

Rancho Seco  
Final Status Survey Summary Report  
June 24, 2008  
Turbine Building (+) 0' El. South Floor  
Survey Unit F8260141

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## FINAL STATUS SURVEY SUMMARY REPORT

### Survey Unit:

F8260141, Turbine Building (+) 0' El. South Floor

### 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 cm<sup>2</sup> and a maximum value of 24,900 dpm/100 cm<sup>2</sup>. Direct measurements on the grade elevation showed a mean gross activity level of 2,035 dpm/100 cm<sup>2</sup> and a maximum value of 6,980 dpm/100 cm<sup>2</sup>. Direct measurements on the mezzanine elevation showed a mean gross activity level of 1,566 dpm/100 cm<sup>2</sup> and a maximum value of 2,626 dpm/100 cm<sup>2</sup>. Direct measurements on the +40' elevation showed a mean gross activity level of 2,843 dpm/100 cm<sup>2</sup> and a maximum value of 3,615 dpm/100 cm<sup>2</sup>. Direct measurements on the building exterior showed a mean gross activity level of 1,984 dpm/100 cm<sup>2</sup> and a maximum value of 10,312 dpm/100 cm<sup>2</sup>. 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 characterization surveys of F8260141 (Turbine Building (+) 0' El., South Floor, Class 2), beta measurements identified activity within a 4-meter by 4-meter area that exceeded the DCGL of 43,000 dpm/100 cm<sup>2</sup>. The area was subsequently remediated and reclassified as a Class 1 structure, based on the classification procedure (DSIP-0020). Final surveys of the Class 1 area were performed under survey package F8260151.

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 496 m<sup>2</sup> were scanned for approximately 51% 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>	F826	Turbine Building (+) 0' El.
<b>Survey Unit:</b>	0141	South Floor
<b>Class:</b>	2	Structure Surface
<b>SU Area (m<sup>2</sup>):</b>	980.5	LTP Table 5-4
<b>Evaluator:</b>	D. Anderson	
<b>DCGL (dpm/100 cm<sup>2</sup>):</b>	43,000	Gross Activity DCGL
<b>Area Factor:</b>	N/A	Class 2
<b>Design DCGL<sub>emc</sub></b> (dpm/100 cm <sup>2</sup> ):	N/A	Class 2
<b>LBGR (dpm/100 cm<sup>2</sup>):</b>	39,052	Adjusted
<b>Design Sigma (dpm/100 cm<sup>2</sup>):</b>	1,316	
<b>Type I Error:</b>	0.05	
<b>Type II Error:</b>	0.05	
<b>Predominant Nuclide:</b>	Cs-137	
<b>Sample Area (m<sup>2</sup>):</b>	70.1	Class 2
<b>Scan Area (m<sup>2</sup>):</b>	496	
<b>Scan Coverage (%):</b>	51%	Class 2
<b>Z<sub>1-α</sub> :</b>	1.645	
<b>Z<sub>1-β</sub> :</b>	1.645	
<b>Sign P:</b>	0.99865	
<b>Calculated Relative Shift:</b>	3	
<b>Relative Shift Used:</b>	3	Uses 3.0 if Relative Shift is >3
<b>N-Value:</b>	11	
<b>Design N-Value + 20%:</b>	14	NUREG-1575 Table 5-5
<b>Design Min Samples N:</b>	14	Class 2
<b>Grid Spacing L:</b>	8.3	Class 2

## Survey Results:

A total of 14 direct measurements were made in F8260141. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. One ISOCS gamma scan measurement indicated a possible area of elevated activity ( $> 4,300$  dpm/100 cm<sup>2</sup> average Cs-137 activity for 12.56 m<sup>2</sup> field of view). Seven additional ISOCS measurements were performed at the location using a reduced field of view (3.14 m<sup>2</sup>) and were evaluated as shown in Table 3-1 of Attachment 3. The gamma scan activity for the survey unit ranged from  $< 991$  dpm/100 cm<sup>2</sup> Co-60 and  $< 1,250$  dpm/100 cm<sup>2</sup> to 10,408 dpm/100 cm<sup>2</sup> Cs-137. 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> )
F8260141-C0001BD	1,172
F8260141-C0002BD	1,193
F8260141-C0003BD	1,572
F8260141-C0004BD	1,717
F8260141-C0005BD	1,769
F8260141-C0006BD	1,800
F8260141-C0007BD	1,722
F8260141-C0008BD	1,857
F8260141-C0009BD	1,810
F8260141-C0010BD	1,795
F8260141-C0011BD	1,758
F8260141-C0012BD	1,909
F8260141-C0013BD	1,945
F8260141-C0014BD	1,753
Mean:	1,698
Median:	1,764
Standard Deviation:	236
Range:	1,172 – 1,945

**Table 3. Removable Surface Activity Results**

<b>Measurement ID</b>	<b>Surface Beta Activity (dpm/100 cm<sup>2</sup>)</b>
F8260141C0001SM	0.34
F8260141C0002SM	-2.24
F8260141C0003SM	-2.24
F8260141C0004SM	-0.95
F8260141C0005SM	0.34
F8260141C0006SM	-4.82
F8260141C0007SM	-4.82
F8260141C0008SM	-2.24
F8260141C0009SM	-0.95
F8260141C0010SM	-4.82
F8260141C0011SM	-4.82
F8260141C0012SM	-4.82
F8260141C0013SM	-2.24
F8260141C0014SM	-4.82
<b>Mean:</b>	-2.79
<b>Median:</b>	-2.24
<b>Standard Deviation:</b>	2.01
<b>Range:</b>	-4.82 to 0.34

