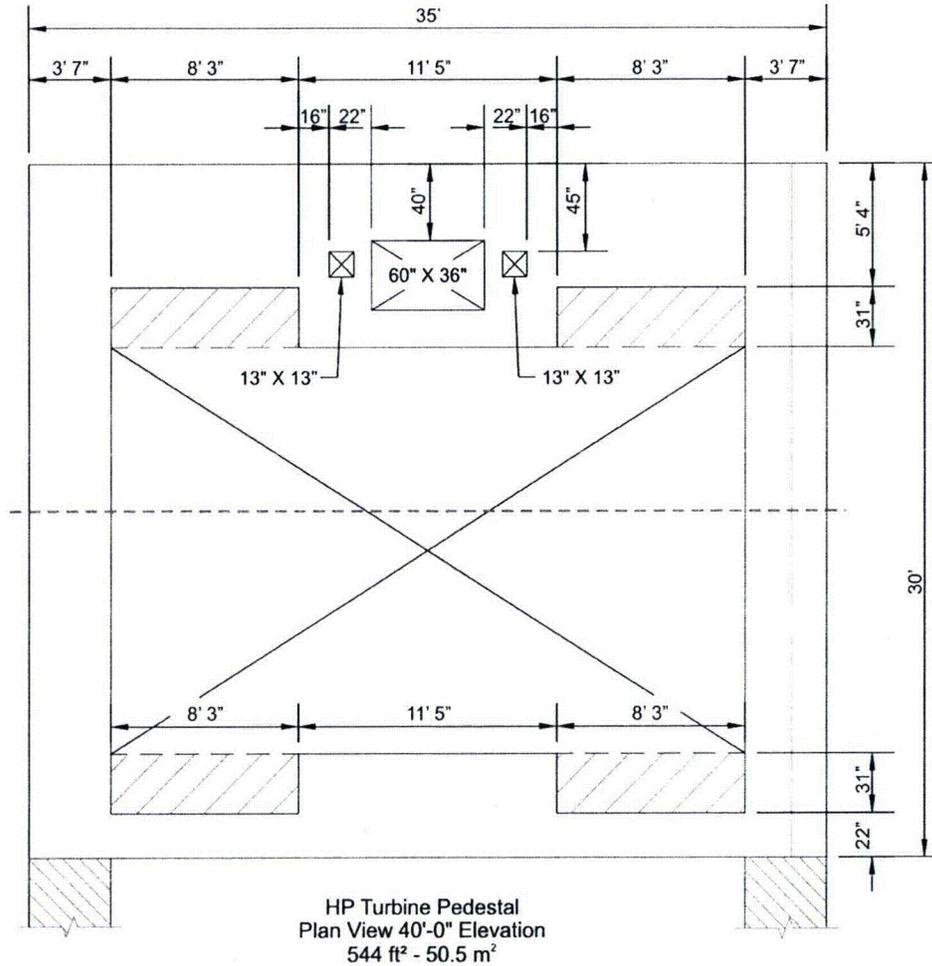
East Column Looking East



East Column Looking West

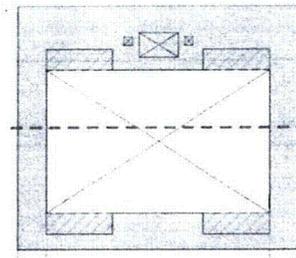


Map F8261003-9, Turbine Building (+) 0' El. to (+) 40' El.
High Pressure Turbine Pedestals East Column Looking West



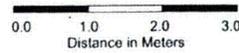
North Portion Area Estimate:
29.05 sq. meters

South Portion Area Estimate:
21.45 sq. meters

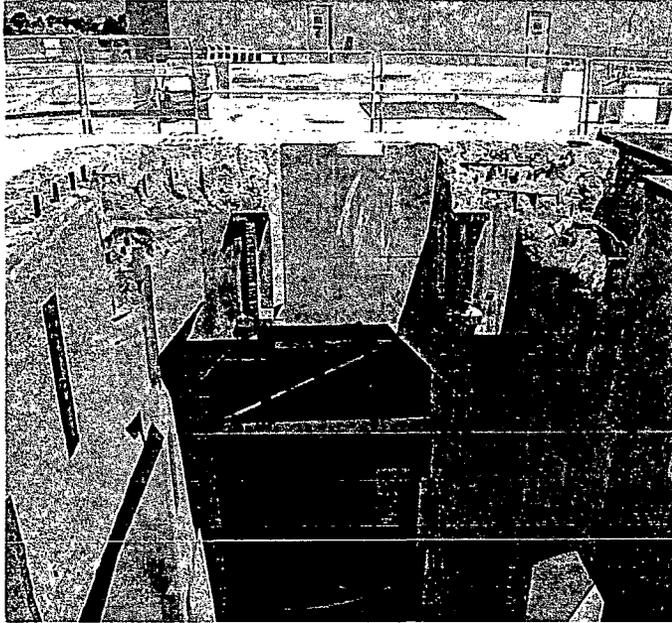


HP Turbine Pedestal
Plan View - 40' El.

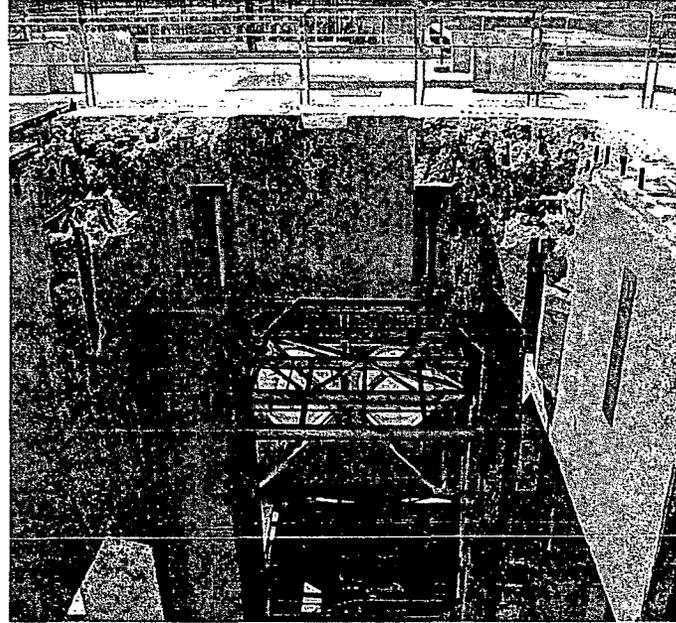
- F8261003, Class 1
- F8261004, Class 1
- F8261005, Class 2



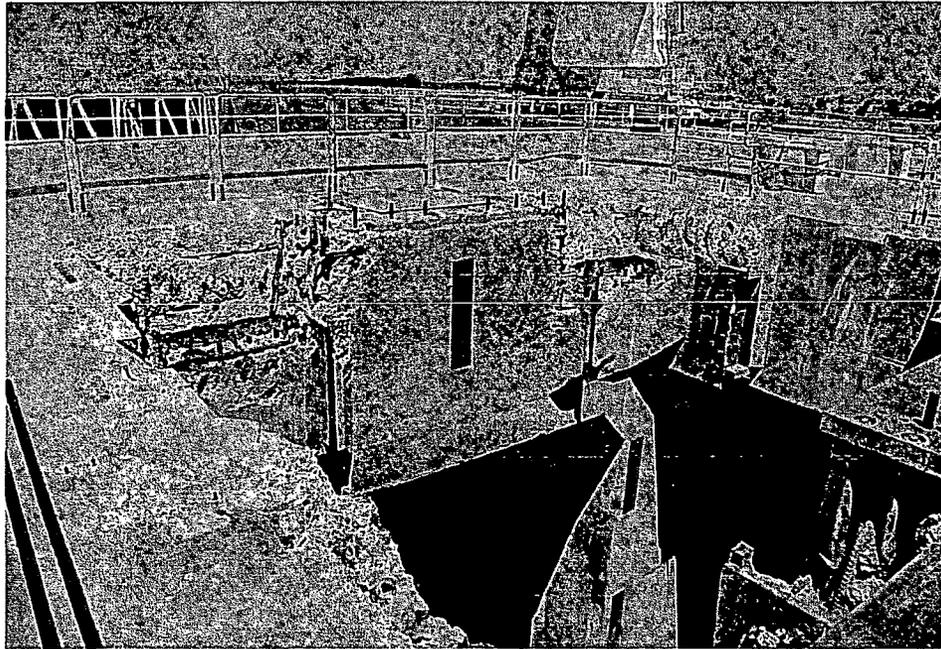
Map F8261003-10, Turbine Building (+) 40' El.
High Pressure Turbine Pedestals -
Plan View at 40' Elevation
Area Estimate: 544 sq ft. - 50.5 sq. meters
F8261003 Area Estimate: 50.5 sq. meters



