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00C	This calculation revision resolves CA 4412-002 for CR 4412. No change bars are used due to complete revision.	8	8	S. Zinkevich <i>S. Zinkevich</i> 03/22/05	D. Green <i>H. H. H.</i> 03/22/05	J. F. Lacret <i>Joe F. Lacret</i> 3/22/2005	D. Tooker <i>DWT</i> 3/22/2005	03/22/05

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QUALITY ASSURANCE

In accordance with the *Q-List* (BSC 2005), the communications system is not Important to Safety, not Important to Waste Isolation, and non Safety Category. Therefore, the development of this calculation is not subject to the *Quality Assurance Requirements and Description* (DOE 2004) requirements. This calculation is prepared, reviewed, and controlled in accordance with AP-3.12Q, *Design Calculations and Analyses*.

1. PURPOSE AND SCOPE

The purpose of the Fuel Handling Facility Backup Central Communications Room Space Requirements Calculation is to determine a preliminary estimate of the space required to house the backup central communications room in the Fuel Handling Facility (FHF). This room provides backup communications capability to the primary communication systems located in the Central Control Center Facility. This calculation will help guide FHF designers in allocating adequate space for communications system equipment in the FHF.

This is a preliminary calculation determining preliminary estimates based on the assumptions listed in Section 4. As such, there are currently no limitations on the use of this preliminary calculation.

The calculations contained in this document were developed by Design and Engineering and are intended solely for the use of Design and Engineering in its work regarding the FHF Backup Central Communications Room Space Requirements. Yucca Mountain Project personnel from Design and Engineering should be consulted before the use of the calculations for purposes other than those stated herein or use by individuals other than authorized personnel in Design and Engineering.

2. USE OF SOFTWARE

No computer software was used to produce this calculation.

3. ACRONYMS AND ABBREVIATIONS

D	Depth
FHF	Fuel Handling Facility
H	Height
NFPA	National Fire Protection Association
W	Width

4. ASSUMPTIONS

Assumptions and the rationale for the suitability of the use of the assumptions are included in this section.

4.1 BOUNDING ASSUMPTIONS

4.1.1 Fire Barrier Thickness

Assume that there shall be, at maximum, a 12-inch fire-rated barrier bisecting the backup central communications room of the FHF, as described in assumption 4.2.4.

Rationale: 12-inches is larger than the 3.625-inches provided in the *International Building Code 2000* (ICC 2000 Table 719.1(2)) for a noncombustible stud 2-hour fire-rated barrier. It is anticipated that a 2-hour fire-rated barrier will be required in the central communications room of the FHF, with a possible maximum thickness of 12-inches.

Where Used: Sections 4.2.4 and 6.1

4.1.2 Additional Workspace

Assume that at a minimum there shall be an additional 6.5 feet added to the room length and 1.5 feet added to the room width to provide adequate additional workspace.

Rationale: Additional workspace is required to house necessary filing or spare parts cabinets, as well as work desks or benches. Expanding the room dimensions will provide additional space for these necessary items.

Where Used: Section 6.1

4.2 ASSUMPTIONS

4.2.1 Communications Equipment Cabinet Dimensions

Assume a communications equipment cabinet shall have the following dimensions: Width (W) = 2.5 feet, Depth (D) = 3.0 feet, Height (H) = 7.0 feet. Access to the inside of each equipment cabinet shall be obtained along the W dimension.

Rationale: The dimensions in this assumption are based on standard communications equipment cabinets used routinely in industry. This assumption will be validated in the future with vendor drawings as the design progresses.

Where Used: Section 6.1

4.2.2 Number of Communications Equipment Cabinets

Assume there shall be room for 30 communications equipment cabinets located in the backup central communications room of the FHF.

Rationale – The number of communications equipment cabinets in this assumption is based on engineering judgment and past experience to derive a preliminary estimate for the amount of

voice, video, and data communications equipment that will be located in the backup central communications room of the FHF. Specifically, a preliminary estimate of how the 30 equipment cabinets will be composed is as follows:

- 2 cabinets – Digital Control and Management Information System (DCMIS) interface equipment
- 6 cabinets – Surface and Subsurface fiber optics interfacing and networking equipment
- 2 cabinets – Synchronous Optical Network (SONET) equipment and terminals
- 4 cabinets – Surface and Subsurface two-way radio and interfacing equipment
- 4 cabinets – Surface and Subsurface voice communications and interfacing equipment
- 2 cabinets – Digital video interfacing and recording equipment
- 2 cabinets – Administrative Information Technology (IT) equipment
- 2 cabinets – Termination and patch panel equipment
- 6 cabinets – Expansion cabinets for future use

30 cabinets – Total number of cabinets

Each of the different equipment cabinets listed above is given in a multiple of two for redundancy, thus allowing for separation of equipment cabinets into the separate “A” and “B” rows on each side of the bisecting fire-rated barrier described in assumption 4.2.4.

This assumption will be validated in the future with further analyses and vendor drawings, as applicable, as the design progresses.

Where Used: Sections 4.2.3 and 6.1

4.2.3 Orientation of Communications Equipment Cabinets

Assume the 30 communications equipment cabinets shall be oriented in two rows of 15 cabinets placed side by side.

