3E.2 Emergency Power Generating Buildings

Description of Emergency Power Generating Buildings

Two Emergency Power Generating Buildings (EPGB) are located adjacent to the NI Common Basemat and the Essential Service Water Buildings (ESWB) structures. Each EPGB is 178 ft 0 in long by 94 ft 6 in wide. The height of the building, relative to the top of the mat foundation, varies from 51 ft 6 in in the diesel fuel storage tanks areas to 68 ft 0 in at the remainder of the structure.

Cross sections and plan views associated with the typical EPGB are provided in Section 3.8.4, Figure 3.8-89, Figure 3.8-90, Figure 3.8-91, Figure 3.8-92, Figure 3.8-93, and Figure 3.8-94. A general description of the structure, including descriptions of functional equipment at each floor level, is provided in Section 3.8.4.1.4.

The lateral load resisting system primarily consists of exterior and interior reinforced concrete shear walls and a reinforced concrete mat foundation situated at grade. The basemat foundation, elevated concrete slabs, and steel framed platform levels consist of the structural elements described in Sections 3.8.4.1.4 and 3.8.5.1.2.

The list of EPGB critical sections is provided in Table 3E.2-1.

Materials

Concrete for the EPGB shall have compressive strength f'_c = 5000 psi (minimum), modulus of elasticity, E= 4287 ksi, shear modulus, G = 1832 ksi, and Poisson's ratio is 0.17.

Reinforcing Steel – deformed steel bars conforming to ASTM A615 Grade 60 with minimum yield strength of F_y = 60 ksi, and minimum tensile strength F_u = 90 ksi. Minimum bar elongation is based on ASTM A615.

Structural Steel – conforms to the requirements specified in Table 3.8-8.

Floor Live and Dead Load Distribution

Dead loads include self weight of the structure, piping, cable tray, conduits and permanent equipment loads. Live loads include design live load. Design snow loads are provided in Section 3.8.4.3.1 and Table 2.1-1.

- Concrete self weight - based on concrete density of 150 pcf.
- Steel platform self weight at El. 33'-4" = 20 psf.
- Composite steel beam self weight on slab/roof at El. 51'-6" = 45 psf.
- Uniform area dead load for basemat = 100 psf.

- Uniform area dead load for slab at El. 51’-6” = 50 psf.
- Uniform area dead load for roof at El. 51’-6” = 70 psf.
- Uniform area dead load for roof at EL. 68’-0” = 20 psf.
- Uniform area live load for basemat = 100 psf.
- Steel platform at El. 33’-4” live load = 100 psf.

Equipment Loads

The weight of major equipment, combustion air ducts, and exhaust ducts is applied as point load throughout the building.

Equipment	Elevation (kips)	Weight
Engine/Generator skid	Basemat	3000
Combustion air filter	51’-6”	4.10 each
Combustion air silencers	51’-6”	4.00 each
Exhaust gas silencer	51’-6”	18.00
Air start equipment	Basemat	15.00
Fuel day tank	32’-0”	13.37
Lube oil make-up tank	Basemat	13.14
Jacket water expansion	16’-0”	1.815
Generator neutral grounding resistor	D/G skid	0.50
MCC’s	Basemat	12.00
I&C TCP control panels	Basemat	0.772 each
I&C TXS control panels	Basemat	0.822 each
HVAC control room chiller	Basemat	2.37
HVAC control room air handler	19’-3”	0.55
HVAC supply fan-small	51’-6”	1.862
HVAC supply fan-large	51’-6”	3.20
Intake and exhaust louvers	51’-6”	2.10 each

Foundation Stability

The EPGB is evaluated for stability against overturning, sliding, and floatation for the soil profiles used in establishing the certified plant design. Shear keys in the form of grade beams around the periphery of the building and in the middle of the building are used to enhance stability. The minimum factors of safety for the EPGB are listed in Table 3E.2-1. The calculated factors of safety against overturning, sliding and floatation satisfy the acceptance criteria.