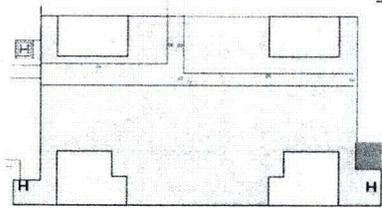
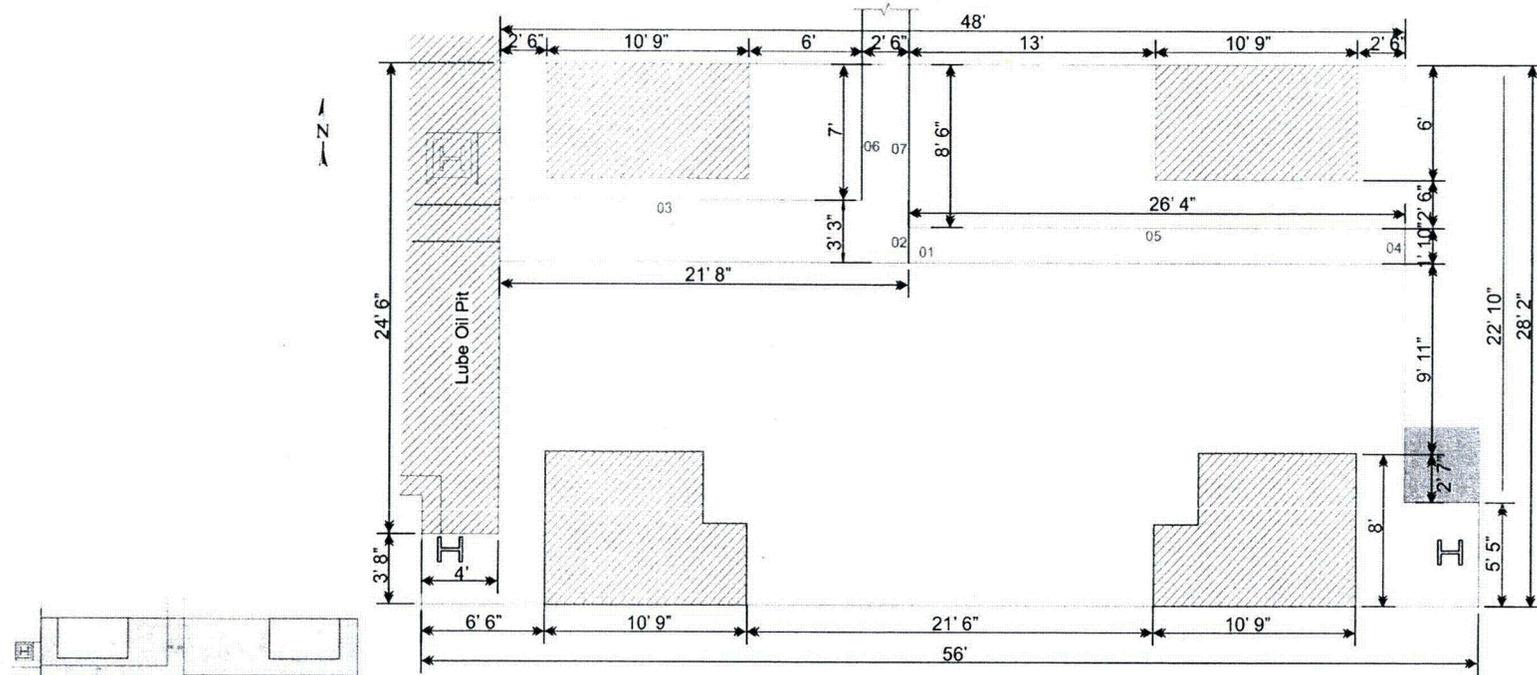
Turbine Building 40' El. - East Column Looking East



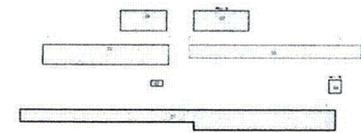
Turbine Building 40' El. - West Column Looking West



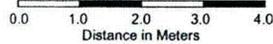
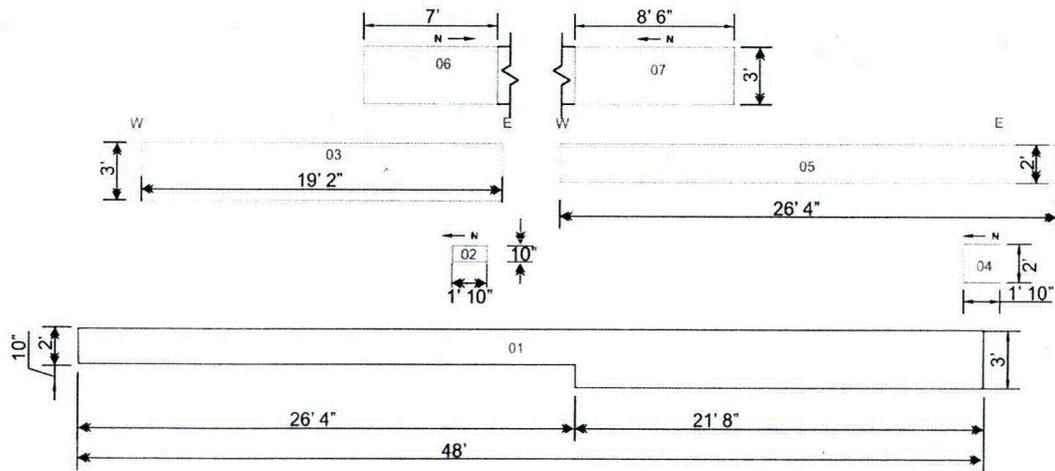
Map F8261003-11, Turbine Building (+) 40' El.
High Pressure Turbine Pedestals
Views at 40' Elevation
North Column Looking North



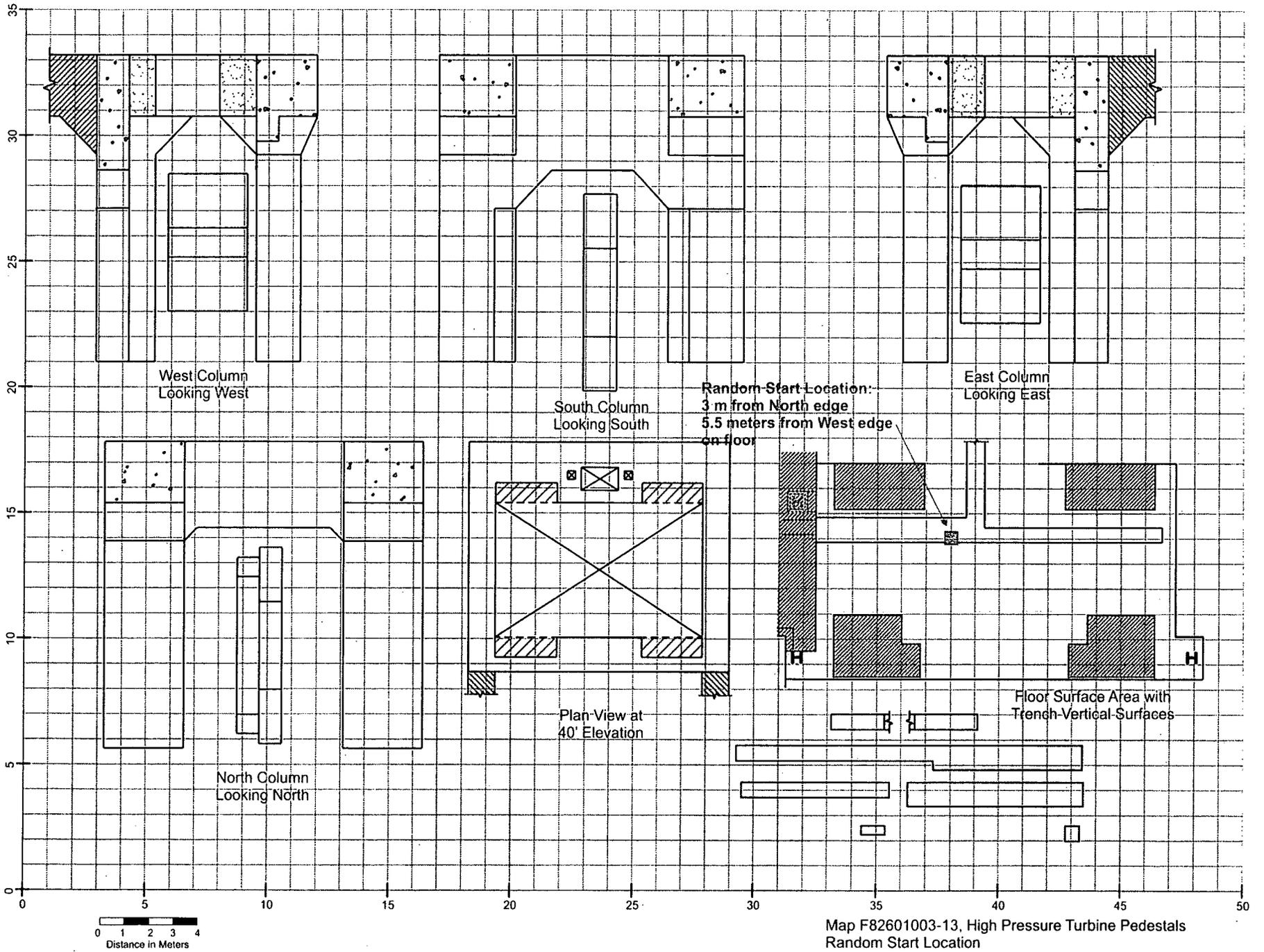
HP Turbine Pedestal
Plan View - 40' EI.



