

  
**MITSUBISHI HEAVY INDUSTRIES, LTD.**  
16-5, KONAN 2-CHOME, MINATO-KU  
TOKYO, JAPAN

December 28, 2010

Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Attention: Mr. Jeffery A. Ciocco

Docket No. 52-021  
MHI Ref: UAP-HF-10352

**Subject:** MHI's Responses to US-APWR DCD RAI No. 658-5130 Revision 2 (SRP 03.08.04)

**Reference:** 1) "Request for Additional Information No. 658-5130 Revision 2, SRP Section: 03.08.04 - Other Seismic Category I Structures," dated 11/15/2010.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No. 658-5130, Revision 2."

Enclosed are the responses to 2 RAIs contained within Reference 1. This transmittal completes the response to this RAI.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

*Atsushi Kamada for*

Yoshiki Ogata,  
General Manager- APWR Promoting Department  
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 658-5130, Revision 2

CC: J. A. Ciocco  
C. K. Paulson

Contact Information

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D081  
NRD

Docket No. 52-021  
MHI Ref: UAP-HF-10352

Enclosure 1

UAP-HF-10352  
Docket No. 52-021

Response to Request for Additional Information No. 658-5130,  
Revision 2

December, 2010

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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12/28/2010

**US-APWR Design Certification  
Mitsubishi Heavy Industries  
Docket No. 52-021**

**RAI NO.:** NO. 658-5130 REVISION 2  
**SRP SECTION:** 03.08.04 – Other Seismic Category I Structures  
**APPLICATION SECTION:** 3.8.4  
**DATE OF RAI ISSUE:** 11/15/10

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**QUESTION NO. RAI 03.08.04-48:**

In the response to question 03.08.04-40, MHI states that boundary elements are not used because the aspect ratio of the wall is less than 2 as permitted by ACI 349-06 Section 21.7.6.1. The staff reviewed the ACI 349-06 Section 21.7.6.1 and concurs with the Applicant. However, MHI is requested to provide additional data to support their statement. Specifically, the Applicant is requested to provide a table that lists the aspect ratio,  $h_w/l_w$  defined in ACI 349-06 Section 21.7.6.1, for all of the shear walls.

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**ANSWER:**

The statement contained in this RAI question refers to the Power Source Building (PS/B) walls. The attached Table (Attachment 1 to this RAI) shows the ratio of the  $h_w/l_w$  for all the walls and wall segments of the West PS/B. The wall designation in the second column of this Table is shown on the attached URS drawings PSB-13-11-008-003 through 005 (Attachment 2 to this RAI). The  $h_w/l_w$  of all walls of West PS/B is less than 2 with a maximum  $h_w/l_w$  ratio of 1.72. The wall aspect ratios  $h_w/l_w$  of the East PS/B are less than 2 and similar to the West PS/B which had a maximum  $h_w/l_w$  ratio of 1.72.

**Impact on DCD**

There is no impact on the DCD.

**Impact on COLA**

There is no impact on the COLA.

**Impact on PRA**

There is no impact on the PRA.

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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12/28/2010

**US-APWR Design Certification  
Mitsubishi Heavy Industries  
Docket No. 52-021**

**RAI NO.:** NO. 658-5130 REVISION 2  
**SRP SECTION:** 03.08.04 – Other Seismic Category I Structures  
**APPLICATION SECTION:** 3.8.4  
**DATE OF RAI ISSUE:** 11/15/10

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**QUESTION NO. RAI 03.08.04-49:**

In the response to Part 2 of question 03.08.04-45, MHI states that “simple models can be considered / defined to be simple linear frame-type structures consisting of members that are physically similar to beams and columns.” The staff disagrees with the Applicant. The staff believes that the “simple model” representing the structure of which the dynamic response is dominated by its fundamental mode of vibration. The Applicant is requested to provide any documentation that supports their position.