**Survey Unit Data Assessment:**

The survey design required 14 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>	14	
<b>Median</b> (dpm/100 cm <sup>2</sup> ):	1,764	
<b>Mean</b> (dpm/100 cm <sup>2</sup> ):	1,698	
<b>Direct Measurement Standard Deviation</b>	236	
(dpm/100 cm <sup>2</sup> ):		
<b>Total Standard Deviation</b> (dpm/100 cm <sup>2</sup> ):	236	
<b>Maximum</b> (dpm/100 cm <sup>2</sup> ):	1,945	
<b>Material Type:</b>	N/A	
<b>Sign Test Final N Value:</b>	14	Background Subtract Not Applied
<b>S+ Value:</b>	14	
<b>Critical Value:</b>	10	
<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; DCGLmc:</b>	N/A	
<b>Total Standard Deviation &lt;= Sigma:</b>	Yes	
<b>Pass the Sign Test?</b>	Yes	
<b>Reject the Null Hypothesis?</b>	Yes	Class 2
<b>Does the Survey Unit Pass All Criteria?</b>	Yes	

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

One investigation (scan grid 26) was required for the scan measurements and the results are reported in Attachment 3. Seven additional ISOCS investigation measurements were performed with a reduced field of view and did not exceed the Investigation Level to detect a 100 cm<sup>2</sup> hot spot within the detector field of view (3.1 sq. meters).

### **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. One potential area of elevated activity was 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 cm<sup>2</sup> and none of the removable surface activity measurements exceeded 10% of the DCGL. One ISOCS investigation was performed but did not identify activity exceeding the Investigation Level for the reduced field of view.

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.

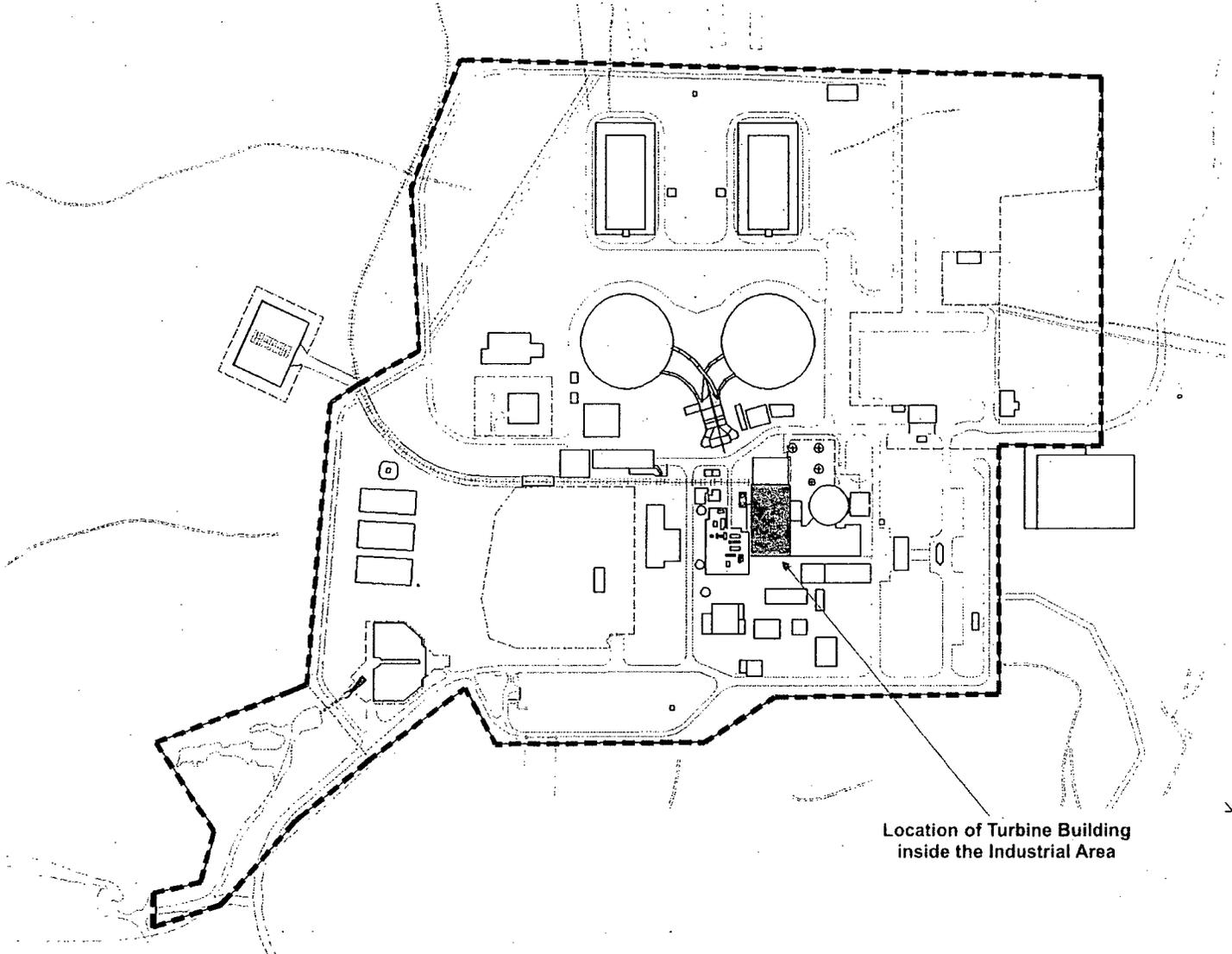
It is concluded that survey unit F8260141 meets the release criteria of 10CFR20.1402.

