**BSC**

# Design Calculation or Analysis Cover Sheet

*Complete only applicable items.*

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**RECORD OF REVISIONS**

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| 00B | Revised ventilation airflow values of number of rooms to clarify sources of the infiltration and/or cascade air and clarify temperature entries. | 179 | 179 | Monico C. Pingul, Jr. | Orlando T. Asuncion | Tracy Johnson | Hadi Jalali |
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## DISCLAIMER

The calculations contained in this document were developed by Bechtel SAIC Company, LLC (BSC) and are intended solely for the use of BSC in its work for the Yucca Mountain Project.

# CONTENTS

# TABLES

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACH | air changes per hour |
| AHU | air handling unit |
| ANSI | American National Standards Institute |
| ASHRAE | American Society for Heating, Refrigeration and Air Conditioning Engineers |
| BSC | Bechtel SAIC Company, LLC |
| Btu/h | British thermal unit per hour |
| CLF | cooling load factor |
| CLTD | cooling load temperature difference (or differential) |
| DIRS | Document Input Reference System |
| DOE | U.S. Department of Energy |
| HVAC | heating, ventilating, and air conditioning |
| ITS | important to safety |
| RF | Receipt Facility |
| WP | Waste Package |

# 1. PURPOSE

The purpose of this calculation is to determine the following quantities for heating, ventilating, and air conditioning (HVAC) subsystems serving the non-ITS tertiary confinement areas of the Receipt Facility (RF):

- Room-by-room cooling and heating loads
- Room airflow rates
- Subsystem airflow rates
- Required outdoor air rates
- Total cooling load per subsystem
- Total heating load per subsystem

The heating and cooling load for the non-confinement (non-ITS) areas of the RF is determined in a separate calculation, 200-M8C-VNI0-00100-000-00B (Reference 2.2.24). The ITS Electrical and Battery Rooms (tertiary confinement areas) cooling and heating load is determined in calculation 200-M8C-VCT0-00700-000-00B (Reference 2.2.27). The ITS confinement breach areas exhaust requirement is determined in calculation 200-M8C-VCT0-00100-000-00A (Reference 2.2.21).

Revision C of this calculation relates the HVAC Subsystems (i.e. AHU-D, EXH-D) to HVAC equipment numbers consistent with References 2.2.29 through Reference 2.2.36. All HVAC equipment numbers are prefixed by "200-VCT0" unless otherwise noted.

# 2. REFERENCES

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## 2.3 DESIGN CONSTRAINTS

None

## 2.4 DESIGN OUTPUTS

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# 3. ASSUMPTIONS

## 3.1 ASSUMPTIONS REQUIRING VERIFICATION

### 3.1.1 General Arrangement Drawings

It is assumed that the room name designations, dimensions, and constructions are as shown in the Receipt Facility General Arrangement Drawings (References 2.2.13 through 2.2.20).

**Rationale**–The RF General Arrangement Drawings are presently in the preliminary design stage; hence, they are a preliminary source of information for determining the thermal heat loads of the individual rooms in the HVAC system. When the plant design drawings and architectural drawings are issued for construction, the room designations, room dimensions, wall and roof construction, and material information will be verified.

### 3.1.2 Lighting

The lighting type in rooms with a ceiling height of 14 ft or lower and all first, second and third floor corridors is assumed to be fluorescent, with two lamps per fixture, a lighting density of 2 W/sq. ft, and a ballast factor of 1.2. The lighting for all of the remaining spaces is assumed to be High Bay, Incandescent-type, with a lighting density of 2 W/sq. ft.

**Rationale**–The lighting fixture types have not been specified at this stage in the design. A lighting density of 2 W/sq. ft is a conservative estimate, based on the range of lighting densities allowed by the ANSI/ASHRAE/IESNA Standard 90.1-2004, *2004 Energy Standard for Buildings Except Low-Rise Residential Buildings* (Reference 2.2.6, Tables 9.5.1 and 9.6.1). The assumption of two fluorescent lamps per fixture, according to the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, Table 4.1, p. 4.1), indicates an average ballast factor of 1.2 for use in the lighting portion of the load calculation, for rooms with a ceiling height of 14 ft or lower and all first, second and third floor corridors. The types of fixtures and lighting density will be verified with actual design lighting densities, as the design progresses to completion.

### 3.1.3 Factor of Safety

It is assumed that the 20% factor of safety, added to each room's cooling load, is adequate to include heat gains in the supply ductwork and to include any uncertainties in equipment heat gain.

**Rationale**–Various heat gain quantities are not firmed-up at this time. Adding a factor of safety for any unverified cooling loads is common engineering practice. The factor of safety will be checked and adjusted as the design progresses to completion.

### 3.1.4 Equipment Heat Gain List

It is assumed that the equipment heat gain estimates used in Appendix E represent the best available information at this stage of the design.

**Rationale**–The design of the RF is still in a preliminary stage, and accurate configurations and sizes of heat producing equipment are not known. However, a combination of preliminary inputs from interdepartmental disciplines yields conservative estimates for the RF room heat loads. As the design progresses, Appendix E will be updated.