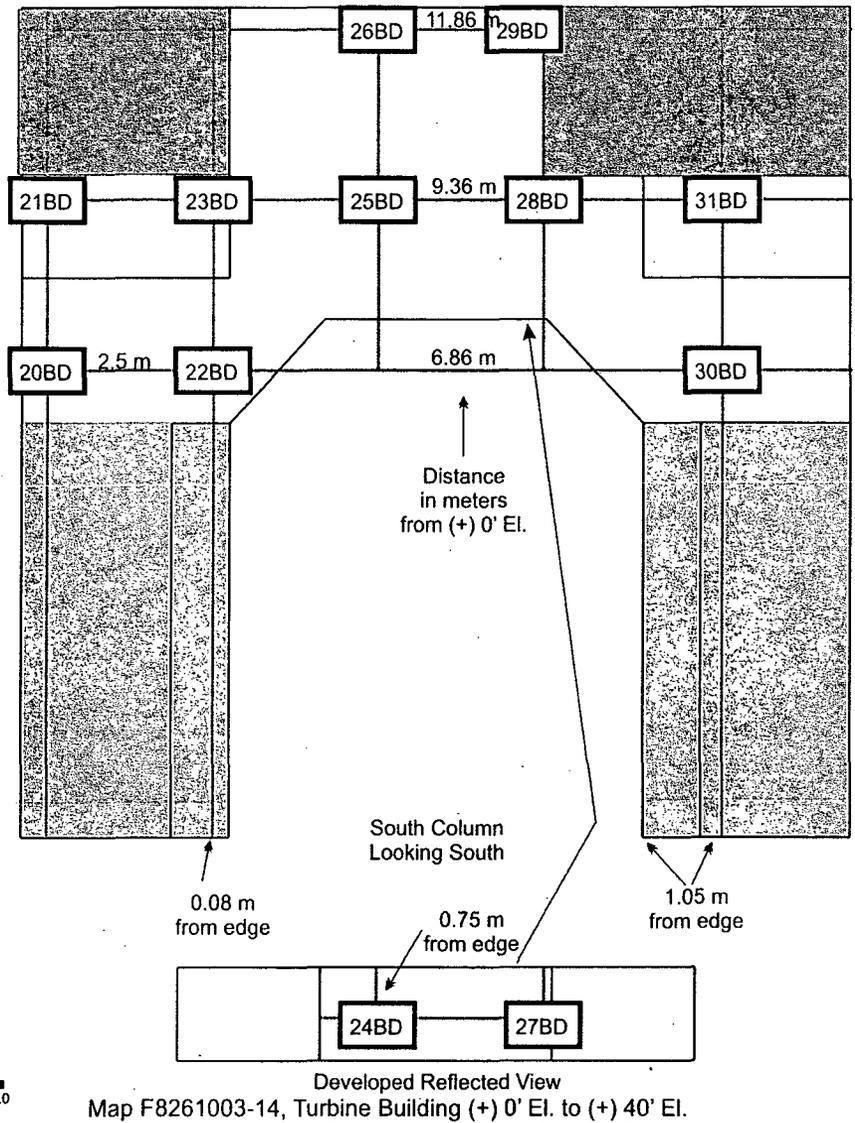
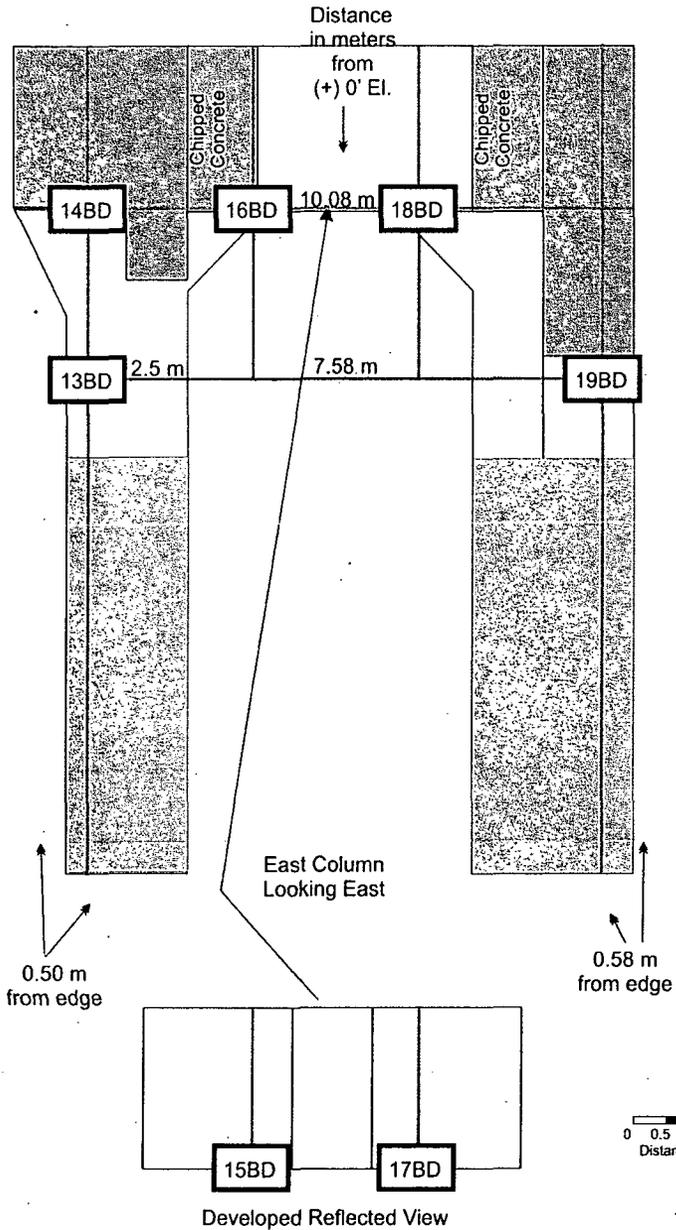
- F8261003, Class 1
- F8261004, Class 1
- F8261005, Class 2



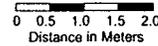
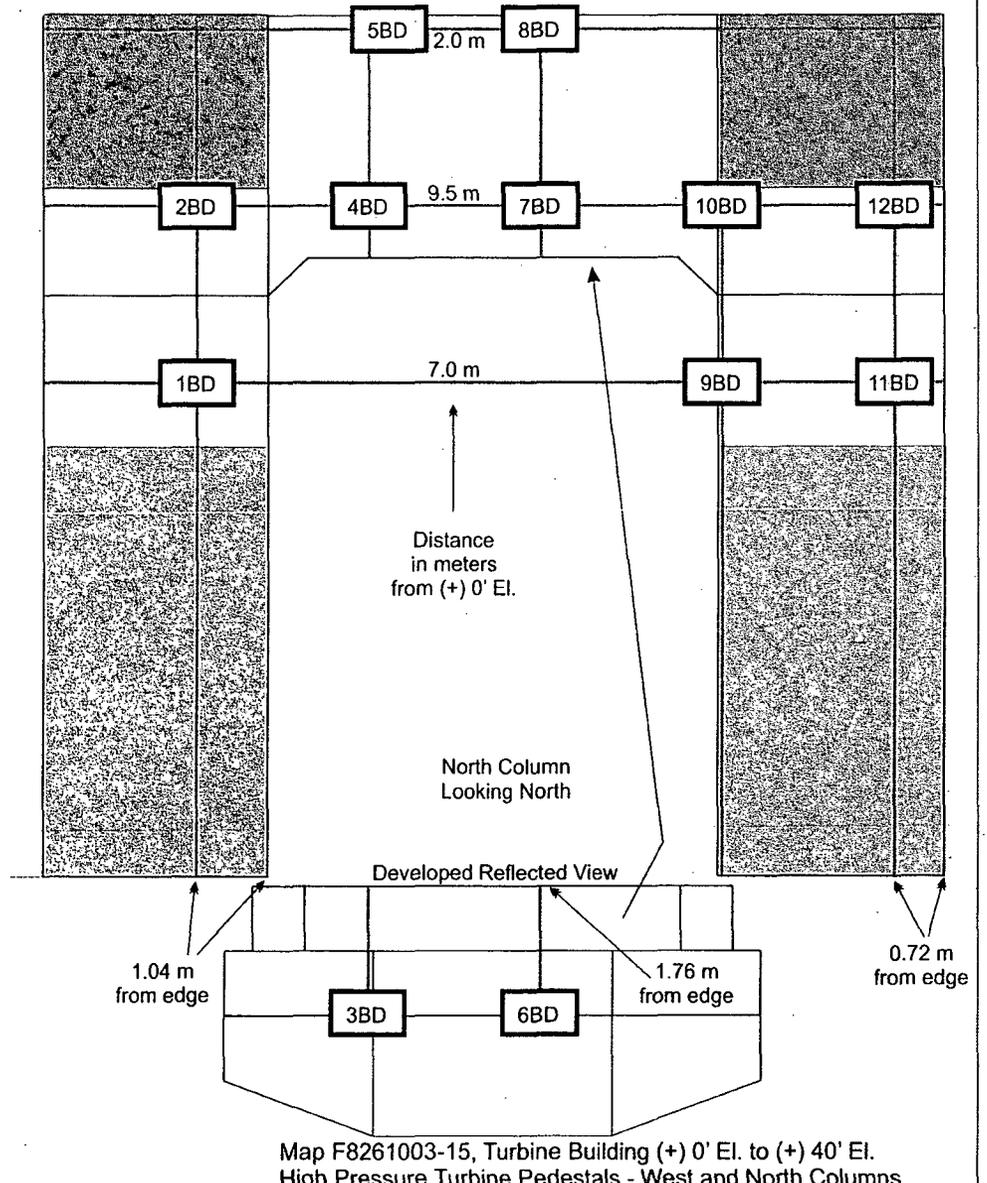
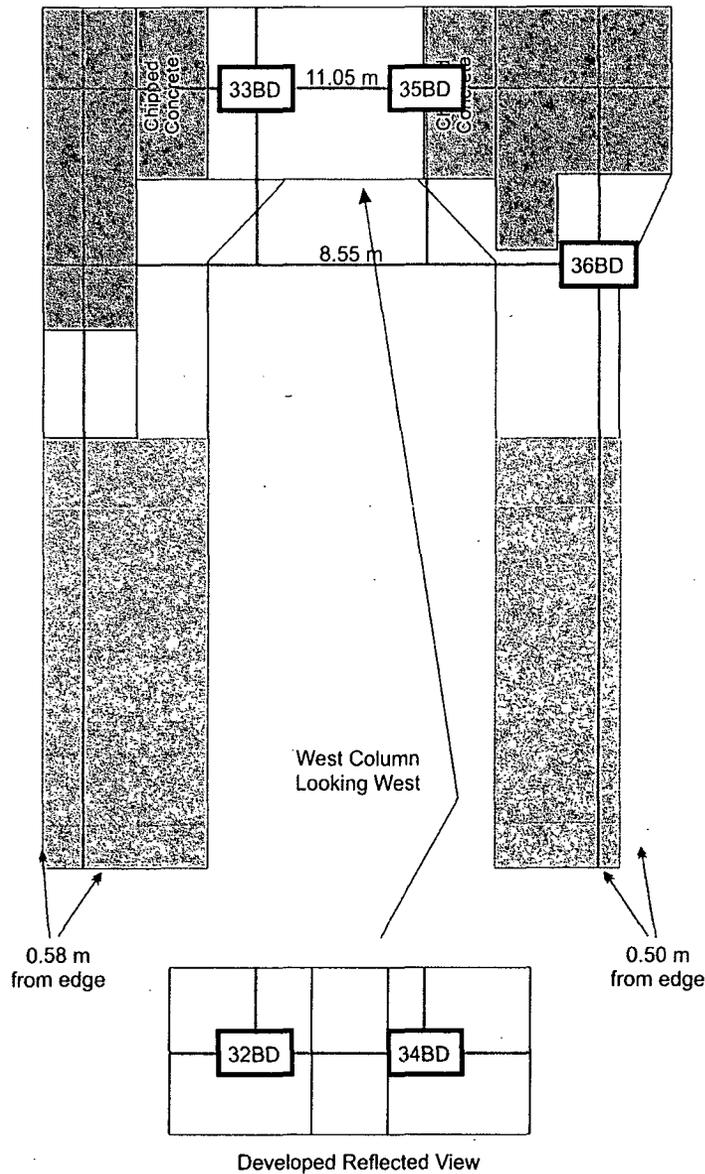
Map F8261003-12, Turbine Building (+) 0' EI.
High Pressure Turbine Pedestals - Floor Surface Area
with Trench Vertical Surfaces
Area Estimate: 1,402 sq ft. - 130.2 sq. meters