**Attachment 1**

**Maps**

**June 24, 2008**

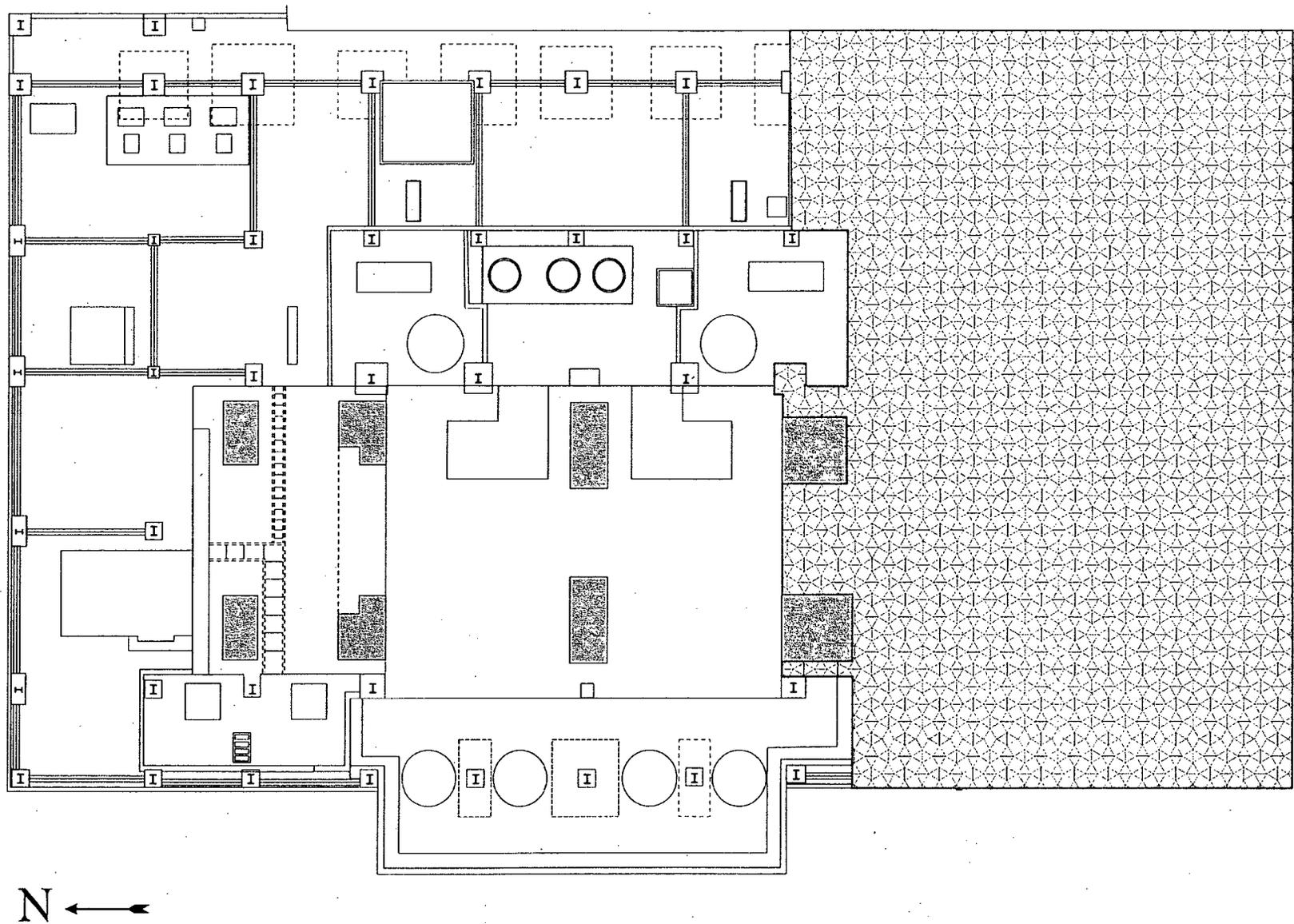
**Survey Unit