### 3.1.5 Air Temperature Leaving the Cooling Coil

It is assumed that the air temperature leaving the cooling coil is 51°F dry bulb and 46.36°F wet bulb.

**Rationale**–The actual air temperature leaving the cooling coil can only be determined upon selection of a cooling coil. In this calculation a leaving dry bulb temperature of 51°F is assumed, because a normal cooling coil design has a 9°F approach. A typical entering chilled water temperature is 42°F, the 51°F dry bulb leaving air temperature then meets the approach criteria. Per Assumption 3.1.11, the humidity ratio of the indoor air is assumed to be approximately 0.00645 lb moisture/lb of dry air. With this humidity ratio the cooling coil process is expected to be a sensible only process. Consequently, the leaving air humidity ratio will equal 0.00645 lb moisture/lb of dry air and this equates to a wet bulb temperature of 46.36°F.

### 3.1.6 Supply Fan Heat Gain

It is assumed that the maximum temperature rise of the supply air as it passes through the supply fan and motor is 6°F for all subsystems.

**Rationale**–From *2004 ASHRAE HVAC Systems and Equipment* (Reference 2.2.7, Chapter 18, p. 18.6) for low pressure rises, the following equation is used to calculate the temperature rise across a fan:

$$\Delta T = \frac{\Delta P \cdot C_p}{\rho \cdot c_p \cdot J \cdot \eta} \qquad \text{(Eq. 1)}$$

where

$\Delta T$ = temperature rise across fan, °F
$\Delta P$ = pressure rise across fan, in. w.g.
$C_p$ = conversion factor = 5.193 lbf/ft$^2$ in. w.g.
$\rho$ = density of air, lbm/ft$^3$
$c_p$ = specific heat = 0.24 Btu/lbm °F
$J$ = mechanical equivalent of heat = 778.2 ft lbf/Btu
$\eta$ = efficiency (combined efficiencies of motor and fan).

A pressure rise across the fan of 9.5 in. w.g. is a reasonable total pressure drop for the RF HVAC systems, especially the units containing HEPA filters. The density of the air at the temperature entering the supply fans, 102°F (highest expected air temperature), is approximately 0.062 lbm/ft$^3$. A conservative efficiency for a centrifugal fan is 0.84. A reasonable motor efficiency for motors in the range of 75 hp to 125 hp is 0.90 (Reference 2.2.4, Table 3A p. 30.7). These values give a temperature rise of 5.64°F. Rounding up to $\Delta T$ = 6°F gives a conservative estimate for the temperature rise across the supply fan and motor. This result derives from a subsystem with the worst pressure rise across fan. For other subsystems with lower pressure rise across fan, it will be re-evaluated in the detailed design.

### 3.1.7 Room Ventilation Confinement Zoning

It is assumed that the ventilation confinement zoning classifications, for the layouts given in the *RF Ventilation Confinement Zoning Analysis* (Reference 2.2.12), are suitable for use and are the best available information at this stage of the design.

**Rationale**–The *RF Ventilation Confinement Zoning Analysis* (Reference 2.2.12) is a committed calculation and determines the ventilation confinement zoning for the rooms in the RF. When that calculation is confirmed, the ventilation confinement zoning will be verified.

### 3.1.8 Room Infiltration Rates

It is assumed that the infiltration rates presented in the *RF Building Confinement Areas Air Leakage Calculation* (Reference 2.2.21) are suitable for use and represents the best available information at this stage of the design. Note that Rooms 1006 and 1007A have been changed to Rooms 1212 through 1224 and 1205 as shown on Receipt Facility General Arrangement Drawings (Reference 2.2.13 and 2.2.14).

**Rationale**–This cooling and heating load calculation uses a building layout that has been updated from the layout assumed in the *RF Building Confinement Areas Air Leakage Calculation* (Reference 2.2.21). Consequently, some rooms have minor changes, but these changes have a negligible impact. If the infiltration airflow rates calculated in the next revision of the *RF Building Confinement Areas Air Leakage Calculation* change then the infiltration rates will be verified and updated accordingly. There are non confinement room infiltrations that are accounted for in *RF Heating and Cooling Load Calculation (Non Confinement)* (Reference 2.2.24); however no credit is taken for these rooms that are adjacent to the Tertiary Confinement Non-ITS areas. These rooms are considered non-existent and the Tertiary Confinement Non ITS walls are assumed to face the outside wind conditions which results in higher delta pressure and hence higher infiltration.

### 3.1.9 U-Values for Metal Building

It is assumed that the U-Values for the metal building roofs and walls are as follows:

$$U_{ROOF} = 0.065 \text{ Btu/h-ft}^2\text{-°F and } U_{WALL} = 0.113 \text{ Btu/h-ft}^2\text{-°F}$$

**Rationale**–The design of the building envelope associated with this calculation is in the preliminary stage. These values are the best available information at this time, which are consistent with Table 5.5-5 and Figure B-1 of ASHRAE Standard 90.1-2004, *2004 Energy Standard for Buildings Except Low-Rise Residential Buildings* (Reference 2.2.6). As the design progresses to the detailed design phase, the U-values will be verified and updated appropriately.