The sliding and overturning factors are determined using load combination containing dead load (D), lateral earth pressure (H), SSE (E’), hydrostatic load (F), and buoyant force (F_b). It is conservatively assumed that (E') and (F_b) occur simultaneously. The floatation factor of safety is determined based on dead load (D) and buoyant force (F_b). For uniformity of site characteristics, the minimum static and dynamic bearing capacity of the foundation soil is the same as the NI. The static and dynamic bearing pressure demands for the EPGB are listed in Table 3E.2-3.

Design Criteria

SSI analysis using MTR/SASSI is used to determine enveloping structural response accelerations for development of equivalent static SSE loads for the GTSTRUDL FEM.

The use of GTSTRUDL for the design of the critical sections is described in Section 3.8.4.4.3 and Section 3.8.5.4.3. Design forces and moments are extracted from GTSTRUDL analyses for basemat foundation and superstructure component design.

All applicable loads used for the design of the critical sections located within the EPGBs are described in Sections 3.8.4.3.1 and 3.8.5.3; the applicable loading combinations are described in Sections 3.8.4.3.2 and 3.8.5.3. The design also accommodates the soil analysis cases shown in Table 3.7.1-8.

Reinforced concrete and structural steel components (including composite beams) are designed in accordance with the applicable codes, standards, and specifications described in Sections 3.8.4.2 and 3.8.5.2.

Table 3E.2-1—Emergency Power Generating Building Critical Sections

CS No.	Description of Critical Section
CS-27	Basemat Foundation at Elevation 0 ft 0 in
CS-28	Shear Wall on Column Line 11
CS-29	Concrete Slab and Composite Beams at Elevation 51 ft 6 in
CS-30	Shear Wall on Column Line C
CS-31	Shear Wall on Column LIne E

Table 3E.2-2—Minimum Factors of Safety for the Emergency Power Generating Buildings

	Sliding			Overturning			Flotation	
Soil Case	Required	Calculated X-DIR	Calculated Y-DIR	Required	Calculated X-DIR	Calculated Y-DIR	Required	Calculated
2sn4u	1.1	1.3	1.2	1.1	1.7	1.3	1.1	7.8
5a	1.1	1.2	1.1	1.1	1.5	1.6		
4u	1.1	1.1	1.1	1.1	1.7	1.2		
1n2u	1.1	1.4	1.6	1.1	1.9	1.6		
1n5a	1.1	1.2	1.1	1.1	1.6	1.4		
hf_c	1.1	1.6	1.1	1.1	2.7	2.5		
hf_s	1.1	2.6	2.9	1.1	3.1	2.9		

Notes:

1. hf_c is a high frequency profile with concrete.
2. hf_s is a high frequency profile with soil.
3. See Table 3.7.1-8 for more information.

Table 3E.2-3—Maximum Static and Dynamic Bearing Pressures for the Emergency Power Generating Buildings

Analysis Case	Static (ksf)		Dynamic (ksf)	
	Peak-Corner	Edge	Peak-Corner	Edge
1n2u	5.6	4.2	13.6	10.6
1n2u-cr	5.6	4.2	13.7	10.7
1n5a	5.3	4.0	22.0	11.2
1n5a-cr	5.3	4.0	20.0	10.0
2sn4u	5.5	3.9	17.2	14.2
2sn4u-cr	5.5	3.9	16.8	13.7
4u	5.6	4.2	19.6	11.2
4u-cr	5.6	4.2	18.8	12.3
5a	5.2	4.7	20.5	8.0
5a-cr	5.2	4.7	18.9	9.4
hf_c	5.2	4.0	16.0	7.8
hf_c-cr	5.2	4.0	12.6	7.7
hf_s	5.1	4.1	9.2	7.9
hf_s-cr	5.1	4.1	9.2	7.7
Maximum Bearing Pressure	5.6	4.7	22.0	14.2

Notes:

1. Analysis cases indicated with "-cr" represent the cracked case.
2. hf_c is a high frequency profile with concrete.
3. hf_s is a high frequency profile with soil.
4. See Table 3.7.1-8 for more information.

Next File