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**ANSWER:**

The definition of “simple models” was provided in the responses to RAI 213-1951 Rev. 1, Question 03.08.04-15 and RAI 497-3743 Rev. 0, Question 03.08.04-45 Part 2 on the design/analysis of HVAC duct supports employing the equivalent static analysis method is from Subsection 6.3 of IEEE 344-1987. This definition was unchanged and maintained in Subsection 7.3 of IEEE 344-2004. Simple models are used to design and analyze commodities such as ducts, conduits, and cable trays and their associated supports that are described in DCD Subsections 3.8.4.1.4, 3.8.4.1.5, 3.8.4.1.6 and DCD Appendices 3A, 3F, and 3G. As stated in Subsection 6.3 or 7.3 of IEEE 344, the Static Coefficient Analysis method (or equivalent static analysis method) is an acceptable alternate method of analysis that allows a simpler technique in return for added conservatism and determination of natural frequencies is not required. MHI has reviewed the long history of this issue (definition of “simple models”) and similar questions by the NRC Staff relating to employment of equivalent static analysis method on subsystem designs on the US-APWR and believes that the definition of “simple models” as provided above is correct and sufficient to resolve this issue.

**Impact on DCD**

There is no impact on the DCD.

**Impact on COLA**

There is no impact on the COLA.

**Impact on PRA**

There is no impact on the PRA.

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Wall Pier Height to Width Aspect Ratio of PSB

Story	Wall Pier ID	Length (ft)	Height (ft)	H/L Ratio	Height Reference
Basement (B1F)	B1FH01	33.000	12.166	0.37	from B1F to BM1F
	B1FH02	33.000	12.166	0.37	from B1F to BM1F
	B1FH03	26.834	6.833	0.25	Opening (6'-10")
	B1FH04	5.667	6.833	1.21	Opening (6'-10")
	B1FH05	26.834	6.833	0.25	Opening (6'-10")
	B1FH06	26.500	12.166	0.46	from B1F to BM1F
	B1FH07	23.500	6.833	0.29	from B1F to BM1F
	B1FH08	26.000	29.916	1.15	from B1F to 1F
	B1FH09	27.500	29.916	1.09	from B1F to 1F
	B1FH10	54.000	29.916	0.55	from B1F to 1F
	B1FH11	54.000	29.916	0.55	from B1F to 1F
	B1FV01	22.667	12.166	0.54	from B1F to BM1F
	B1FV02	88.166	29.916	0.34	from B1F to BM1F
	B1FV03	29.500	8.500	0.29	Opening (8'-6")
	B1FV04	24.500	8.500	0.35	Opening (8'-6")
	B1FV05	18.000	8.500	0.47	Opening (8'-6")
	B1FV06	22.667	12.166	0.54	from B1F to BM1F
	B1FV07	27.833	12.166	0.44	from B1F to BM1F
	B1FV08	22.667	12.166	0.54	from B1F to BM1F
	B1FV09	10.333	12.166	1.18	from B1F to BM1F
B1FV10	78.499	29.916	0.38	from B1F to 1F	
Basement (B1MF)	BM1FH01	33.333	17.750	0.53	from BM1F to 1FL
	BM1FH02	16.833	17.750	1.05	from BM1F to 1FL
	BM1FH03	13.333	17.750	1.33	from BM1F to 1FL
	BM1FH04	11.333	6.833	0.60	Opening (6'-10")
	BM1FH05	4.667	6.833	1.46	Opening (6'-10")
	BM1FH06	6.833	8.500	1.24	Opening (8'-6")
	BM1FH07	15.001	8.500	0.57	Opening (8'-6")
	BM1FH08	5.166	8.500	1.65	Opening (8'-6")
	BM1FH09	4.666	6.833	1.46	Opening (6'-10")
	BM1FH10	17.167	8.500	0.50	Opening (8'-6")
	BM1FH11	13.000	8.500	0.65	Opening (8'-6")
	BM1FH12	6.333	6.833	1.08	Opening (6'-10")
	BM1FH13	26.000	17.750	0.68	from BM1F to 1FL
	BM1FH14	19.000	17.750	0.93	from BM1F to 1FL
	BM1FH15	12.000	17.750	1.48	from BM1F to 1FL
	BM1FV01	22.667	17.750	0.78	from BM1F to 1FL
	BM1FV02	20.333	17.750	0.87	from BM1F to 1FL
	BM1FV03	22.667	17.750	0.78	from BM1F to 1FL
	BM1FV04	13.667	17.750	1.30	from BM1F to 1FL
	BM1FV05	13.667	17.750	1.30	from BM1F to 1FL
BM1FV06	22.667	17.750	0.78	from BM1F to 1FL	
BM1FV07	13.667	17.750	1.30	from BM1F to 1FL	
BM1FV08	22.667	17.750	0.78	from BM1F to 1FL	
BM1FV09	10.333	17.750	1.72	from BM1F to 1FL	
First (1F)	1FH01	66.000	35.917	0.54	from 1FL to Roof
	1FH02	13.500	6.833	0.51	Opening (6'-10")
	1FH03	49.500	6.833	0.14	Opening (6'-10")
	1FH04	22.750	9.000	0.40	Opening (9'-0")
	1FH05	16.500	8.500	0.52	Opening (8'-6")
	1FV01	22.667	35.917	1.58	from 1FL to Roof
	1FV02	78.499	35.917	0.46	from 1FL to Roof
	1FV03	78.499	35.917	0.46	from 1FL to Roof
	1FV04	22.667	35.917	1.58	from 1FL to Roof
	1FV05	78.499	35.917	0.46	from 1FL to Roof