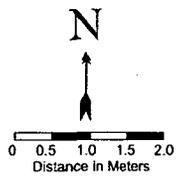
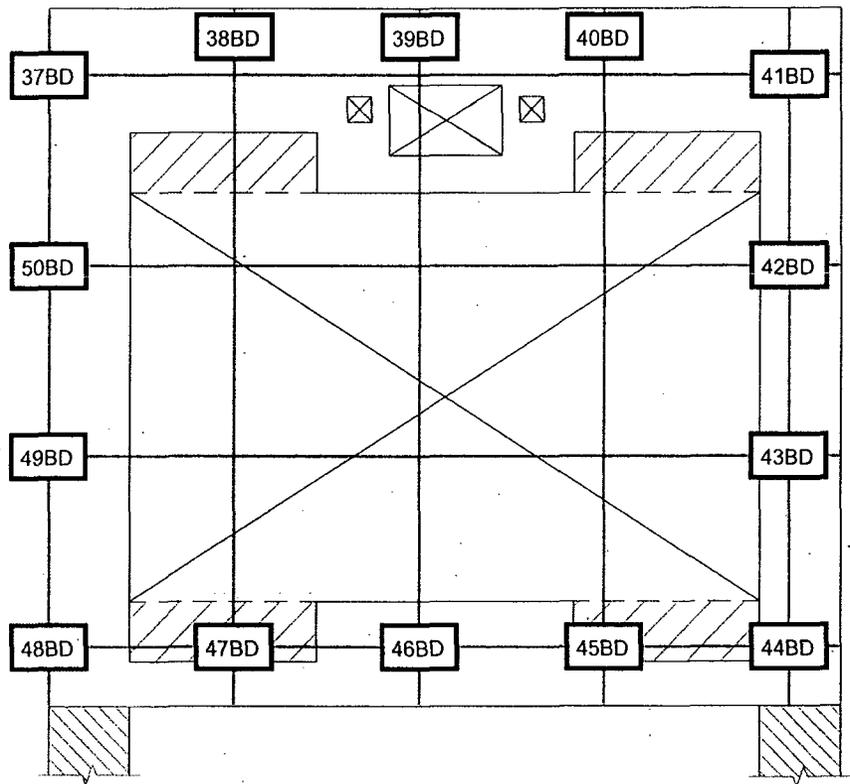
Map F82601003-13, High Pressure Turbine Pedestals
Random Start Location



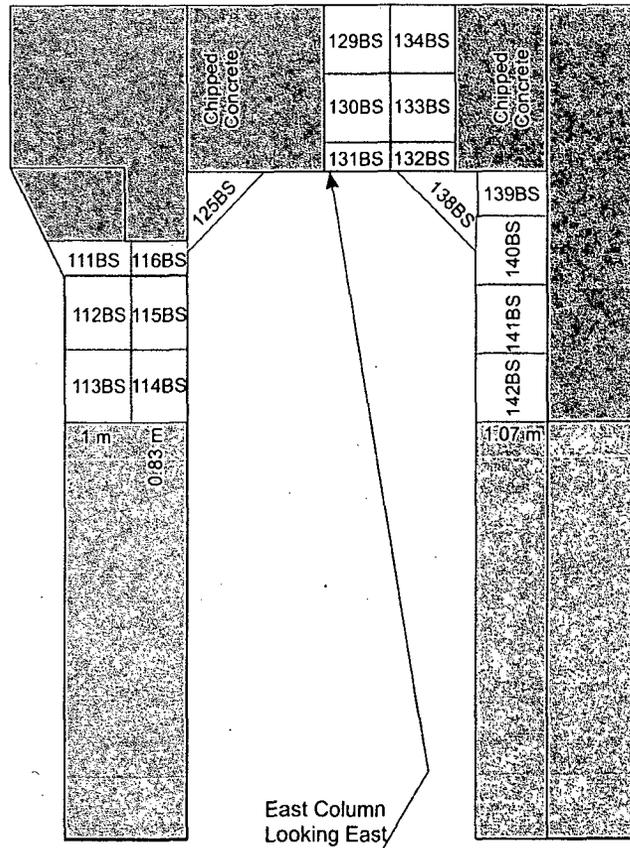
Map F8261003-14, Turbine Building (+) 0' El. to (+) 40' El.
High Pressure Turbine Pedestals - East and South Columns
Beta Direct Measurements
F8261003C0013BD to F8261003C0023BD, F8261003X0024BD,
F8261003C0025BD to F8261003C0026BD, F8261003X0027BD, and
F8261003C0028BD to F8261003C0031BD
2.5 meter grid spacing



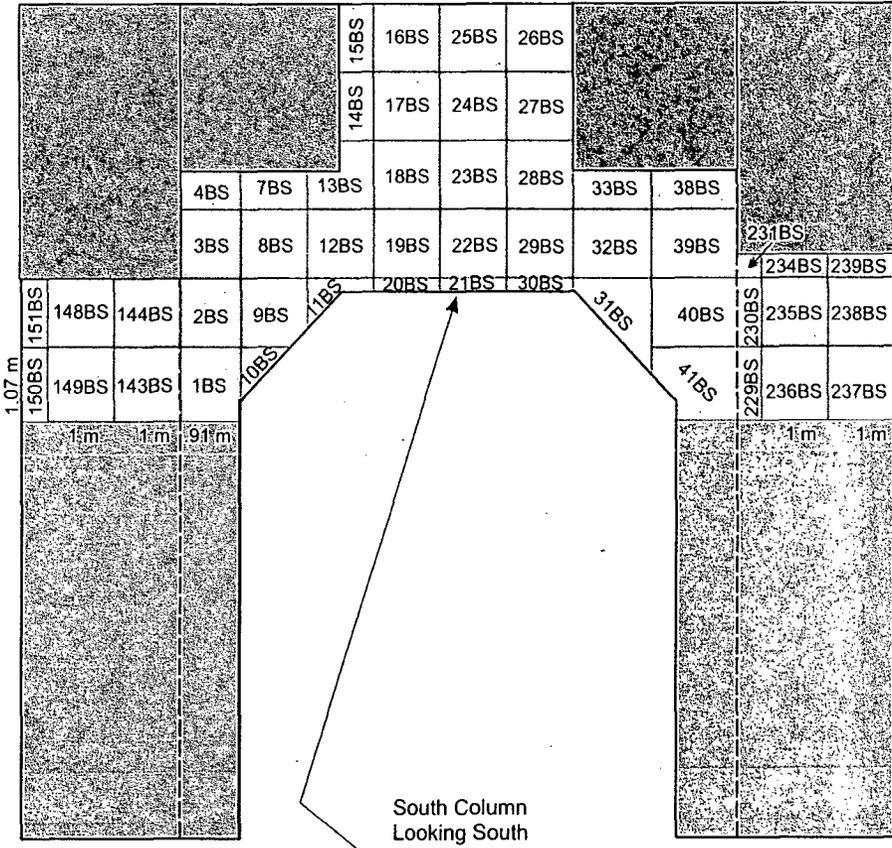
Map F8261003-15, Turbine Building (+) 0' El. to (+) 40' El.
High Pressure Turbine Pedestals - West and North Columns
Beta Direct Measurements
F8261003C0001BD to F8261003C0012BD and
F8261003C0032BD to F8261003C0036BD
2.5 meter grid spacing



Map F8261003-16, Turbine Building (+) 40' El.
High Pressure Turbine Pedestals - Plan View at 40' Elevation
Beta Direct Measurements
F8261003C0037BD to F8261003C0043BD,
F8261003M0044BD to F8261003M0047BD, and
F8261003C0048BD to F8261003C0050BD
2.5 meter grid spacing