F8260141**



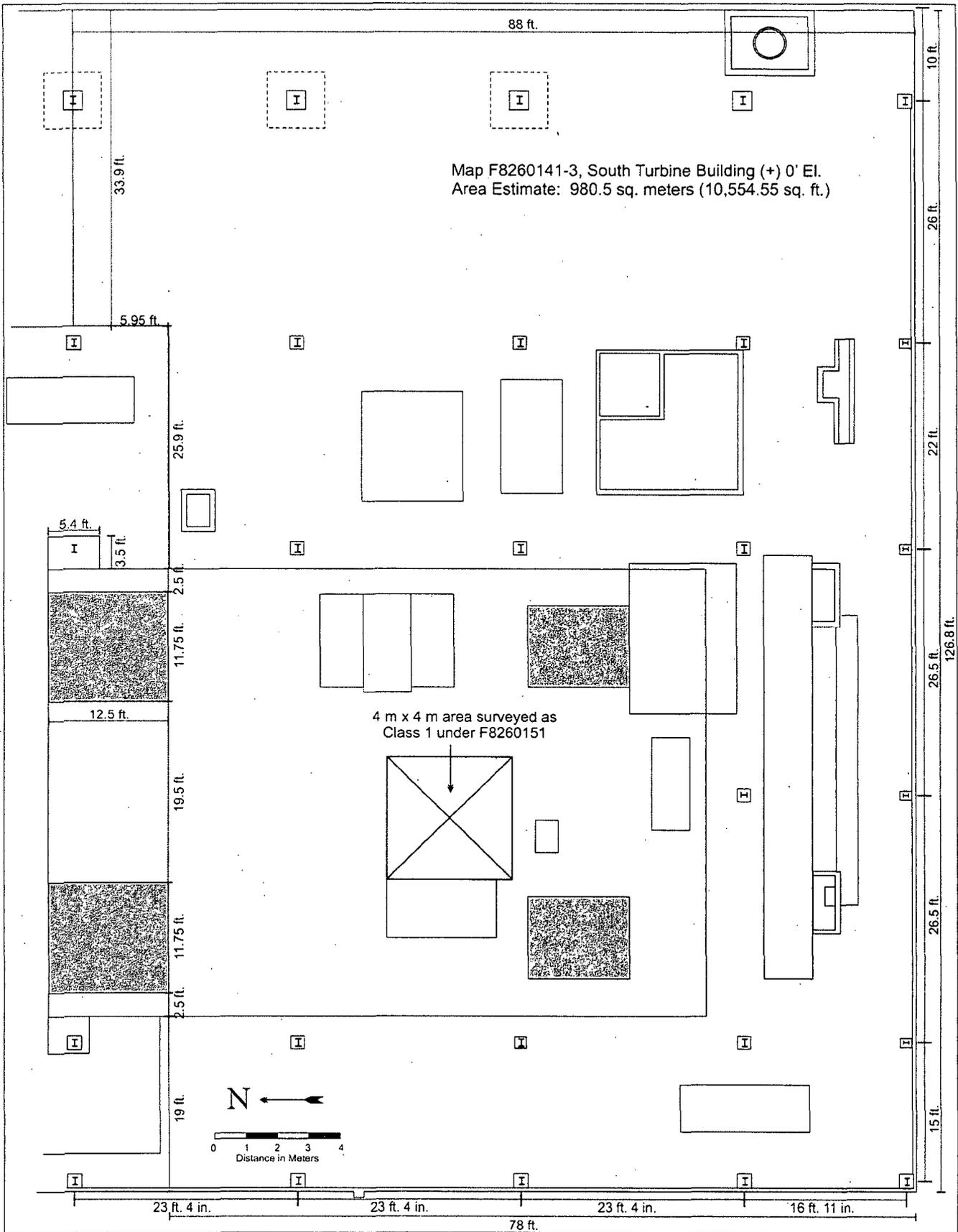
Location of Turbine Building  
inside the Industrial Area

