CRWMS/M&O

Non-Q Design Analysis Cover Sheet

Complete only applicable items.

①

QA: N/A

Page: 1 Of: 5

2. DESIGN ANALYSIS TITLE			
NORTH PORTAL - HOT WATER CALCULATION - CHANGE HOUSE FACILITY #5008 (SCPB: N/A)			
3. DOCUMENT IDENTIFIER (Including Rev. No.)		4. REV. NO.	5. TOTAL PAGES
BABBAF000-01717-0200-00155 REV 01		01	5
6. TOTAL ATTACHMENTS	7. ATTACHMENT NUMBERS - NO. OF PAGES IN EACH		8. SYSTEM ELEMENT
1	I-1		MGDS
	Print Name	Signature	Date
9. Originator	R. Blackstone	R. E. Flye FOR R. BLACKSTONE	1-24-96
10. Checker	D. F. Vanica	A. J. Vanica	1-24-96
11. Lead Design Engineer	R. E. Flye	R. E. Flye	1-24-96
12. Department Manager	G. N. Kimura	G. N. Kimura	1-25-96
13. Remarks			

Design Analysis Revision Record

Complete only applicable items.

①

Page: 2

Of: 5

2. DESIGN ANALYSIS TITLE

NORTH PORTAL - HOT WATER CALCULATION - CHANGE HOUSE FACILITY #5008

3. DOCUMENT IDENTIFIER (Including Rev. No.)

BABBAF000-01717-0200-00155 REV 01

4. Revision No.

5. Description of Revision

00

Initial Issue

01

Reformatted to NAP-MG-013, Rev. 0

Revised Title

Deleted TBV-122

Changed QA Classification to QA: N/A

1. PURPOSE

The purpose of this design analysis and calculation is to determine the demand for hot water and to size the supply main piping for the Change House Facility #5008 in accordance with the Uniform Plumbing Code (UPC) (Section 4.4.1) and U.S. Department of Energy Order 6430.1A-1540 (Section 4.4.2).

2. QUALITY ASSURANCE

This analysis is non-Q because it is for a temporary item. A Determination of Importance Evaluation (Reference 5.1) of the Change House Facility has determined that no quality assurance (QA) controls are applicable within the context of this analysis.

3. METHOD

The method used for the calculations is based on Section 4.4.1. The first step is to determine the maximum pressure drop between the most remote plumbing fixture and the main supply. The pressure drop for the hot water system is based on the total length of the supply piping from the cold water supply source through the water heater to the most remote hot water outlet. Equivalent fixture units are then assigned using Section 4.4.1. For hot water, the values are reduced by 25 percent in accordance with the UPC. The demand load in gpm is then determined based on the number of fixture units. The demand load and the pressure drop between the source and the most remote fixture is used to determine the pipe size and the corresponding friction losses for a given flow velocity not to exceed 10 feet/second.

4. DESIGN INPUTS

4.1 DESIGN PARAMETERS

Water supply main pressure = 60 psi (Reference 5.2)

Pressure at most remote fixture = 15 psi (Reference 5.3)

Flow Velocity = 5 feet/second (Reference 5.4)

Number of Fixture Units = 144 (Attachment I)

4.2 CRITERIA

The Plumbing Design for the Change House Facility will be designed in accordance with DOE Order 6430.1A (Section 4.4.2) and appropriate state and local codes (ESFDR Sections 3.2.1Q, 3.2.1R, and 3.2.1S, Reference 5.6).

4.3 ASSUMPTIONS

Not used.

4.4 CODES AND STANDARDS

4.4.1 International Association of Plumbing and Mechanical Officials:

UPC 1991

Uniform Plumbing Code

4.4.2 U.S. Department of Energy (DOE):

DOE Order 6430.1A - 89

General Design Criteria

5. REFERENCES

- 5.1 Determination of Importance Evaluation for ESF Change House Facility and Shop Building BABBA0000-01717-2200-00007 Rev. 00.
- 5.2 Water Supply Analysis B00000000-01717-0200-00074 Rev. 01.
- 5.3 Exploratory Studies Facility Basis for Design (BFD) BAB000000-01717-6300-00002 Rev. 05.
- 5.4 Crane Technical Paper No. 410, "Flow of Fluids," Crane Co., 1988.
- 5.5 Drawings:
 - 5.5.1 BABBAF000-01717-2100-27150-01 Change House - Bldg 5008 Plumbing Isometrics and Details
 - 5.5.2 BABBAF000-01717-2100-27151-00 Change House - Bldg 5008 Plumbing and Piping Plan
 - 5.5.3 BABBAF000-01717-2100-27152-00 Change House - Bldg 5008 Plumbing Enlarged Plans
- 5.6 Yucca Mountain Site Characterization Project Exploratory Studies Facility Design Requirements, YMP/CM-0019, Rev. 1, ICN 3.

6. USE OF COMPUTER SOFTWARE

Not used.

7. DESIGN ANALYSIS

The allowable pressure drop between the main supply header and the most remotely located plumbing fixture is 45 psi based on the design parameters in Section 4.1. The distance from the supply to the most remote hot water fixture is 210 feet as determined from the plumbing drawings (Reference 5.5). The allowable friction loss per 100 feet of pipe is therefore 21.42 psi for zero flow. The equivalent fixture units allowing for a 25 percent reduction as required by the UPC (Section 4.4.1) totals 144 that establishes the hot water flow as 54 gpm as shown in Attachment I. The hot water pipe size is then determined from the allowable pressure drop and flow rate while satisfying the flow velocity.

8. CONCLUSIONS

A 2-1/2-inch diameter building supply main is required for the hot water system based on the allowable friction loss per 100 feet of pipe, a total demand of 54 gpm, and a flow velocity of 5 feet/second.

9. ATTACHMENTS

ATTACHMENT

TITLE

I

Calculations

CALCULATIONS

DOMESTIC HOT WATER				
Fixture	No. Req'd A*	Units per Fixture B**	Fixture Units A x B	Remarks
Lavatory	7	1.5	11	
Wash Fountain	2	3	6	
Shower	28	4	112	
Service Sink	3	3	9	
Mop Sink	2	3	6	
Kitchen Sink				
Lab Sink				
Cup Sink				
TOTAL FIXTURE UNITS			144 = 54 GPM = 2½" Supply***	

* Number of Fixture Units required are obtained from References 5.5.1, 5.5.2, and 5.5.3.

** Values assigned to Units per Fixture are equal to 75% of Unit Value in Table 10-1 of UPC (Section 4.4.1).

*** Total GPM was taken from Chart A-3 of Appendix A of UPC (Section 4.4.1). A 2-1/2-inch diameter supply main is required for the hot water system based of a demand of 54 GPM and velocity of 5 ft/sec (Reference 5.4).