### 3.1.10 Cascade Airflow

It is assumed that the cascade airflow "in" and "out" quantities presented in Table 5, Space Airflow Rates, are suitable for use.

**Rationale**–The determination of cascade airflows is an integral part of the design process and is determined based on room layout and room air balance. The cascaded quantities are ideally developed during the conceptual stage of the Ventilation Flow Diagrams but these diagrams are not currently available. The values presented in Table 5 will be updated in future revisions using issued ventilation flow diagrams, as applicable.

### 3.1.11 Humidity Ratio of Indoor Air

It is assumed that the humidity ratio of all air inside the facility for summer design will equal the humidity ratio of the design outdoor air condition 102°F dry bulb/65°F wet bulb which equals approximately 0.00645 lb moisture/lb of dry air.

**Rationale**–This is a reasonable assumption because the expected latent loads in the RF are very small compared to the amount of sensible loads expected. Due to infiltration and ventilation, air entering the building on a continual basis and an expectation that all cooling coil processes will be sensible cooling only, the indoor air should reach, for design purposes, a steady state humidity level equal to the design outdoor conditions.

### 3.1.12 Large Interior and Exterior Metal Doors

It is assumed that the large interior and exterior metal doors (roll-up, etc.) have a U-Value of 1.15 Btu/h-ft$^2$-°F and the door dimensions are based on the committed calculation, *RF Building Confinement Areas Air Leakage Calculation* (Reference 2.2.21).

**Rationale**–The door dimensions are not indicated on the RF Layouts and Sections (References 2.2.13 through 2.2.20), consequently the door dimensions used in the *RF Building Confinement Areas Air Leakage Calculation* (Reference 2.2.21), are used in this calculation. Also, the large interior and exterior metal doors have not been specified at this time, therefore the U-Value of 1.15 Btu/h ft$^2$ °F is taken from the Annunciated Steel Door entry in Table 6 on p. 31.11 of *2005 ASHRAE Fundamentals* (Reference 2.2.4). The number is the most conservative in the Table for Sectional Overhead Doors. The U-Value and dimensions of the large interior and exterior metal doors will be verified in detailed design.

### 3.1.13 Corridor Tunnel Construction

It is assumed that all corridors on the first, second and third level, inside the concrete portion of the structure, are of tunnel construction and have a ceiling height of 14 ft.

**Rationale**–The RF General Arrangement and Sections (References 2.2.13 through 2.2.20) show some of the corridors with a tunnel construction, but not all corridors are visible in the building sections. The current Plant Design computer model shows tunnel construction for the first and second level corridors. Because the Plant Design computer model cannot be referenced, the construction of the corridors must be assumed. The height of the top of the tunnel ceiling will be verified when the General Arrangement Drawings are issued.

### 3.1.14 Temperature of External Stairwells and Fire Water Riser Valve Rooms

It is assumed that the internal temperatures of all externally located stairwells and all Fire Water Riser Valve Rooms are equal to the outdoor ambient temperature and walls adjacent to the exterior stairwells and fire water riser valve rooms can be treated as walls with sunlit facing exteriors.

**Rationale**–The external stairwells and fire water riser valve rooms are not conditioned spaces at this point in the design of the RF. Their internal temperatures will rise and fall with the outdoor temperature. Consequently, a more conservative load calculation can be achieved if these small areas are assumed to be non-existent. This assumption will be verified during the detailed design phase of the RF.

### 3.1.15 Occupancy Numbers

It is assumed that the number of people in the occupied areas of the RF Tertiary Non-ITS areas is as indicated in Table 1.

Table 1. Occupancy Numbers

| Room No. | Room Name | No. of People |
|---|---|---|
| 1002 | Lid Bolting Room | 4 |
| 1017 | Cask Preparation Room | 6 |
| 1017A | Cask Preparation Annex | 2 |
| 1212 to 1224 | Support Areas | 3 |
| | Total | 15 |

**Rationale**–The number of people is estimated based on conversations with the Operations group. The preliminary numbers have been confirmed in an e-mail shown in Attachment 7. These occupancy numbers will be verified as the design progresses.

### 3.1.16 Not Used

### 3.1.17 Not Used

### 3.1.18 Equipment Heat Gain in R001, Freight Elevator Machine Room

It is assumed that the equipment heat gain in Room R001, Freight Elevator Machine Room, is equal to 1000 Watts or 3412 Btu/h.

**Rationale**–The equipment in Room R001 has not yet been specified. A heat gain of 1000 W or 3412 Btu/h is assigned to this room as a placeholder for future equipment. During detailed design, the actual equipment heat gain will be verified.