Wall Pier Height to Width Aspect Ratio of PSB

Story	Wall Pier ID	Length (ft)	Height (ft)	H/L Ratio	Height Reference	
EL 24'-2"	1MFH01	66.000	15.333	0.23	from 24'-2" to Roof	
	1MFH02	66.000	15.333	0.23	from 24'-2" to Roof	
	1MFV01	25.333	15.333	0.61	from 24'-2" to Roof	
	1MFV02	25.333	15.333	0.61	from 24'-2" to Roof	
Roof	RH01	23.083	11.583	0.50	from Roof to Penthouse Roof	
	RH02	12.183	11.583	0.95	from Roof to Penthouse Roof	
	RH03	23.083	11.583	0.50	from Roof to Penthouse Roof	
	RH04	12.183	11.583	0.95	from Roof to Penthouse Roof	
	RH05	24.250	11.583	0.48	from Roof to Penthouse Roof	
	RH06	24.250	11.583	0.48	from Roof to Penthouse Roof	
	RH07	24.250	11.583	0.48	from Roof to Penthouse Roof	
	RH08	24.250	11.583	0.48	from Roof to Penthouse Roof	
	RH09	25.041	11.583	0.46	from Roof to Penthouse Roof	
	RH10	25.041	11.583	0.46	from Roof to Penthouse Roof	
	RH11	17.083	11.583	0.68	from Roof to Penthouse Roof	
	RH12	17.583	11.583	0.66	from Roof to Penthouse Roof	
	RH13	25.041	11.583	0.46	from Roof to Penthouse Roof	
	RH14	17.083	11.583	0.68	from Roof to Penthouse Roof	
		RV01	35.584	11.583	0.33	from Roof to Penthouse Roof
		RV02	13.583	11.583	0.85	from Roof to Penthouse Roof
		RV03	25.333	11.583	0.46	from Roof to Penthouse Roof
		RV04	25.333	11.583	0.46	from Roof to Penthouse Roof
		RV05	25.333	11.583	0.46	from Roof to Penthouse Roof
		RV06	35.584	11.583	0.33	from Roof to Penthouse Roof
		RV07	13.583	11.583	0.85	from Roof to Penthouse Roof
		RV08	25.333	11.583	0.46	from Roof to Penthouse Roof
		RV09	35.584	11.583	0.33	from Roof to Penthouse Roof
		RV10	13.583	11.583	0.85	from Roof to Penthouse Roof
		RV11	35.584	11.583	0.33	from Roof to Penthouse Roof
		RV12	13.583	11.583	0.85	from Roof to Penthouse Roof
	RV13	25.333	11.583	0.46	from Roof to Penthouse Roof	