East Column Looking East



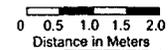
South Column Looking South

Developed Reflected View 1 m

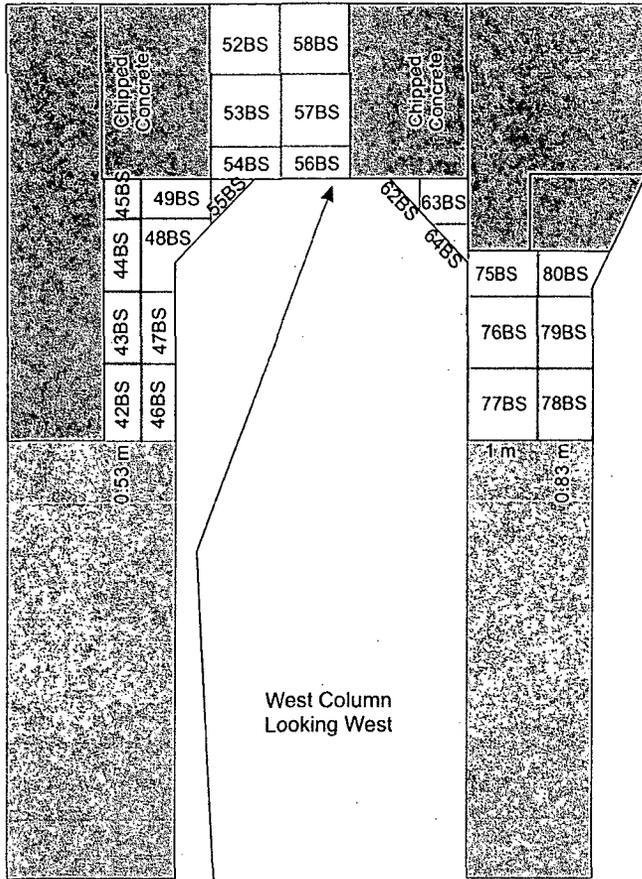
171BS	166BS	165BS	160BS	159BS	172BS
170BS	167BS	164BS	161BS	158BS	173BS
169BS	168BS	163BS	162BS	157BS	174BS

Developed Reflected View

253BS	250BS	249BS	246BS	245BS	242BS	241BS
252BS	251BS	248BS	247BS	244BS	243BS	240BS



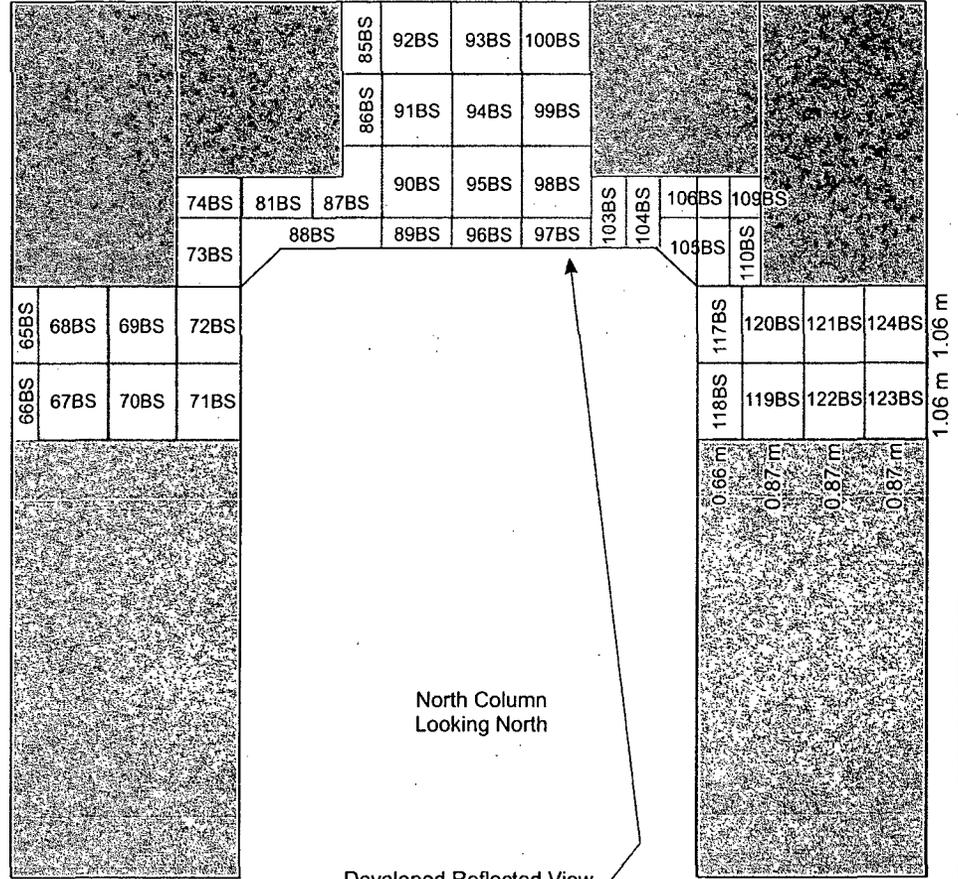
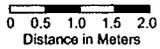
Map F8261003-17, Turbine Building (+) 0' El. to (+) 40' El.
High Pressure Turbine Pedestals - East and South Columns
Beta Scan Measurements



0.85 m

222BS	221BS	216BS	215BS	210BS	209BS
223BS	220BS	217BS	214BS	211BS	208BS
224BS	219BS	218BS	213BS	212BS	207BS

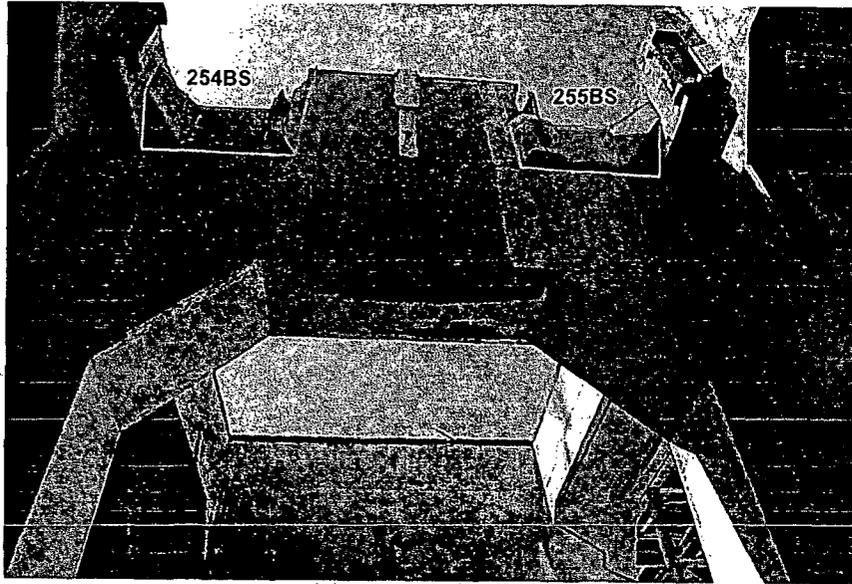
Developed Reflected View



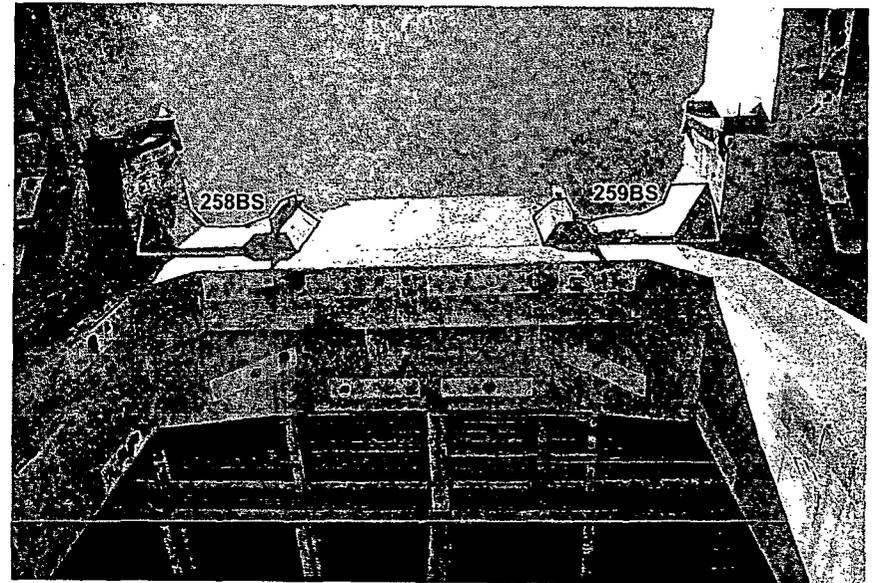
Developed Reflected View

181BS	180BS	179BS	178BS	177BS	176BS	175BS
183BS	184BS	185BS	186BS	187BS	188BS	189BS
198BS	197BS	196BS	195BS	194BS	193BS	192BS
200BS	201BS	202BS	203BS	204BS	205BS	206BS

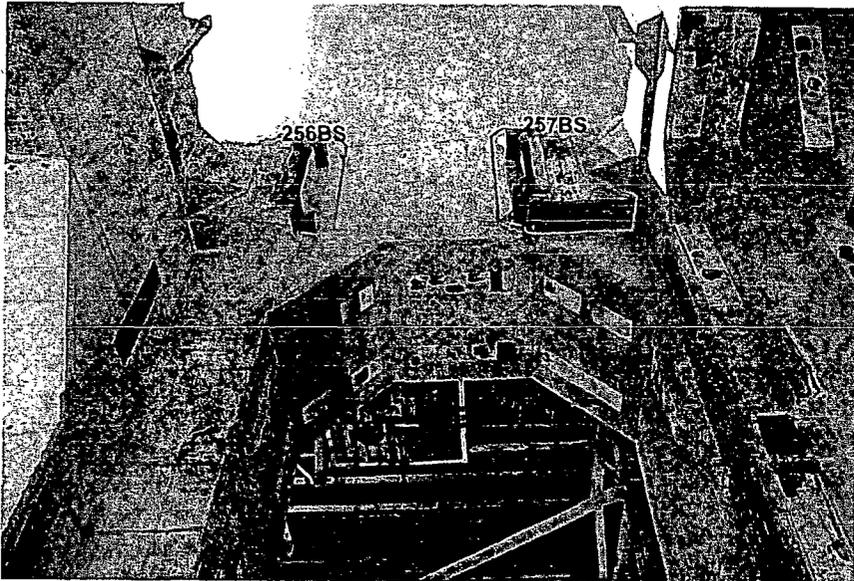
Map F8261003-18, Turbine Building (+) 0' El. to (+) 40' El.
High Pressure Turbine Pedestals - West and North Columns
Beta Scan Measurements