### 3.1.19 Outdoor Ventilation Air

It is assumed that all *ASHRAE Standard 62.1* (Reference 2.2.2) outdoor air requirements are going to be adequately handled with infiltration air and air-handling unit make-up air to offset exhaust air requirements.

**Rationale**–The fundamental design principle for the tertiary confinement area of RF is the use of infiltration and engineered openings to cascade air throughout the building in order to maintain negative pressures between tertiary confinement areas and non-confinement areas. Because the design is in a very early stage, the number of people expected to occupy the building are relatively low (See Assumption 3.1.15), and infiltration and exhaust make-up is the fundamental design principle for maintaining confinement. It is reasonable to assume that the amount of outside air entering the spaces through infiltration and make-up will exceed the amount required by *ASHRAE Standard 62.1* (Reference 2.2.2). During detailed design, the subsystems that serve areas containing people can be analyzed in more depth.

### 3.1.20 Support Areas

It is assumed that Rooms 1212 through 1224 can be modeled as one large space (room) for this load calculation. This is also the case for Rooms 1221 and 1205.

**Rationale**–Grouping the rooms together as one Support Area allows for a simplified approach to calculating the loads and airflows for the overall spaces. The impact on the overall calculation results would only be to the distribution of air and not to the total cooling and heating load required for the space, since all of the individual rooms would be modeled at the same temperature. As the individual rooms are better defined in detailed design, the individual room loads will be calculated.

### 3.1.21 Temperature of Personnel Vestibule Room 1021B

It is assumed that the Personnel Vestibule, Room 1021B, is equal to the outdoor ambient temperature and the walls adjacent to this room can be treated as walls with sunlit facing exteriors.

**Rationale**–The Personnel Vestibule, Room 1021B, is not accounted for in the RF heating and cooling load calculation for the non-confinement areas (Reference 2.2.24), therefore the internal temperature will rise and fall with the outdoor temperature. Thus, the most conservative approach for this calculation is to consider the room as non-existent. This assumption will be verified during the detailed design phase of the RF.

### 3.1.22 HVAC and Mechanical Process Equipment Sizes

The power ratings for the HVAC and mechanical process equipment are assumed as listed in Appendix E, Room Equipment Heat Gain List.

**Rationale**–The equipment list in Attachment 5 contains all of the HVAC and mechanical process equipment necessary to run the RF. The equipment motor horsepower shown in this list were based on the calculated horsepower rating from various Equipment Sizing and Selection

Calculation and shown in V&ID's as referred in Attachment 5. The actual power ratings for the HVAC and mechanical process equipment will be verified during the detailed design phase of the RF.

### 3.1.23 Refrigerated Dryer Package Heat Rejection

It is assumed that the heat rejection from GP Dryer Package is 120,596 Btu/h based on Vendor's Information for model no. NVC2000A. (Reference 2.2.28).

**Rationale**–The design of the GP Dryer Package located in Room 2012 is in the preliminary stage. The information is representative of similar packages throughout the compressor industry. As the design progresses to the detailed design phase, heat rejection from this equipment will be verified and updated appropriately.

### 3.1.24 Miscellaneous Equipment Heat Gain in Rooms 1002, 1017, 2007 and 2012.

It is assumed that there are miscellaneous equipment heat gain and future additional heat gain shown in Appendix E that are not known at this time in Rooms 1002, 1017, 2007 and 2012.

**Rationale**–In the revision of this calculation from the previous version, it is not necessary to remove conservative equipment heat gains at this time. Instead, the extra heat gain is categorized as a miscellaneous load. As the design progresses to the detailed design phase, it will be verified and updated.

## 3.2 ASSUMPTIONS NOT REQUIRING VERIFICATION

### 3.2.1 Hours of Operation

It is assumed that the RF will operate 7 days a week, 24 hours a day.

**Rationale**–It is expected that 7 days a week, 24 hours a day operation will be necessary to meet throughput requirements. But, whether it is necessary or not, an assumption of continuous operation will provide the most conservative bounding results for this calculation.

### 3.2.2 Outside Air Film Resistance for Calculating U-Values

The outside air film resistance during summer will be used in this analysis (Reference 2.2.4, Table 1, p. 25.2).

**Rationale**–Calculation of the airflow rate is based on calculated summer heat loads. Higher U-Values translate into higher calculated heat loads, therefore the use of a higher U-Value for the outside air film resistance gives a maximum bounding value.

### 3.2.3 Wall and Roof Color

A dark colored surface is assumed in determining the cooling load from sunlit walls and flat roofs, in order to provide an upper bounding solar radiation absorption component to the cooling load temperature differences generated.

**Rationale**–The assumption of a dark colored surface for the roof and walls in this calculation allows the use of a CLTD correction factor of 1.0; that maximizes the adjusted CLTD values. Because the color of the walls and roofs are not known at this time, assuming a dark color results in the most conservative upper bounding CLTD values.

### 3.2.4 F-factor for Slab on Grade

The F-factor for calculating heating loads from slab-on-grade floors is F = 0.73.