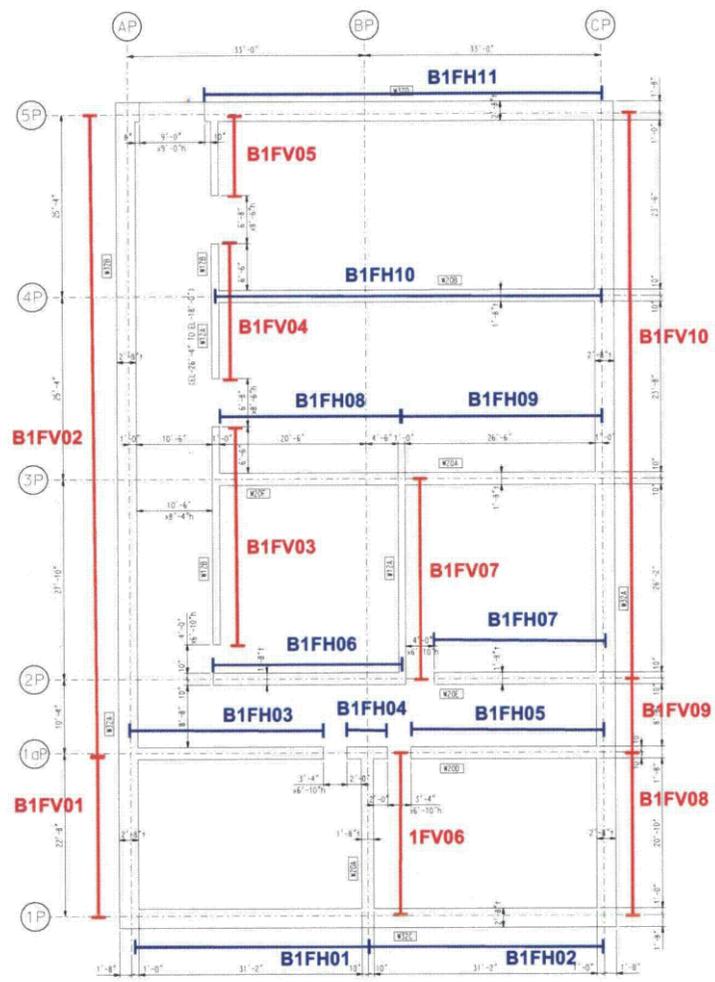
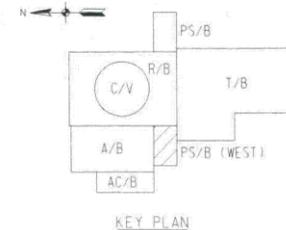
Max H/L Ratio = 1.72

- \* Wall pier width is based on construction joint (from center line to center line) and opening.
- \* Wall pier height is based on the dimension from the top of lower floor slab to the top of upper floor slab.
- \* The opening height is the wall pier height for piers next to openings.