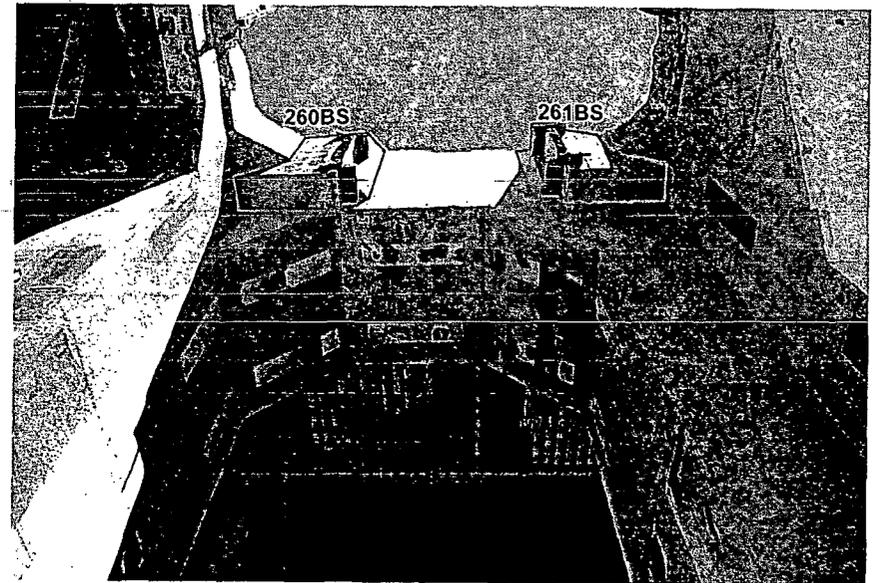
South Column Looking South



North Column Looking North

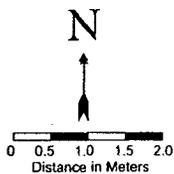
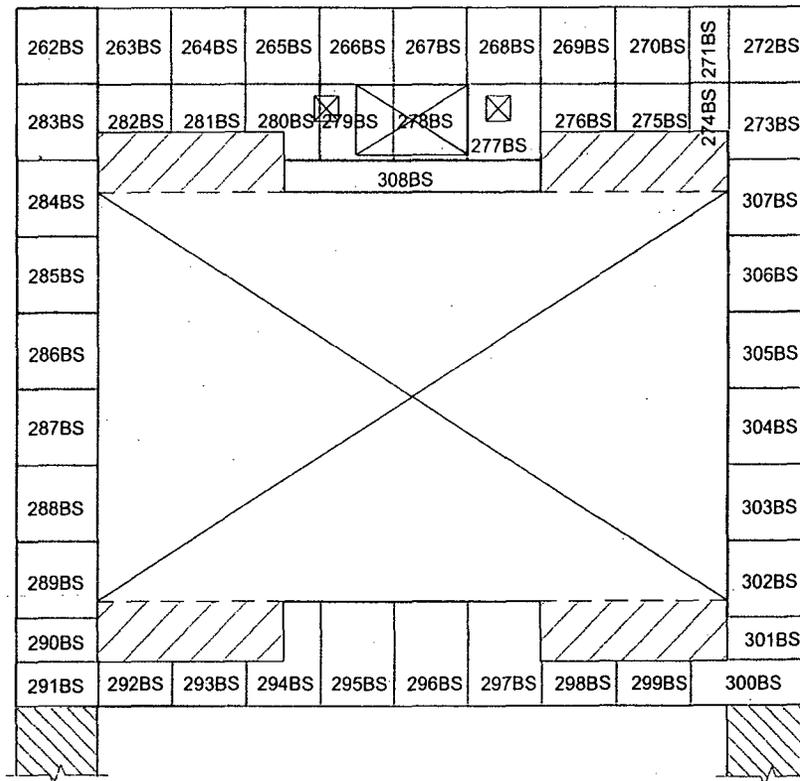


West Column Looking West

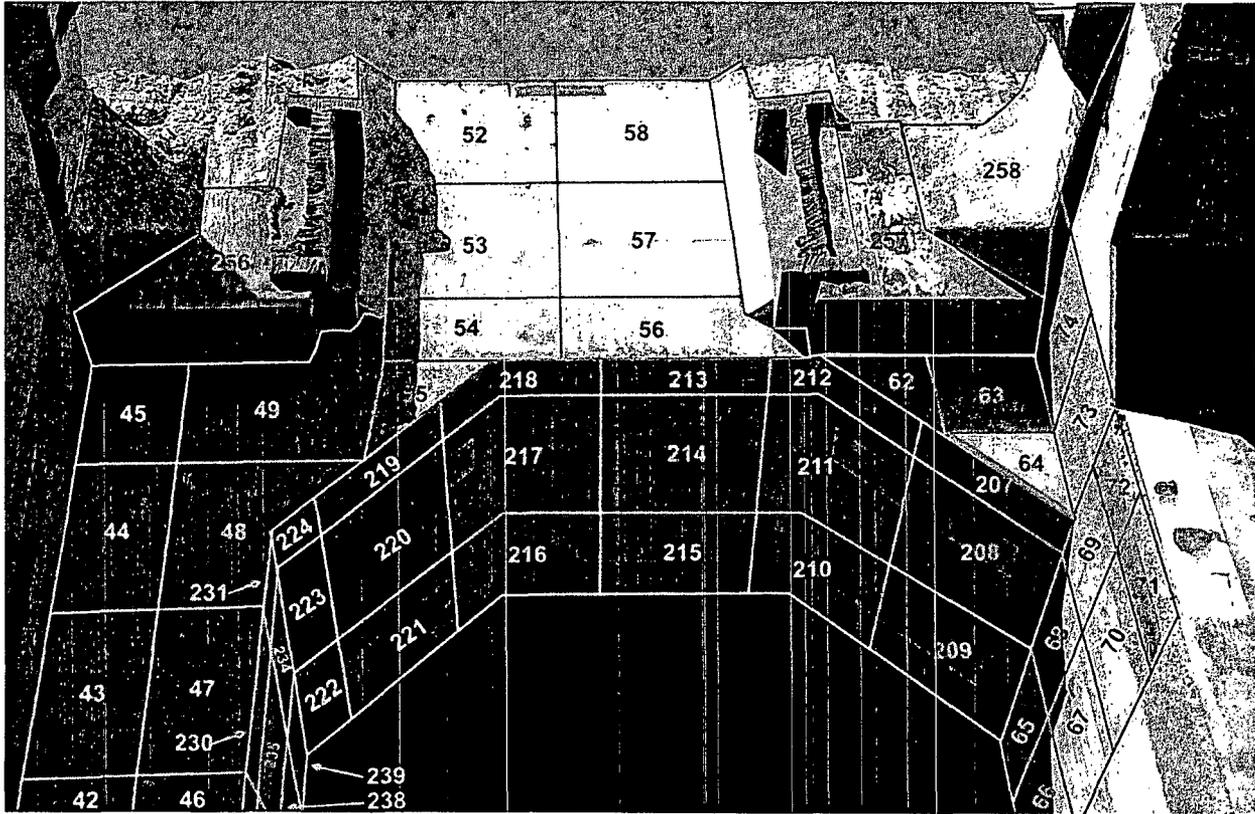


East Column Looking East

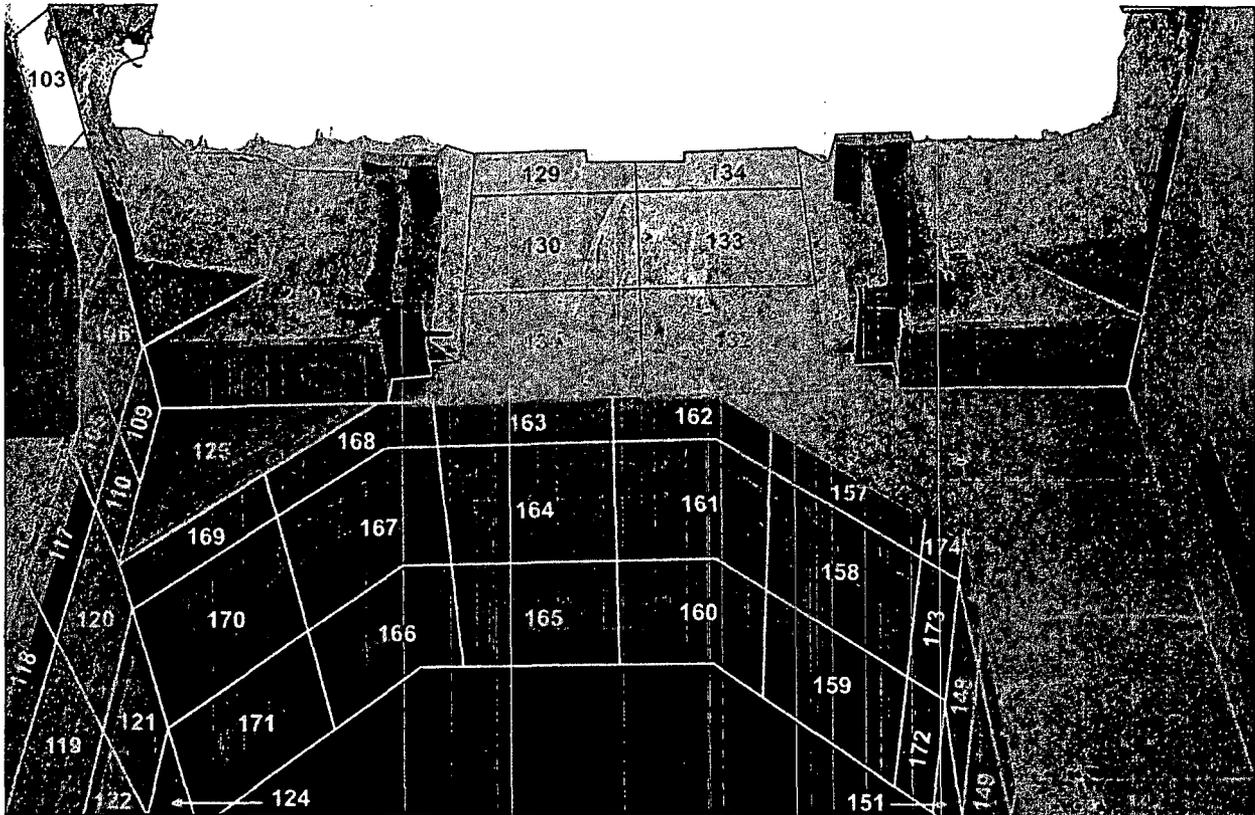
Map F8261003-19, Turbine Building High Pressure Turbine Pedestals
Beta Scan Measurements