Rationale – The orientation of the communications equipment cabinets in this assumption is based on engineering judgment and past experience on the placement of multiple communications equipment cabinets in the same room. The “A” and “B” rows of equipment cabinets will be placed on each side of the bisecting fire-rated barrier, as described in assumptions 4.2.2 and 4.2.4.

This assumption will be validated in the future with further analyses and vendor drawings, as applicable, as the design progresses.

Where Used: Section 6.1

4.2.4 Dividing Wall

Assume there shall be a fire-rated barrier dividing the backup central communications room of the FHF.

Rationale – A dividing fire-rated barrier is required to ensure that in the event of a fire, one train of equipment in the backup central communications room will not take the other down. Since the communications system is fully redundant, the equipment cabinets will be split into two rows, designated as row “A” and row “B”, for the primary and backup equipment cabinets respectively. As such, the dividing fire-rated barrier provides separation of the “A” and “B” rows of equipment cabinets, thus providing a degree of protection for the equipment in the event of a fire.

This assumption will be validated in the future with further analyses as the design progresses.

Where Used: Sections 4.1.1, 4.2.2, 4.2.3, and 6.1

5. DESIGN INPUTS

The sources of design input, including technical information, codes and standards, applicable criteria and requirements are documented as appropriate in this section.

5.1 CODES AND STANDARDS

In accordance with NFPA 70 (NFPA 2004), paragraph 110.26, a minimum workspace of $W = 2.5$ feet, $D = 3.0$ feet, $H = 6.0$ feet shall be provided in front of and behind communications equipment cabinets. This minimum workspace is required for equipment operating at 600 volts or less.

Additionally, in accordance with NFPA 101 (NFPA 2003), section 7.3.4.1, a minimum egress of 36-inches (3.0 feet) shall be provided along the width of the room at the ends of each row of equipment cabinets.

6. CALCULATION INFORMATION

6.1 ROOM AREA

The assumptions in Section 4 and the design inputs in Section 5.1 were used to determine the minimum space requirement for the backup central communications room in the FHF:

$$\begin{aligned}\text{Room Length} &= (15 * L_{\text{Cabinet}}) + (2 * L_{\text{NFPA 101}}) + L_{\text{Extra}} \\ &= (15 * 2.5 \text{ feet}) + (2 * 3.0 \text{ feet}) + 6.5 \text{ feet} = \mathbf{50.0 \text{ feet}}\end{aligned}$$

Where:

L_{Cabinet}	= Width of an equipment cabinet
$L_{\text{NFPA 101}}$	= The 3 feet of egress at each end of a row required by NFPA 101
L_{Extra}	= Additional length of allocated workspace

$$\begin{aligned}\text{Room Width} &= (R * W_{\text{Cabinet}}) + (R * W_{\text{NFPA 70}}) + W_{\text{Fire}} + W_{\text{Extra}} \\ &= (2 * 3.0\text{ft}) + (2 * 6.0\text{ft}) + 1\text{ft} + 1.5\text{ft} = \mathbf{20.5 \text{ feet}}\end{aligned}$$

Where:

- R = Number of rows of equipment cabinets
- W_{Cabinet} = Depth of an equipment cabinet
- $W_{\text{NFPA 70}}$ = The 6 feet of surrounding workspace required by NFPA 70 for each row of equipment cabinets (3 feet in front, and 3 feet behind)
- W_{Fire} = Fire-rated barrier thickness
- W_{Extra} = Additional width of allocated workspace

$$\begin{aligned}\text{Room Area} &= \text{Room Width} * \text{Room Length} \\ &= 50.0 \text{ feet} * 20.5 \text{ feet} = \mathbf{1025.0 \text{ square feet}}\end{aligned}$$

Thus, the backup central communications room in the FHF shall have a minimum area of 1025.0 square feet.

7. CONCLUSION

As calculated in Section 6, the backup central communications room in the FHF shall have a minimum area of 1025.0 square feet. In addition, at least one of the room dimensions (W or L) must be a minimum of 20.5 feet. As long as this requirement is met, the minimum room area calculated will accommodate all of the estimated 30 communications equipment cabinets in the assumed orientation, the bisecting fire-rated barrier, and will provide additional workspace while also meeting the minimum space requirements of NFPA 70 (NFPA 2004) and NFPA 101 (NFPA 2003). The minimum calculated room area also helps guide FHF designers in assuring adequate space is provided in the design of the facility for the backup communications room.

8. REFERENCES

AP-3.12Q, Rev. 2, ICN 2. *Design Calculations and Analyses*. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20040318.0002.

BSC (Bechtel SAIC Company) 2005. *Q-List*. 000-30R-MGR0-00500-000-001. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20050217.0010. [DIRS 171190]

DOE (U.S. Department of Energy) 2004. *Quality Assurance Requirements and Description*. DOE/RW-0333P, Rev. 16. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20040907.0002. [DIRS 171539]

ICC (International Code Council) 2000. *International Building Code 2000*. Falls Church, Virginia: International Code Council. [DIRS 159179]

NFPA 101. 2003. *Life Safety Code*. 2003 Edition. Quincy, Massachusetts: National Fire Protection Association. [DIRS 165076]

NFPA 70. 2004. *National Electrical Code*. 2005 Edition. Quincy, Massachusetts: National Fire Protection Association. [DIRS 172711]