**Rationale**–This value is the maximum value allowed by Table 5.5-5 of the *2004 Energy Standard for Buildings Except Low-Rise Residential Buildings* (Reference 2.2.6, p. 27). Using the maximum value allowed for calculating heating loads provides an adequate margin of safety.

### 3.2.5 Lighting Load to Space

For the calculation of cooling loads, it is assumed that 100% of the lighting load is transmitted to the space.

**Rationale**–For conservatism, assuming that 100% of the lighting load is transmitted to the space will provide a maximum, upper bounding, heat gain contribution from the lighting to the space.

### 3.2.6 Cooling Load Factor for Lighting

The lighting Cooling Load Factor (CLF) for every hour of the load calculation is equal to 1.0.

**Rationale**–Per Assumption 3.2.1, the RF is assumed to operate 7 days a week, 24 hours a day. Section 4.1 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3) states that a CLF value of 1.0 should be used when lights are on more than 16 hours a day.

### 3.2.7 Cooling Load Factor for People

The person CLF for every hour of the load calculation is equal to 1.0.

**Rationale**–Per Assumption 3.2.1, the RF is assumed to operate 7 days a week, 24 hours a day. It is noted from Table 4.6 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3), that the sensible heat cooling load factors for people would approach a value of 1.0 for people in the space 24 hours a day, since a CLF of 0.97 is listed in the table for people in the space for a total of 18 hours.

### 3.2.8 Cooling Load Factor for Equipment

The equipment CLF for every hour of the load calculation is equal to 1.0.

**Rationale**–Per Assumption 3.2.1, the RF is assumed to operate 7 days a week, 24 hours a day. It is noted from Table 4.11 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3), that the cooling load factors for equipment (unhooded appliances, motors, etc.), as shown in the table, would approach a value of 1.0 for equipment operating 24 hours a day, since a CLF of 0.98 is listed in the table for equipment operating 18 hours.

### 3.2.9 Air Handling Unit Configurations

It is assumed that all AHUs will be configured with a blow-thru fan configuration.

**Rationale**–The blow-thru configuration is assumed in order to keep the airflow values at a reasonable rate, by lowering the supply air temperature to the room to a value equal to the leaving coil temperature.

# 4. METHODOLOGY

## 4.1 QUALITY ASSURANCE

This calculation was prepared in accordance with procedure EG-PRO-3DP-G04B-00037, *Calculations and Analyses* (Reference 2.1.1). The Tertiary Non-ITS portion of the Surface Nuclear Confinement HVAC System discussed in this calculation is classified as Non-ITS in the *Basis of Design for the TAD Canister-Based Repository Design Concept* (Reference 2.2.10, Section 19.1.2) because during operation the HVAC systems do not mitigate the consequences of a radioactive release. Therefore, the approved version of this calculation is designated QA: N/A.

## 4.2 USE OF SOFTWARE

No software was used in this calculation.

## 4.3 METHODOLOGY

The calculation methodology outlined below is accomplished through the use of hand calculations.

1. Gather room information using the preliminary Receipt Facility General Arrangements (Assumption 3.1.1), and develop a Room Load Information Sheet for each room. Additionally, determine U-values for any roofs, walls, partitions, ceilings, and floors. See Appendix A for Room Load Information Sheets and U-Values for this calculation.

2. Calculate room-by-room cooling loads using the CLTD/CLF method and heating loads using the temperature difference method presented in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3). Heating loads from slab-on-grade floors are calculated using the simplified slab perimeter method given by Equations 39 and 40 of *2005 ASHRAE Fundamentals* (Reference 2.2.4, Chapter 29, p. 29.13). See Section 6.1.3 for cooling loads and Section 6.1.4 for heating loads.

3. Calculate room-by-room cooling loads from lighting, equipment and people, and include these loads in each room's total cooling loads. See Section 6.1.3.

4. Calculate each subsystem's airflow rate by summing all the peak space airflow rates belonging to each subsystem. This is a conservative approach since the rooms' peak cooling loads do not occur at the same time. See Section 6.2.1.

5. Calculate the minimum required outdoor air rate using ANSI/ASHRAE 62.1-2004, *Ventilation for Acceptable Indoor Air Quality* (Reference 2.2.2, Section 6.2). See Section 6.2.3.

6. Calculate the room-by-room space airflow rates based on the subsystem requirements. See Section 6.2.3 and Table 5.

7. Calculate the cooling and heating ventilation loads from the required outdoor air rates determined above. See Section 6.3.

8. Calculate the cooling (coil) load for each subsystem by determining the cooling coil entering conditions, the mixed air conditions based on the psychometric equations in Appendix D, and using cooling coil leaving conditions from Assumption 3.1.5. Thermodynamic properties of air entering and leaving the coil for each subsystem are shown in Appendix G. The mixed air is the mixture of the return air and the outside air. See Section 6.3.1.