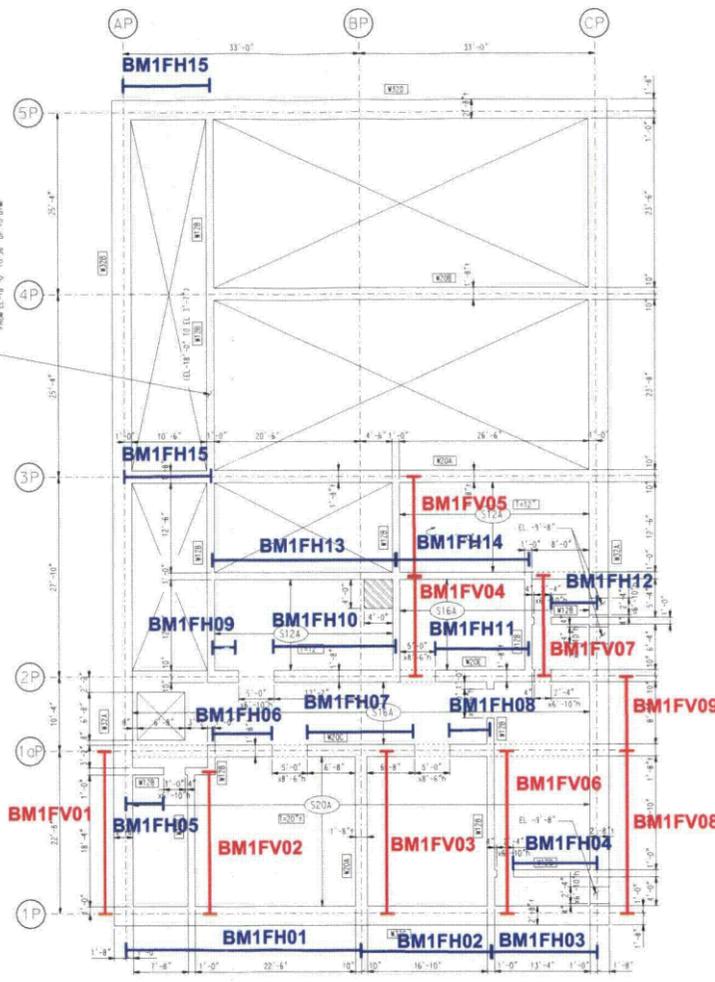


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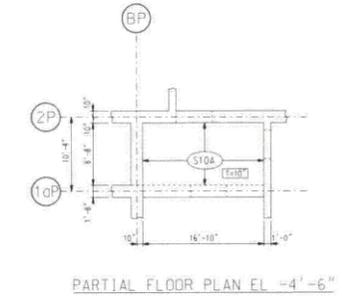
Attachment 2 to  
RAI 658-5130



FLOOR PLAN (B1F) T.O.C. EL -26'-4" U.N.O.  
 [XXXX] - INDICATES WALL REINFORCING MARK. FOR REINFORCING SIZE & SPACING SEE DWG'S PSB-13-11-008-006 THRU PSB-13-11-008-011 & DWG. PSB-13-11-008-023 FOR BASE MAT REINFORCING SEE DWG PSB-13-11-008-002



FLOOR PLAN (BM1F) T.O.C. EL -14'-2" U.N.O.  
 [XXXX] - INDICATES WALL REINFORCING MARK. FOR REINFORCING SIZE & SPACING SEE DWG'S PSB-13-11-008-006 THRU PSB-13-11-008-011 & DWG. PSB-13-11-008-023 [XXXXX] - INDICATES SLAB REINFORCING MARK. FOR REINFORCING SIZE & SPACING SEE DWG. PSB-13-11-008-023



- NOTES:
- FOR CONCRETE NOTES SEE DRAWING XXX-13-11-XXX-XXX.
  - UNLESS OTHERWISE NOTED, TYPICAL FLOOR THICKNESS IS AS BELOW:  
 EL -26'-4" (B1F): 11 1/4" BASE MAT;  
 EL -14'-2" (BM1F): 12"
  - THE DIMENSION WITH CROSS MARK (X) MEANS A CRITICAL (MINIMUM) THICKNESS REQUIRED FOR STRUCTURAL STRENGTH.

LEGEND:

[Symbol]	W-NORTH	E-EAST
[Symbol]	S-SOUTH	W-WEST
[Symbol]	SHEAR #W#12"(N.S.), #W#12"(E.W.)	

NUCLEAR SAFETY RELATED

NOT FOR CONSTRUCTION

POWER SOURCE BUILDING (WEST)  
 CONCRETE FLOOR  
 EL -26'-4"(B1F) & EL -14'-2"(BM1F)