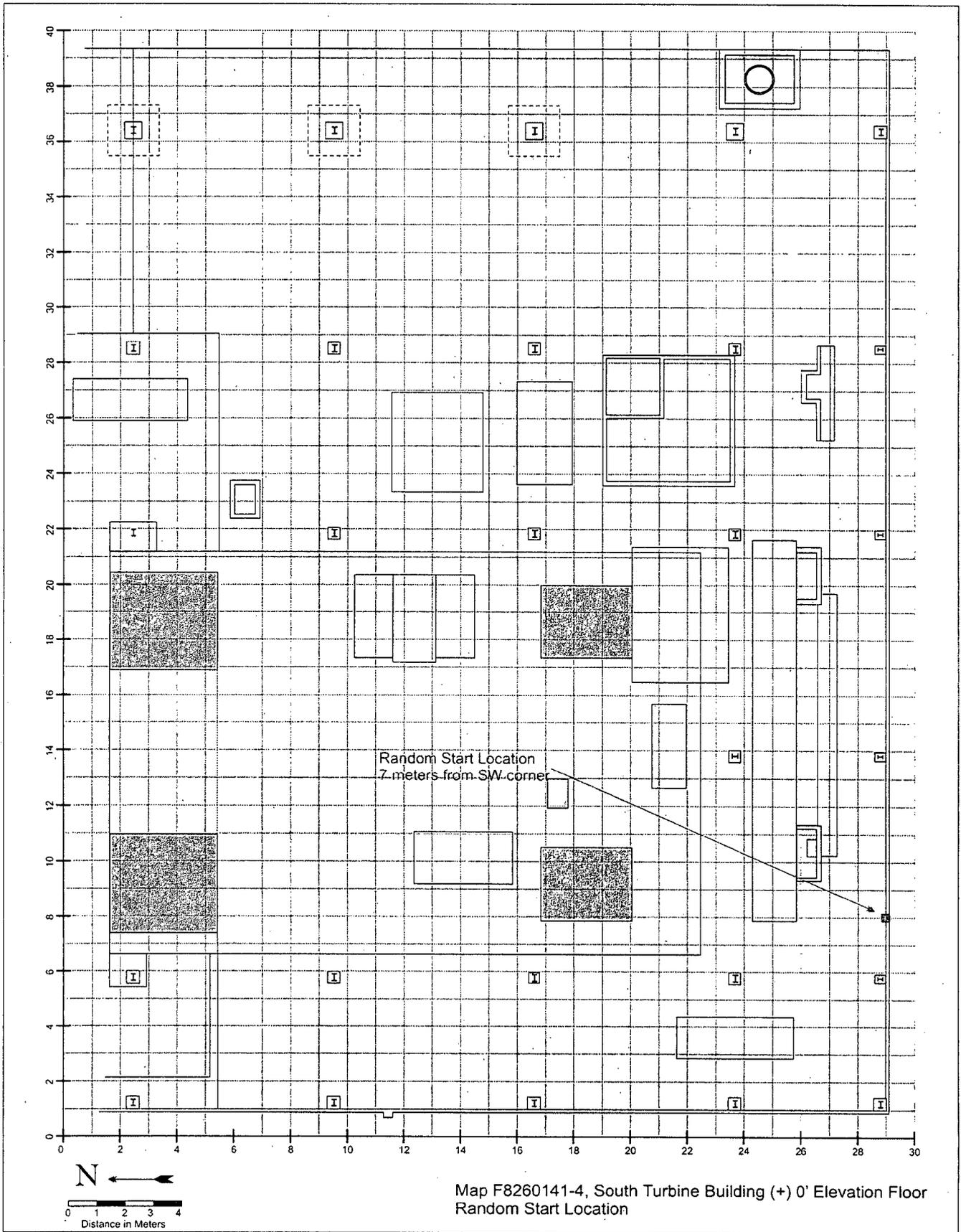


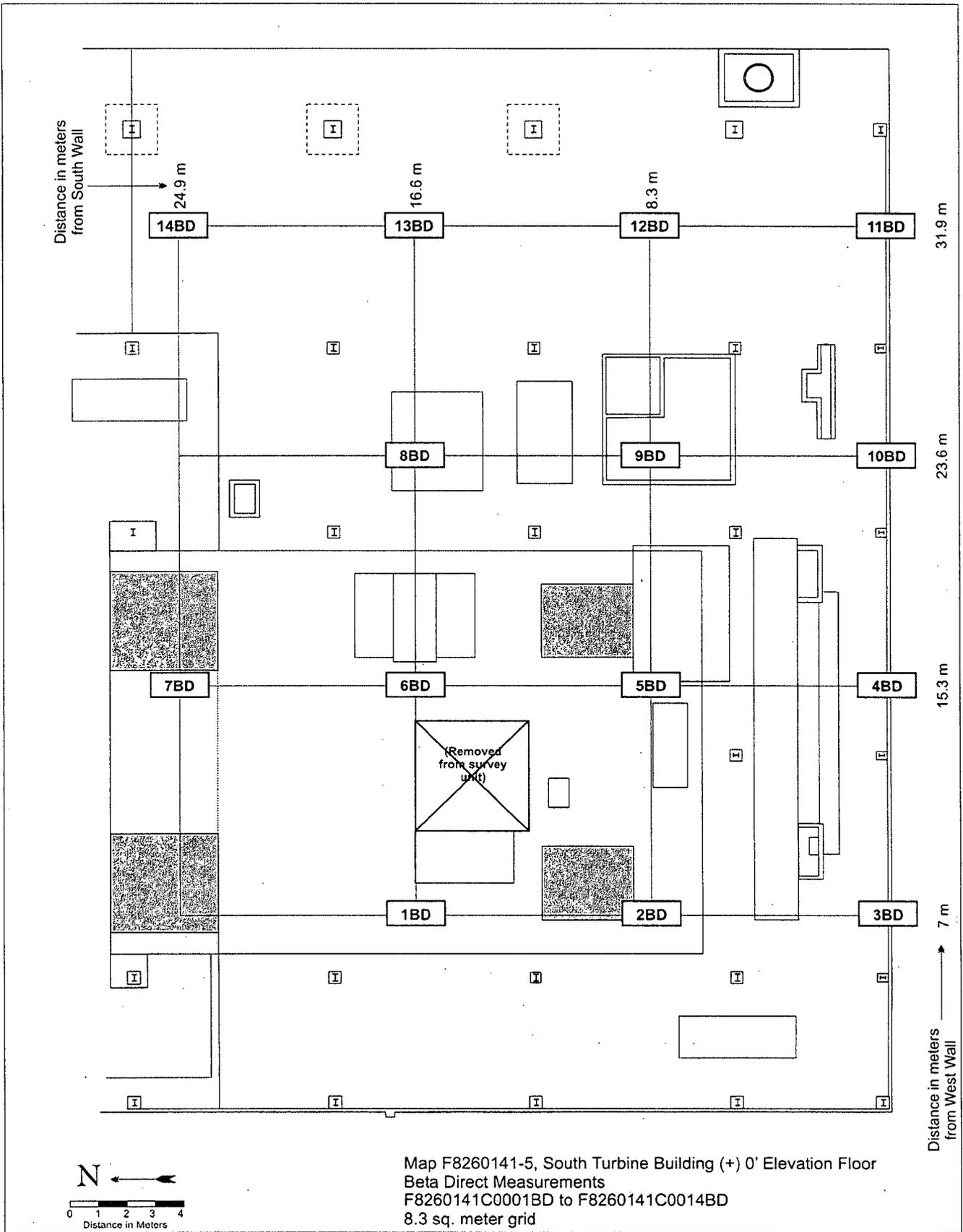
Map F8260141-1, Turbine Building (+) 0' Elevation  
Location of Turbine Building at Rancho Seco site