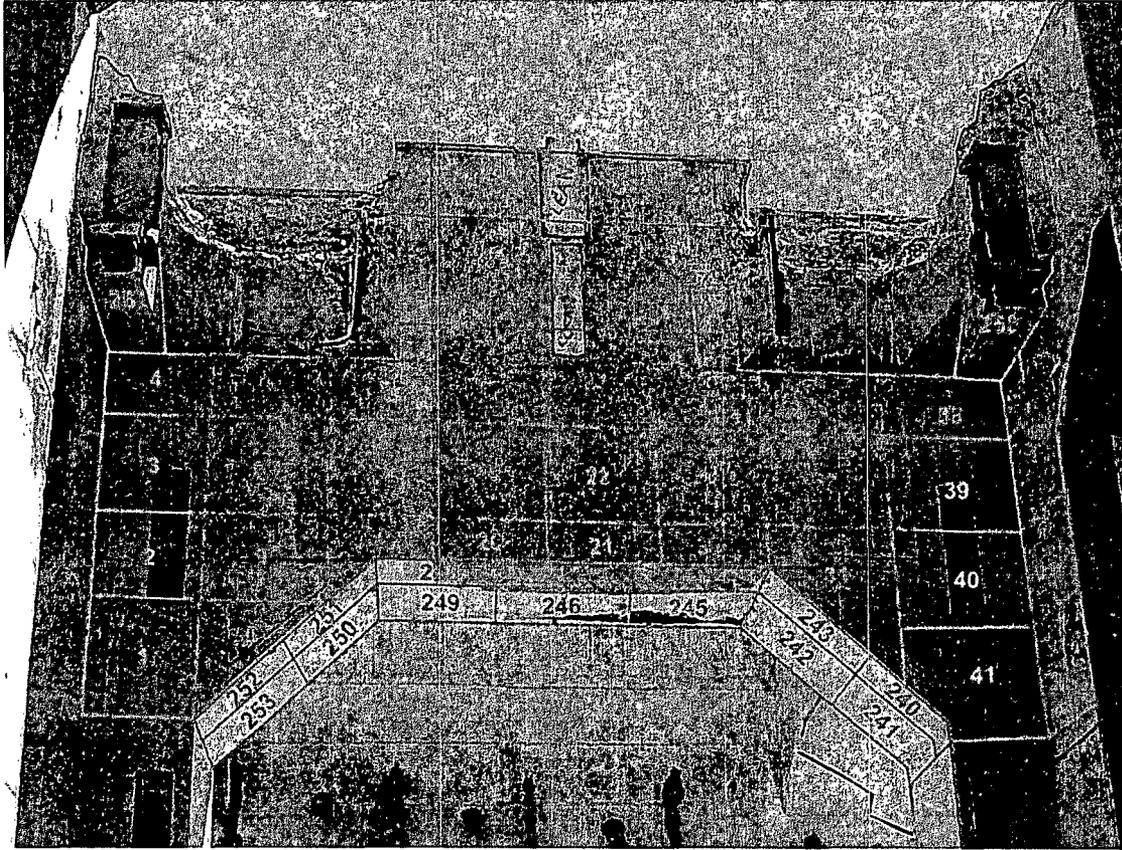
Map F8261003-20, Turbine Building (+) 40' El.
High Pressure Turbine Pedestals - Plan View at 40' Elevation
Beta Scan Measurements