US-APWR  
 STANDARD DESIGN

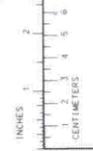


510 CARNEGIE CENTER  
 PRINCETON, NJ 08540  
 1989.1720-2000

URS ENERGY & CONSTRUCTION, Inc.  
 DWG. NO. PSB-13-11-008-003 REV A

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HVAC											
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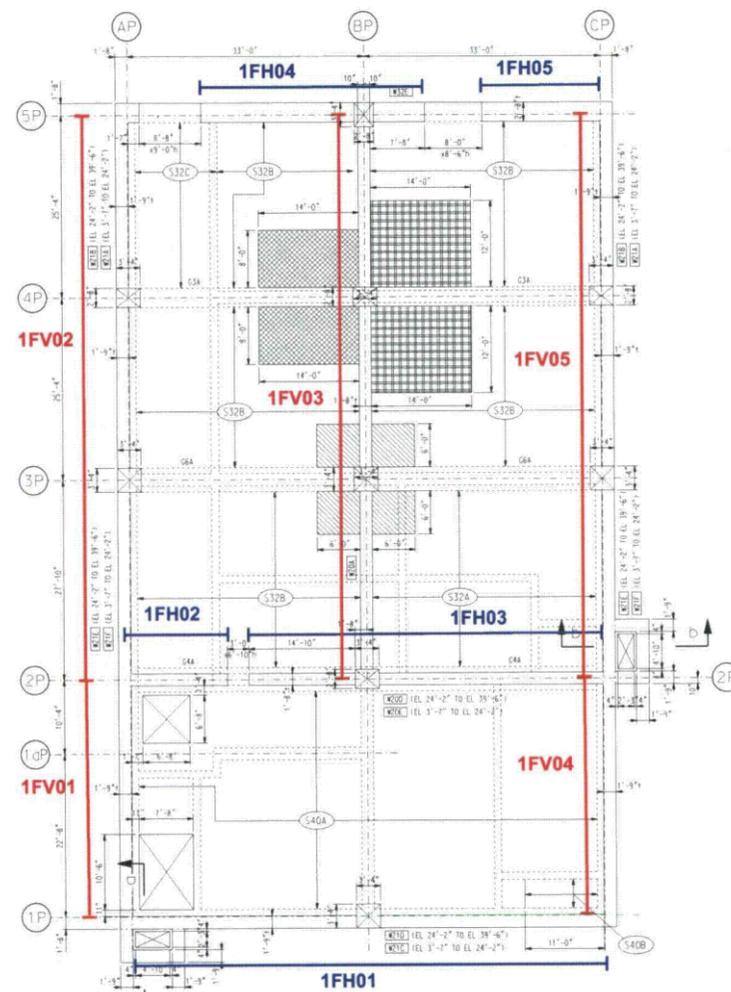
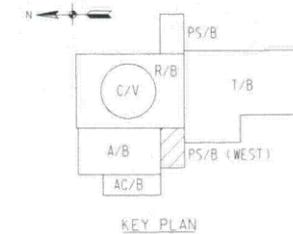
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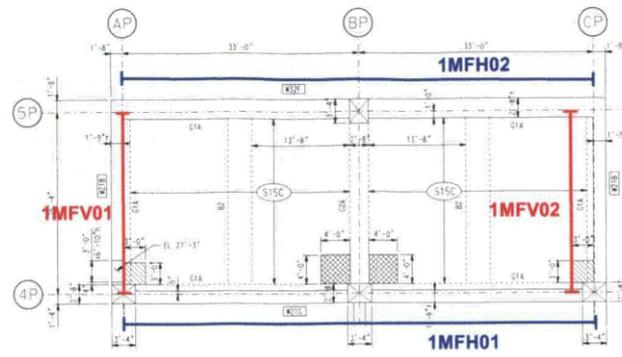


# Wall Pier ID for H/L Ratio Calculation (Continued)

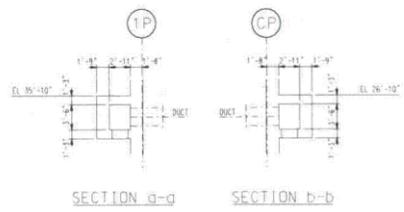
Attachment 2 to  
RAI 658-5130



FLOOR PLAN (1F) T.O.C. EL 3'-7" U.N.O.  
[WALL] - INDICATES WALL REINFORCING MARK...  
[SLAB] - INDICATES SLAB REINFORCING MARK...  
[BEAM] - INDICATES CONCRETE BEAMS OR GIRDERS...



FLOOR PLAN (1MF) T.O.C. EL 24'-2" U.N.O.  
[WALL] - INDICATES WALL REINFORCING MARK...  
[SLAB] - INDICATES SLAB REINFORCING MARK...  
[BEAM] - INDICATES CONCRETE BEAMS OR GIRDERS...



- NOTES:
1. FOR CONCRETE NOTES SEE DRAWING XXX-13-11-XXX-XXX.
2. UNLESS OTHERWISE NOTED, TYPICAL FLOOR THICKNESS IS AS BELOW:
EL 3'-7" (1F) 32"
EL 24'-2" (1MF) 15"
3. THE DIMENSION WITH CROSS MARK (X) MEANS A CRITICAL MINIMUM THICKNESS REQUIRED FOR STRUCTURAL STRENGTH.