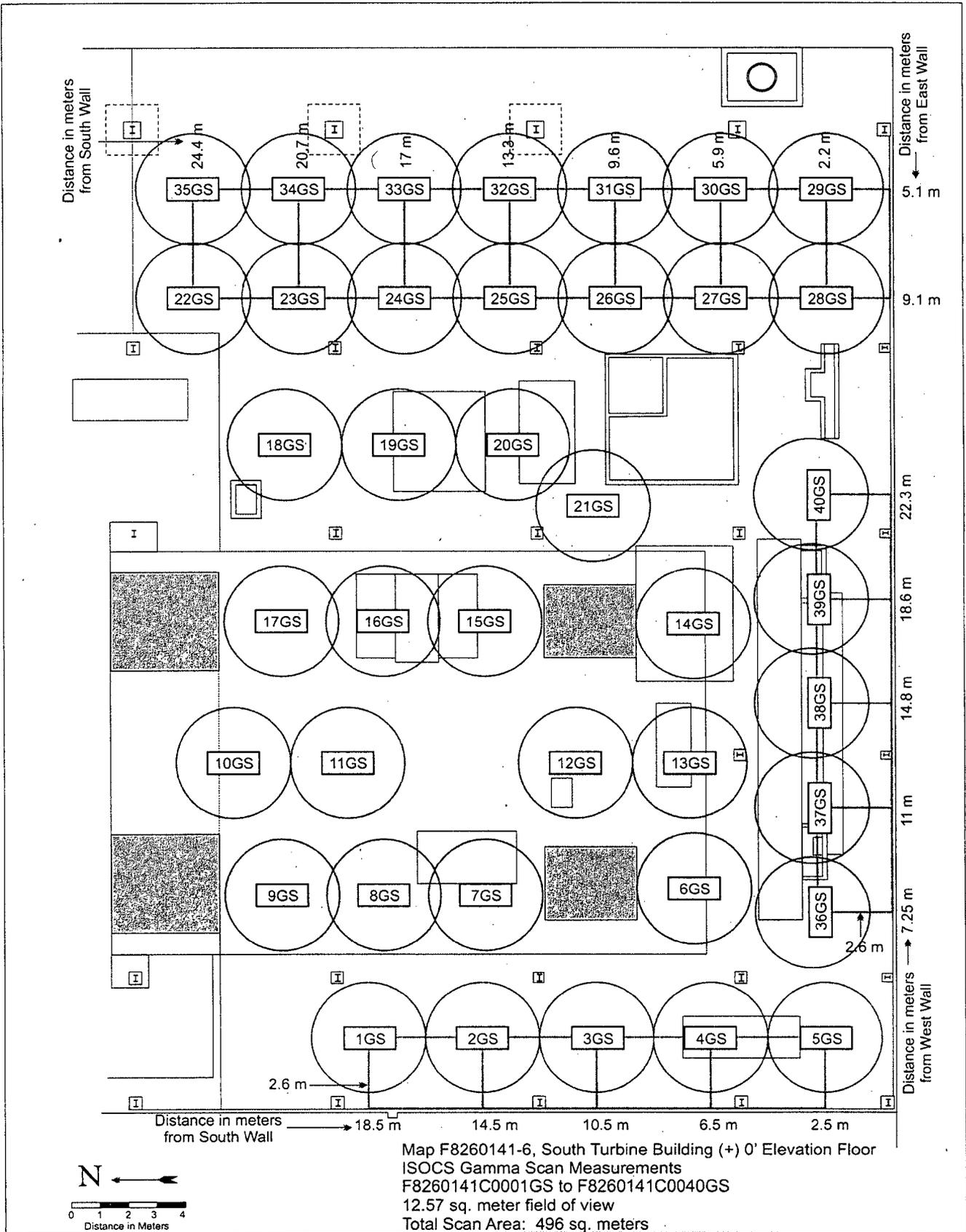


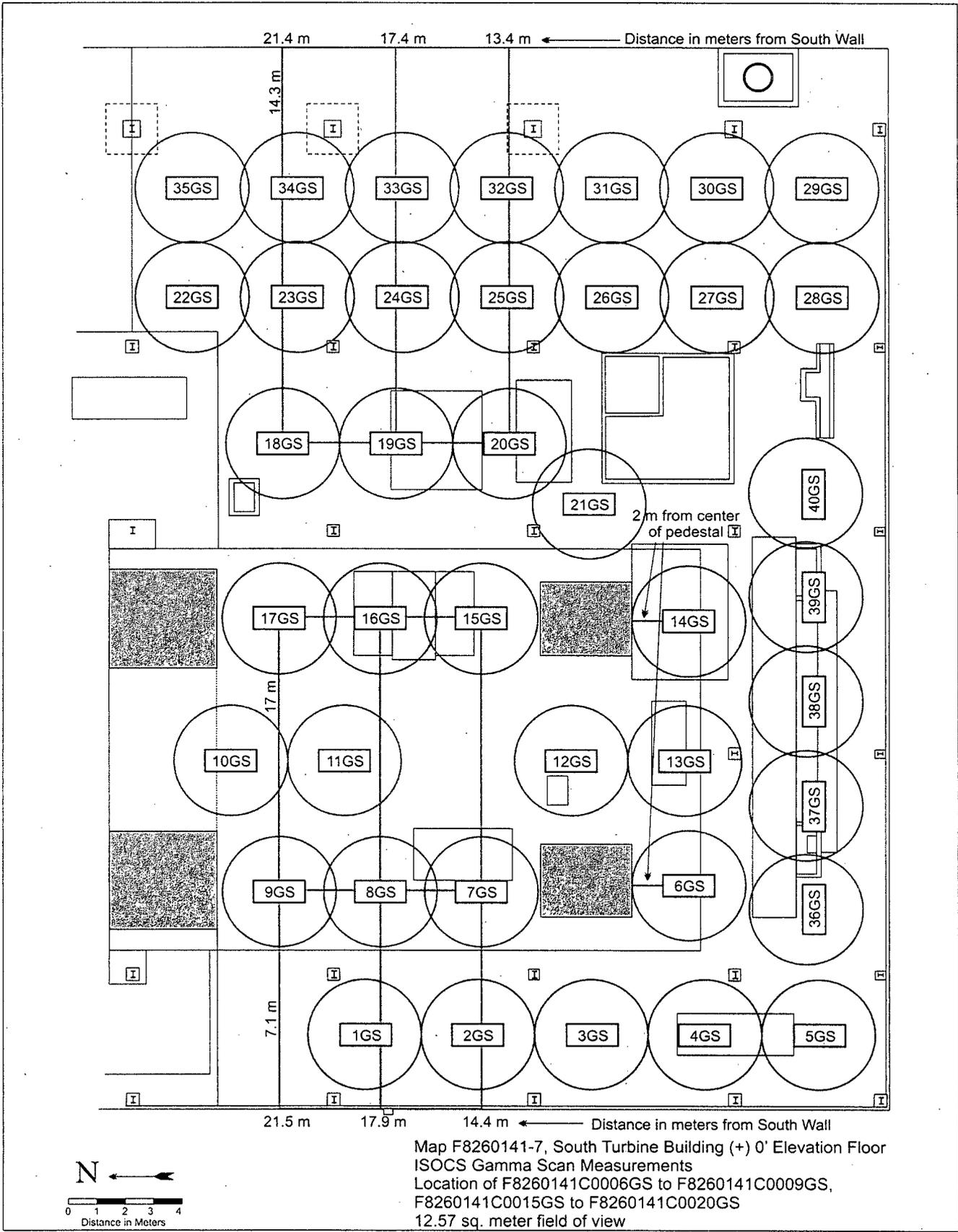
Map F8260141-2, Turbine Building Grade and Below Elevations  
Location of South Turbine Bldg (+) 0' Elevation Floor