West Column Looking West Beta Scan Measurements

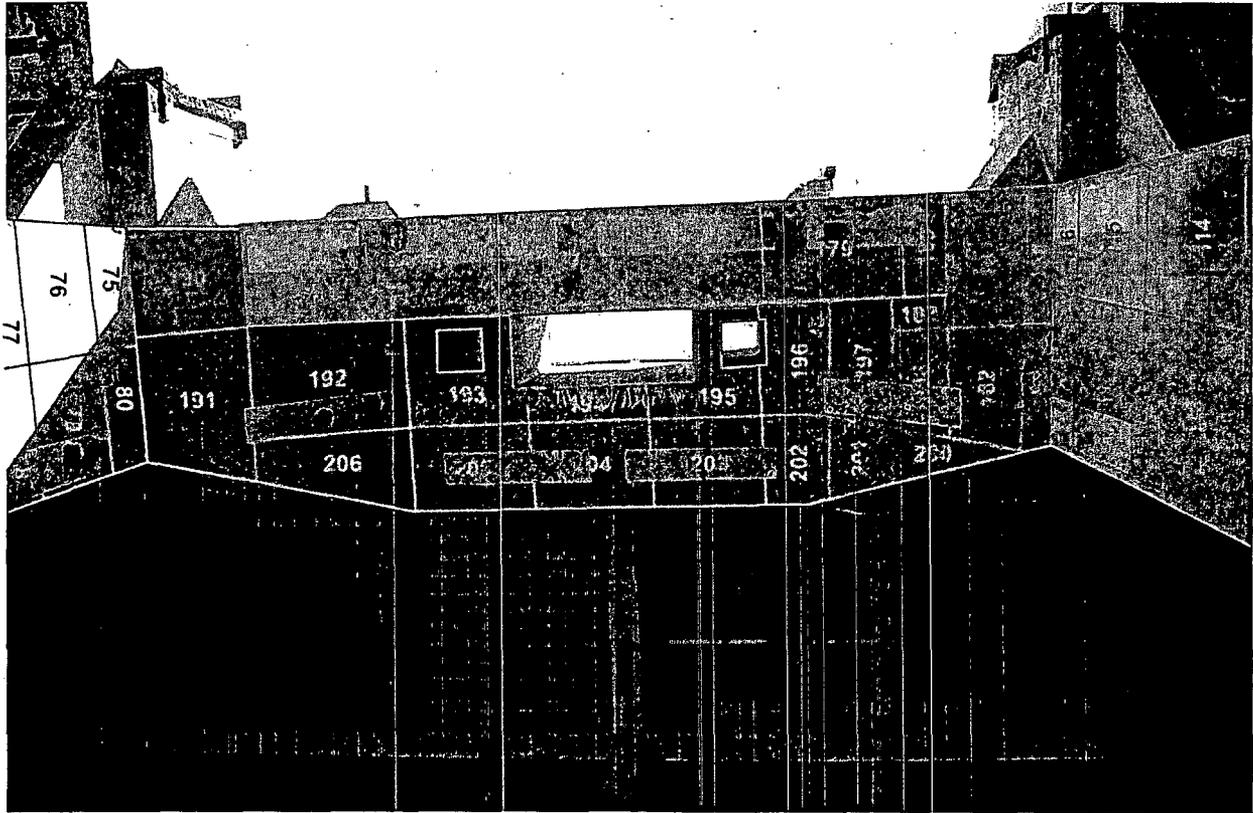


East Column Looking East Beta Scan Measurements

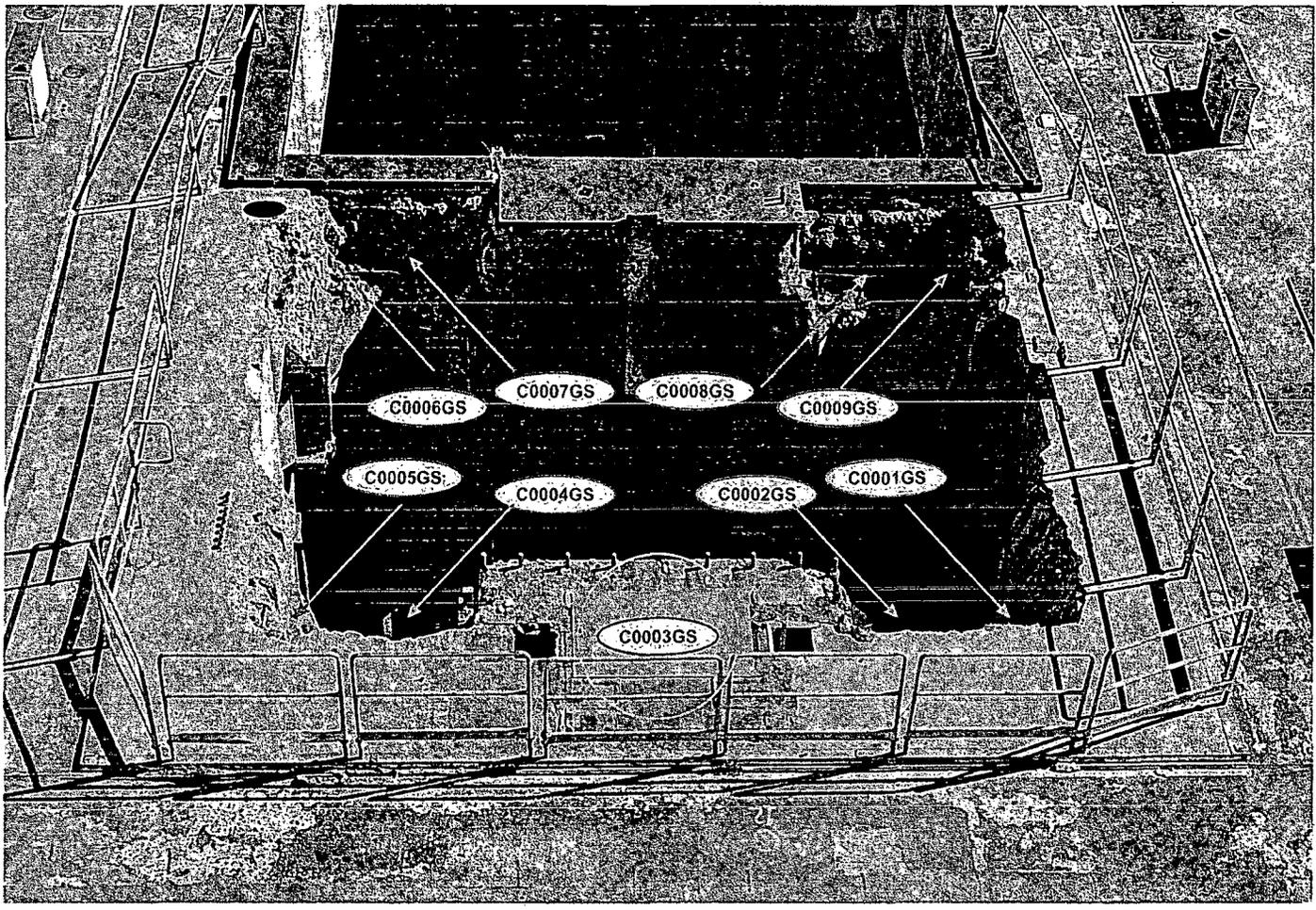


South Column Looking South Beta Scan Measurements



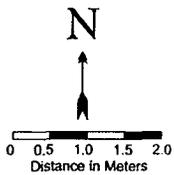
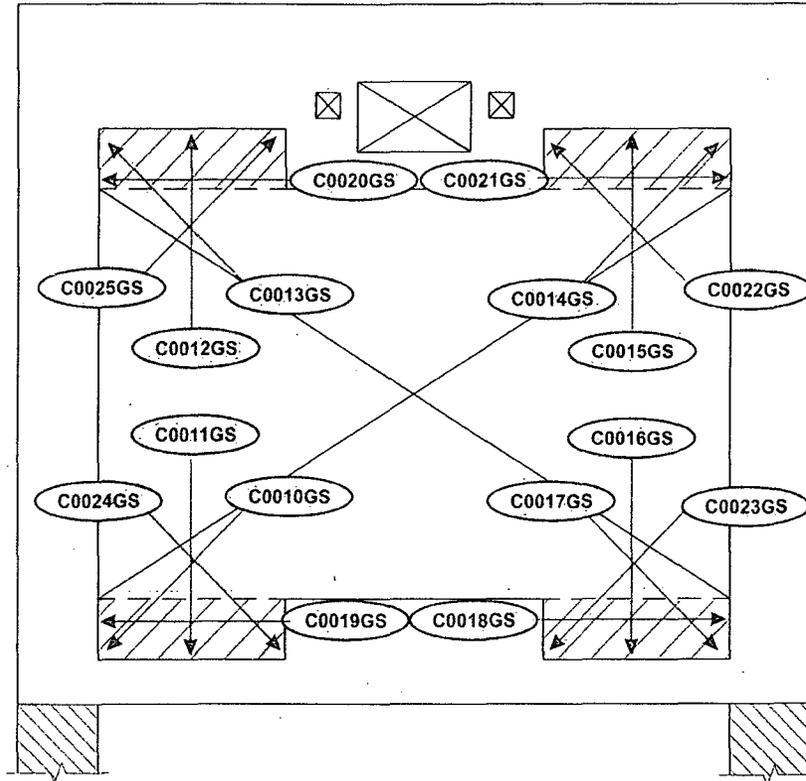


North Column - underside of arch Beta Scan Measurements

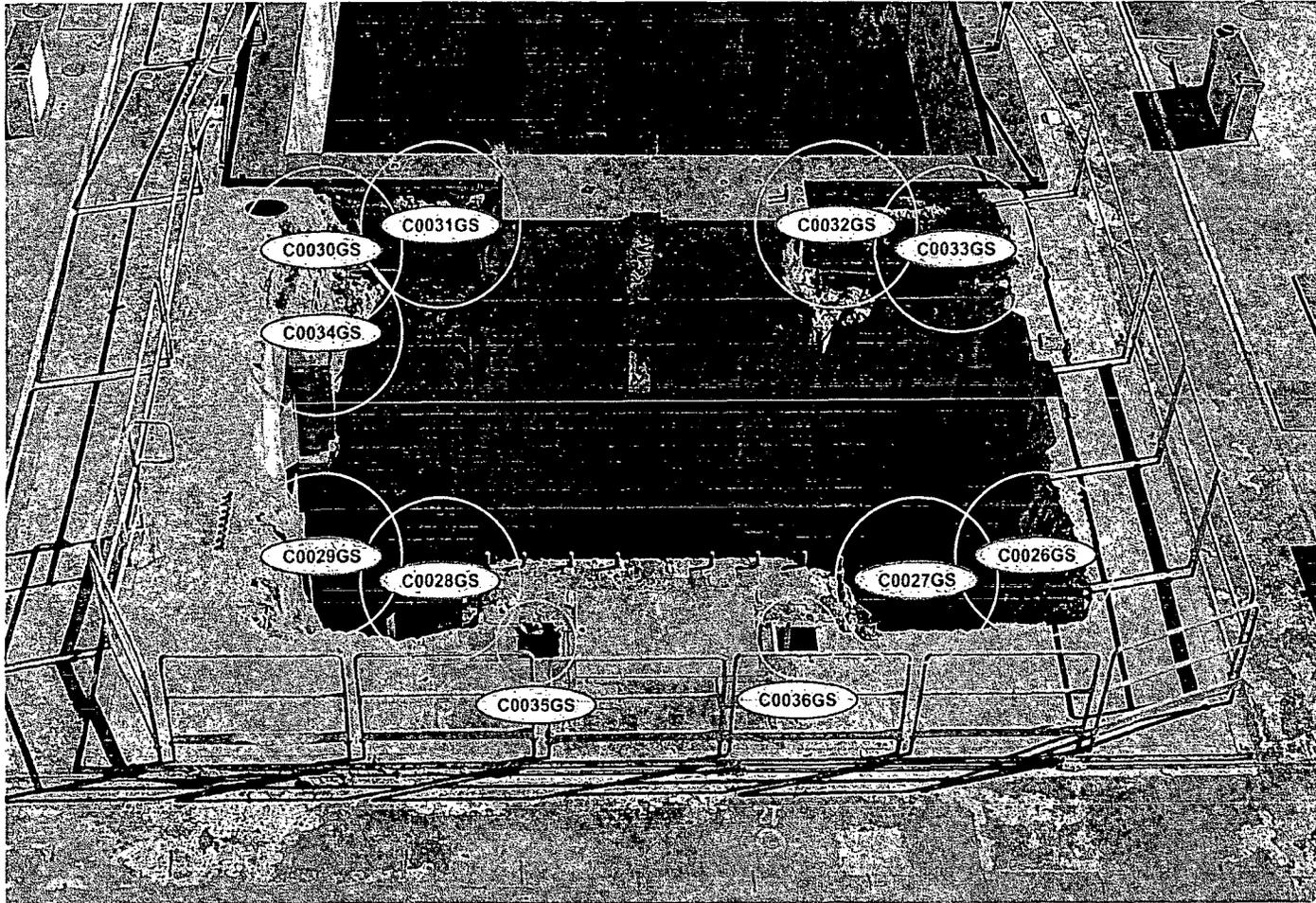


↙ Measurement performed at 45-degree angle

Map F8261003-21, Turbine Building (+) 40' El.
High Pressure Turbine Pedestals
ISOCS Gamma Scan Measurements
F8261003C0001GS to F8261003C0002GS and
F8261003C0004GS to F8261003C0009GS
7 sq. meter field of view
F8261003C0003GS downward looking into shaft with
cover removed



Map F8261003-22, Turbine Building (+) 40' El.
High Pressure Turbine Pedestals - Plan View at 40' Elevation
ISOCS Gamma Scan Measurements
F8261003C0010GS to F8261003C0025GS
3.14 sq. meter field of view



Map F8261003-23, Turbine Building (+) 40' El.
High Pressure Turbine Pedestals
ISOCS Gamma Scan Measurements
F8261003C0026GS to F8261003C0034GS
3.14 sq. meter field of view (downward looking)
F8261003C0035GS and F8261003C0036GS downward
looking into shafts

Attachment 2

Instrumentation

October 20, 2008

Survey Unit F8261003

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; 149789	43-68B; 161415 ¹	433	1,033
M2350; 149789	43-68B; 161415 ²	909	2,169
M2350; 149789	43-68B; 161415 ³	257	612
M2350; 203486	43-68B; 161400	433	1,033
M2350; 175834	43-68B; 148634	433	1,033
Tennelec; 0401171	N/A	5.88 dpm α , 11.71 dpm β	N/A

¹Concrete surfaces

²Concrete surfaces with 1 layer of paint

³Metal surfaces

Instrument	Detector Model No.	Detector Serial No.	MDC
ISOCS	N/A	1983920	Concrete – 1,030 dpm/100 cm ² Cs-137, Concrete – 752 dpm/100 cm ² Co-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	163,400
Investigation Criteria – Scan	163,400
Investigation Criteria – Scan (ISOCS average activity – 3.14 sq. meter field of view)	186,000 Cs-137 64,000 Co-60
Investigation Criteria – Scan (ISOCS average activity – 7.1 sq. meter field of view)	115,000 Cs-137 40,000 Co-60
DCGL _w	43,000
DCGL _{EMC}	163,400

Attachment 3
Investigation
October 20, 2008
Survey Unit F8261003

(none required)

Attachment 4

Data Assessment

October 20, 2008

Survey Unit F8261003