LEGEND:
[Symbol] - SHEAR REINFORCING SCHEDULE W/E

NUCLEAR SAFETY RELATED

NOT FOR CONSTRUCTION

POWER SOURCE BUILDING (WEST)
CONCRETE FLOOR
EL 3'-7" (1F) & EL 24'-2" (1MF)

US-APWR
STANDARD DESIGN
URS
510 CARNEGIE CENTER
PRINCETON, NJ 08540
16091720-2000
PSB-13-11-008-004

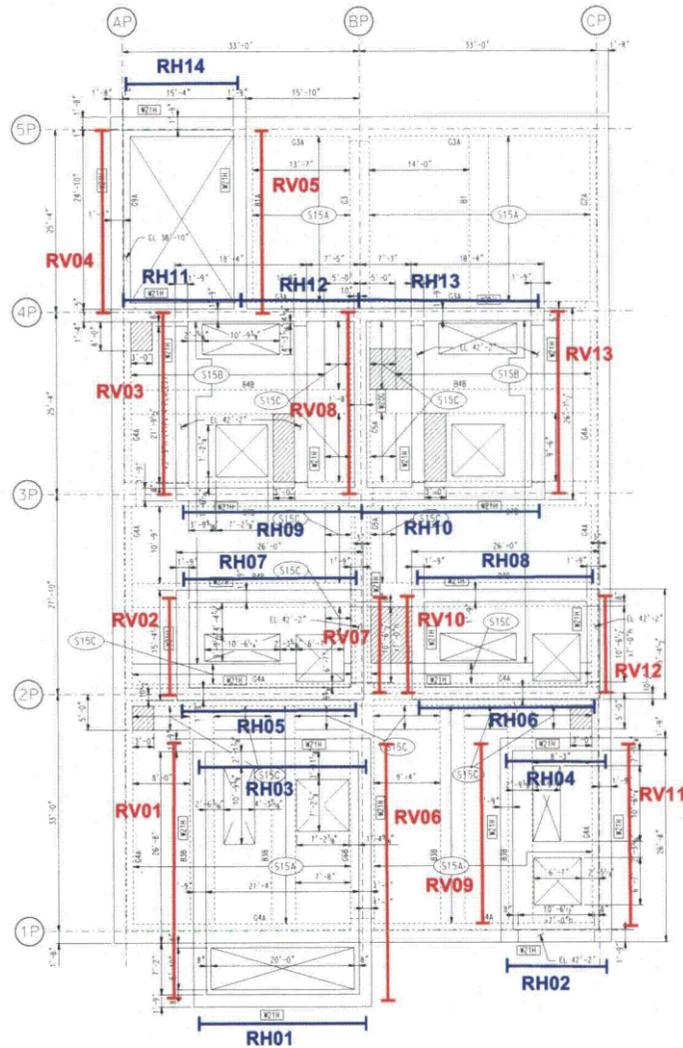
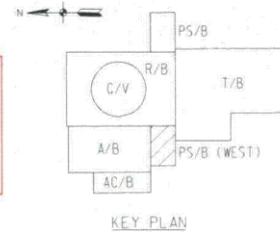
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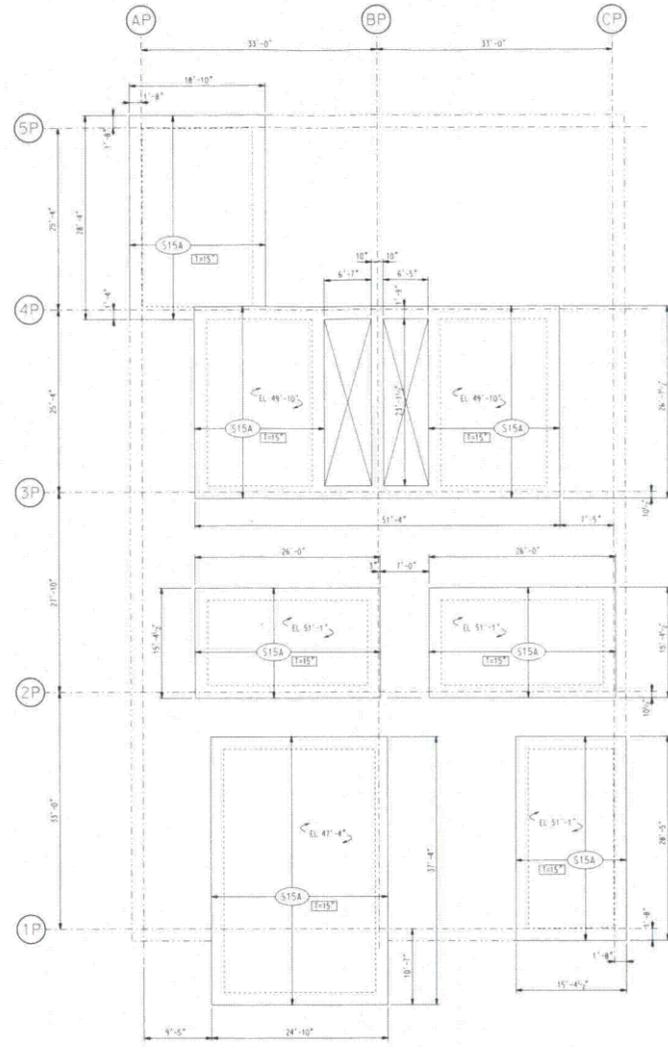