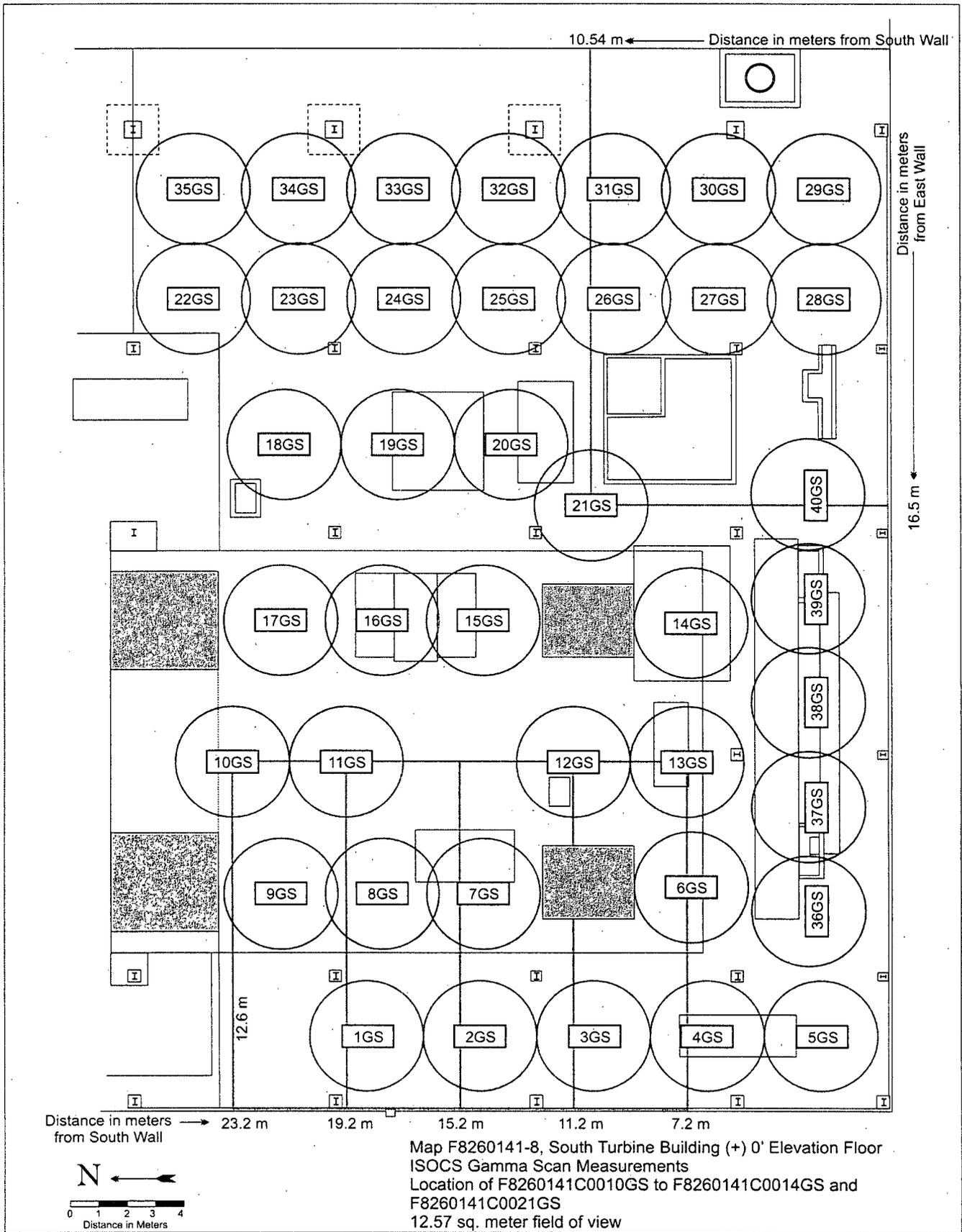


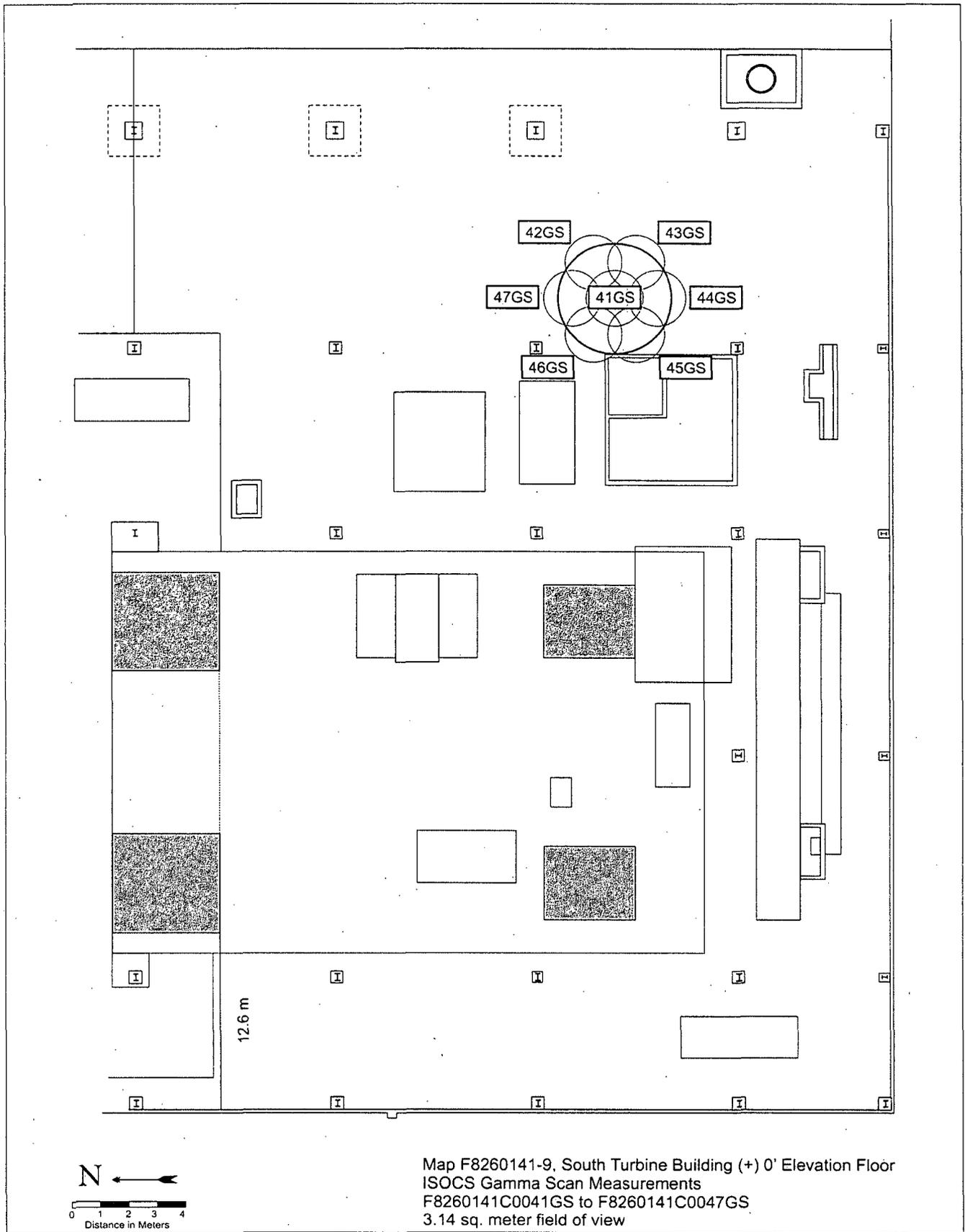












**Attachment 2**

**Instrumentation**

**June 24, 2008**

**Survey Unit F8260141**

**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; 189089	43-68B; 161406	433	1,033
Tennelec; 0401171	N/A	5.88 dpm $\alpha$ , 11.71 dpm $\beta$	N/A

<b>Instrument</b>	<b>Detector Model No.</b>	<b>Detector Serial No.</b>	<b>MDC</b>
ISOCS	N/A	1983920	Concrete – 1,250 dpm/100 cm <sup>2</sup> Cs-137, Concrete – 991 dpm/100 cm <sup>2</sup> Co-60

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

<b>Parameter</b>	<b>Value (dpm/100 cm<sup>2</sup>)</b>
Investigation Criteria - Direct	43,000
Investigation Criteria – Scan (ISOCS average Cs-137 activity for 12.5 m <sup>2</sup> field of view)	4,300
Investigation Criteria – Scan (ISOCS average Cs-137 activity for 3.1 m <sup>2</sup> field of view)	12,600
DCGL <sub>w</sub>	43,000
DCGL <sub>EMC</sub>	N/A