9. Calculate the heating (coil) loads for each subsystem. See Section 6.3.2.

10. Calculate Infiltration/Cascade Air Cooling Load as presented in Appendix H.

## 5. LIST OF ATTACHMENTS

| | | Number of Pages |
|---|---|---|
| Attachment 1: | E-mail Regarding Waste Packages and Canisters Heat Gain Information | 2 |
| Attachment 2: | E-mail Regarding RF Electrical Equipment Heat Gain Information | 5 |
| Attachment 3: | E-mail Regarding Environmental, Safety & Health Equipment Heat Gain Information | 12 |
| Attachment 4: | E-mail Regarding Instrumentation and Controls Equipment Heat Gain Information | 4 |
| Attachment 5: | HVAC and Mechanical Process Equipment List | 5 |
| Attachment 6: | E-mail Regarding Mechanical Handling Group Equipment Heat Gain Information | 3 |
| Attachment 7: | E-mail Regarding the Number of Occupants in the RF Building | 3 |
| Attachment 8: | Second E-mail Regarding Mechanical Handling Group Equipment Heat Gain Information | 3 |
| Attachment 9: | E-mail Regarding Mechanical Handling Equipment Heat Gain Diversity Factor. | 3 |

# 6. BODY OF CALCULATION

## 6.1 ROOM-BY-ROOM COOLING AND HEATING LOADS

### 6.1.1 Outdoor Design Conditions

This calculation uses the meteorological conditions at Mercury, Nevada for the cooling and heating load calculations, as directed in section 4.9.2.3.1 of the *Project Design Criteria Document* (Reference 2.2.1, p. 122). The following data is taken from Table 1A and 1B in Chapter 27 of *2001 ASHRAE Fundamentals Handbook* (Reference 2.2.5):

- Site: Mercury, Nevada
- North latitude: 36.62°
- West longitude: 116.02°
- Elevation: 3310 ft
- Heating Dry Bulb Temperature, 99.6% value: 24°F
- Cooling Dry Bulb/Mean Coincident Wet Bulb Temperatures, 0.4% value: 102°F/65°F
- Daily Temperature Range: 25.9°F

The 0.4% annual percentile design value for cooling and the 99.6% design value for heating are used for confinement and sensitive areas as directed by the Project Design Criteria Document (Reference 2.2.1, Section 4.9.2.3.1, p. 122).

### 6.1.2 Indoor Design Conditions

This calculation uses the summer and winter indoor design temperatures presented in Table 2, as a guide for assigning individual room design temperatures. As for humidity, the normally occupied areas the maximum dew point shall be 62.2°F. There are no established lower humidity limits for thermal comfort per ASHRAE 55-2004 (Reference 2.2.22, Section 5.2.2). Currently, no project requirements exist dictating the need for minimal humidity levels for special processes or equipment needs.

For winter design conditions, there is the possibility for the humidity levels to reach low percentage levels and humidification may be desirable in occupied areas, to reduce skin and eye dryness and in some areas to reduce static electricity generation. But it will not be addressed at this time, since the spaces, processes, and equipment for this facility have not yet been designed in detail.

Table 2. Indoor Design Temperatures

| Rooms/Areas | Summer/Winter |
|---|---|
| Normally Unoccupied Areas (with Occasional Short Term Occupancy): (e.g. Exit / Entrance Vestibules, Electrical & Mechanical Equipment Rooms, LID Bolting Room, and Chases) | 90°F (summer)/65°F (winter)<br>(Reference 2.2.26, Section 3.2) |
| Cask Unloading Room, Loading Room | 100°F (summer)/65°F (winter)<br>See Note 1 |
| Cask Preparation Room, Cask Preparation Annex, Canister Transfer Room, Maintenance Room | 79°F to 85°F; Use 79°F (summer)/65°F (winter)<br>(Reference 2.2.26, Section 3.2) |
| Corridors, Lobby | 79°F to 85°F; Use 82°F (summer)/65°F (winter)<br>(Reference 2.2.26, Section 3.2) |
| Battery Room | 77°F (summer)/77°F (winter)<br>See Note 2 |
| Support Areas | 75°F (summer)/72°F (winter)<br>(Reference 2.2.26, Section 3.2) |

NOTES:

1. These rooms are normally unoccupied and are similar to the Mechanical Equipment Room in Table 1, Chapter 25 of 2007 ASHRAE Applications (Reference 2.2.8), which recommends a maximum room temperature of the "Design Outdoor Temperature + 10°F = (112°F). Electrical equipment (such as a CCTV) within the room cannot sustain a room temperature higher than 104°F; therefore 100°F was used as a design room temperature for conservatism.
2. From Table 1, Chapter 25 of 2007 ASHRAE Applications (Reference 2.2.8).

### 6.1.3 Room-by-Room Cooling Load Calculation

As stated in Section 4.3, the cooling loads are calculated using the CLTD/CLF method presented in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3). For each room the cooling load is calculated by considering the cooling load contribution from the following load components: roofs, walls, partitions, lighting, people, and equipment. The equations used to calculate the various components of the cooling load are given in Appendix C. The specific values used in these equations are given in the Room Load Information Sheets presented in Appendix A. An explanation regarding the sources of the information contained in the Room Load Information Sheets is given at the beginning of Appendix A. U-values for roofs, walls, and partition types are calculated and presented at the end of Appendix A.