# Wall Pier ID for H/L Ratio Calculation (Continued)

Attachment 2 to  
RAI 658-5130



ROOF PLAN T.O.C. EL 39'-6" U.N.O.  
 [Symbol] - INDICATES WALL REINFORCING MARK. FOR REINFORCING SIZE & SPACING SEE DWG P18-11-008-001, P18-11-008-002 & DWG. P18-11-008-003  
 [Symbol] - INDICATES SLAB REINFORCING MARK. FOR REINFORCING SIZE & SPACING SEE DWG P18-11-008-003  
 [Symbol] - INDICATES CONCRETE BEAMS OR GIRDERS. FOR SIZE & REINFORCING SEE SCHEDULES ON DWG P18-11-008-002.



PENTHOUSE ROOF PLAN T.O.C. EL 49'-0" U.N.O.  
 [Symbol] - INDICATES SLAB REINFORCING MARK. FOR REINFORCING SIZE & SPACING SEE DWG P18-11-008-003  
**All walls shown on Penthouse Roof Plan (EL 49'-0") are the same as the walls shown on Roof Plan (EL 39'-6").**

- NOTES:  
 1. FOR CONCRETE NOTES SEE DRAWING 000-13-11-000-000.  
 2. UNLESS OTHERWISE NOTED, TYPICAL FLOOR THICKNESS IS AS BELOW: EL 39'-6"/ROOF IS 15"

LEGEND:

[Symbol]	W NORTH	W EAST
[Symbol]	S SOUTH	S WEST
[Symbol]	1 SHEAR REINFORCING S. L. W/SPACING 12" X 12"	
[Symbol]	2 SHEAR REINFORCING S. L. W/SPACING 12" X 12"	
[Symbol]	3 SHEAR REINFORCING S. L. W/SPACING 12" X 12"	
[Symbol]	4 SHEAR REINFORCING S. L. W/SPACING 12" X 12"	
[Symbol]	5 SHEAR REINFORCING S. L. W/SPACING 12" X 12"	

NUCLEAR SAFETY RELATED

NOT FOR CONSTRUCTION

POWER SOURCE BUILDING (WEST)  
 CONCRETE FLOOR  
 EL 39'-6" (ROOF)

US-APWR  
 STANDARD DESIGN



510 CARNEGIE CENTER  
 PRINCETON, NJ 08540  
 1-800-451-2000

SCALE: 1/4" = 1'-0"  
 DWG. NO. PSB-13-11-008-005  
 REV A

REVISION APPROVAL RECORD		REV		DATE		BY		DRAWING STATUS		
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CIVIL			NUCLEAR							
ELECTRICAL			PIPING							
ENVIRON.			PROCESS							
GEN. ARRANG.			QA / QC							
MISC			STRUCTURAL							
I & C			DES. VERIFY.							