**Attachment 3**

**Investigation**

**June 24, 2008**

**Survey Unit F8260141**

**Table 3-1 Survey Unit Investigation**

<i>Grid</i>	<i>Investigation Level (dpm/100 cm<sup>2</sup>)</i>	<i>Initial Value (dpm/100 cm<sup>2</sup>)</i>	<i>Investigation Result (dpm/100 cm<sup>2</sup>)</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>
26 <sup>1</sup>	4,300 @ 2 meters	6,030	(See Below)	12.57	N/A	N/A	N/A	N/A
26	12,600 @ 1-meter	N/A	10,408	3.14	N/A	N/A	10,408	0.00
			8,368	3.14	N/A	N/A	8,368	0.00
			7,239	3.14	N/A	N/A	7,239	0.00
			4,809	3.14	N/A	N/A	4,809	0.00
			3,872	3.14	N/A	N/A	3,872	0.00
			1,466	3.14	N/A	N/A	1,466	0.00
			2,585	3.14	N/A	N/A	2,585	0.00
Survey Unit Remainder						DCGL = 43,000	SU Mean = 1,698	0.04
EMC Unity Sum								0.04

<sup>1</sup>Investigation Level for ISOCS measurements is based on detection of a 100 cm<sup>2</sup> hot spot at the DCGL value within the detector field of view. Should the average activity for an ISOCS measurement exceed the Investigation Level for the detector field of view, additional measurements are performed with a smaller detector field of view to determine if a hot spot exists that may exceed the DCGL.

**Attachment 4**  
**Data Assessment**  
**June 24, 2008**  
**Survey Unit F8260141**