The unadjusted ASHRAE values for CLTDs are presented in Appendix B. The unadjusted roof CLTD values correspond to a Type-12 roof (6-in. h.w. concrete with 1 in. or 2 in. insulation) and a Type 1 roof (steel with 1 in. or 2 in. insulation), per Table 3.8 in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, p. 3.19). However, from note 4 of Table 3.8 of Reference 2.2.3, an effective CLTD of 29 is used for the Type-12 roof for each solar time, because the RF concrete roof has an R-value of approximately 30 (hr $ft^2$ F)/Btu greater than the Type-12 roof selected. Also, per note 4 of Table 3.8 of Reference 2.2.3, the CLTD values of a Type 2 roof are used for calculating the cooling load from the metal roof, because of a higher calculated resistance of the roof. The unadjusted CLTD values for the wall Types B and G (Reference 2.2.3,

Table 3.10, p. 3.21) are given in Appendix B. These wall types are determined from Table 3.9 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, p. 3.20) by determining the best comparison of the RF walls with the types given in the table. Because the R-value of the RF thick concrete wall is not significantly greater than the Type B wall chosen, a CLTD correction per note 4 of Table 3.10 in Reference 2.2.3 is not required.

The unadjusted CLTD values in Appendix B need to be corrected for latitude-month, color, indoor design temperature, and outdoor design temperature before they can be used in the cooling load equations. See Appendix B for the equations used to correct the unadjusted roof and wall CLTD values. The Latitude and Month corrections for the roofs and walls are given in Table B-2. For the correction of the Roof CLTD and the Wall CLTD, the K-factor is equal to 1.0, based on Assumption 3.2.3. For the correction of the Roof CLTD, the f-factor is taken at 1.0 for conservatism. The monthly outdoor design temperatures used in this calculation are shown in Table B-3. The summer design conditions of 102°F dry bulb/65°F wet bulb were assigned to June, July, August, and September for a more conservative cooling load result. Table F-1 and Table F-2 present the room-by-room roof and wall load calculations, respectively, for the peak month and hour of each room. The roof and wall totals for each room are summarized in Table 3.

The CLF values are also provided in Appendix B, Table B-1. The CLF values for lighting, people, and equipment are all equal to 1.0, based on Assumption 3.2.6, Assumption 3.2.7, and Assumption 3.2.8, respectively.

Partition loads are handled in a simplified and conservative manner in this calculation. Partition loads, due to wall partitions, are considered only when there is a heat gain into the room or space. The negative load value is not considered for the spaces on the side of the partition that experience a heat loss. This method was chosen to make the hand calculations simpler, yet conservative, since not tracking down the heat loss from the multiple partitions and temperature differences that could be experienced by any single room saves time and yields a higher cooling load.

In order to determine the peak cooling load for each room, the maximum value of the sum of the roof, wall, partition, lights, people and equipment heat gains for all months and hourly times is determined. See Example A1.1 in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3) for an example on how to determine the room peak cooling load. The peak month and hour for each room served by the RF HVAC system is given in Tables F-1 and F-2.

A summary of the cooling load calculation is given in Table 3, for both sensible and latent loads. For conservatism, a 20% factor of safety has been added to the room peak sensible and latent loads to account for duct heat gain and to account for any unknowns at this stage of the design (Assumption 3.1.3).

Subsystem designations are added in Table 3 to identify anticipated zoning of rooms with respective air-handling units.

Table 3. Cooling Load Summary

| | | | SENSIBLE COOLING | | | | | | | | | | | | LATENT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room No. | Room Name | Room Peak Mo/hr | Design Room Temp. °F | Roof Btu/h | Walls Btu/h | Partitions Btu/h | Floors Btu/h | People Btu/h | Lights Btu/h | Equip-ment Btu/h | Infilt-ration Btu/h | Room Sensible Btu/h | Factor of Safety | Total Room Peak Sensible Btu/h | People Btu/h | Infilt-ration Btu/h | Equip-ment Btu/h | Room Latent Btu/h | Factor of Safety | Total Room Peak Latent Btu/h |
| Note 1 | Note 1 | Note 2 | Note 1 | Note 6 | Note 7 | Note 8 | Note 9 | Note 10 | Note 11 | Note 12 | Note 13 | Note 14 | Note 15 | Note 16 | Note 10 | Note 13 | Note 12 | Note 17 | Note 15 | Note 18 |
| AHU-B (AHU-00001, 2 & 3) | | | | | | | | | | | | | | | | | | | | |
| 1002 | Lid Bolting Room | 6/15 | 90 | 1,415 | 3,309 | 9,380 | 0 | 1,000 | 13,515 | 132,327 | 9,752 | 170,698 | 1.2 | 204,838 | 800 | 0 | 0 | 800 | 1.2 | 960 |
| 1003A | Corridor | 6/15 | 82 | 0 | 557 | 5,472 | 0 | 0 | 5,242 | 307 | 10,180 | 21759 | 1.2 | 26,111 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1003B | Corridor | All | 82 | 0 | 0 | 7,500 | 0 | 0 | 8,437 | 205 | 0 | 16,142 | 1.2 | 19,370 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1003C | Corridor | 6/15 | 82 | 0 | 471 | 1,584 | 0 | 0 | 5,079 | 0 | 6,965 | 14,099 | 1.2 | 16,919 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1003D | Corridor | All | 82 | 0 | 0 | 8,910 | 0 | 0 | 10,894 | 0 | 0 | 19,805 | 1.2 | 23,766 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1004 | HVAC Room (ITS HEPA Exhaust Train A) | 6/20 | 90 | 0 | 3,374 | 2,620 | 0 | 0 | 33,038 | 62,678 | 321 | 102,031 | 1.2 | 122,437 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1004A | HVAC Room (ITS HEPA Exhaust for Battery Room Train A) | 6/16 | 90 | 0 | 1,920 | 0 | 0 | 0 | 6,143 | 8,794 | 750 | 17,607 | 1.2 | 21,128 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1212 to 1224 | Support Areas [Excluding Room 1221] (Assumption 3.1.20) | 6/15 | 75 | 0 | 9,026 | 27,539 | 0 | 750 | 35,140 | 23,659 | 30,621 | 126,735 | 1.2 | 152,082 | 600 | 0 | 0 | 600 | 1.2 | 720 |
| 1221 & 1205 | Support Areas (Assumption 3.1.20) | 6/15 | 75 | 3,617 | 0 | 0 | 0 | 0 | 5,488 | 4,027 | 0 | 13,132 | 1.2 | 15,758 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2001 | Operations/Maintenance Storage Room | 6/21 | 90 | 1,279 | 8,659 | 0 | 0 | 0 | 12,219 | 341 | 1,607 | 24,105 | 1.2 | 28,926 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002A | Corridor | 6/15 | 82 | 0 | 557 | 7,628 | 0 | 0 | 5,324 | 102 | 6,072 | 19,684 | 1.2 | 23,621 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002B | Corridor | All | 82 | 0 | 0 | 11,974 | 0 | 0 | 12,942 | 307 | 0 | 25,223 | 1.2 | 30,268 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002C | Corridor | All | 82 | 0 | 0 | 1,824 | 0 | 0 | 1,474 | 102 | 0 | 3,401 | 1.2 | 4,081 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002D | Corridor | 6/15 | 82 | 0 | 1,371 | 5,472 | 0 | 0 | 7,782 | 0 | 35,720 | 50,345 | 1.2 | 60,414 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2003 | HVAC Room North (Process Area Supply) | 6/16 | 90 | 3,458 | 4,828 | 0 | 0 | 0 | 33,038 | 15,916 | 1,607 | 58,847 | 1.2 | 70,616 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2004 | HVAC Room North (Process Area Supply) | 6/16 | 90 | 2,265 | 3,429 | 0 | 0 | 0 | 21,638 | 8,532 | 1,179 | 37,043 | 1.2 | 44,452 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2005 | Instrument and Electrical Shop | 6/18 | 90 | 3,065 | 12,297 | 0 | 0 | 0 | 29,284 | 341 | 2,572 | 47,559 | 1.2 | 57,071 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2007 | Canister Transfer Room | 6/22 | 79 | 8,202 | 71,571 | 66,031 | 0 | 0 | 53,038 | 250,687 | 2,054 | 451,583 | 1.2 | 541,900 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2012 | Receiver/Dryer Equipment Room | 9/21 | 90 | 1,904 | 18,214 | 0 | 0 | 0 | 29,284 | 120,425 | 2,572 | 172,398 | 1.2 | 206,878 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| AHU-C (AHU-00004 & 5) | | | | | | | | | | | | | | | | | | | | |
| 1003E | Corridor | 9/16 | 82 | 0 | 1,129 | 10,664 | 0 | 0 | 14,417 | 102 | 0 | 26,312 | 1.2 | 31,574 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1003F | Corridor | 9/15 | 82 | 0 | 504 | 5,472 | 0 | 0 | 5,242 | 205 | 5,894 | 17,317 | 1.2 | 20,780 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1003G | Corridor | 9/15 | 82 | 0 | 388 | 4,256 | 0 | 0 | 5,079 | 307 | 10,537 | 20,567 | 1.2 | 24,680 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1003H | Utility Chase | All | 90 | 0 | 0 | 2,960 | 0 | 0 | 10,894 | 0 | 0 | 13,854 | 1.2 | 16,625 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1012 | LLW Staging Room | 6/17 | 90 | 0 | 7,161 | 2,620 | 0 | 0 | 21,707 | 2,455 | 4,608 | 38,551 | 1.2 | 46,261 | 0 | 0 | 0 | 0 | 1.2 | 0 |

| | | | SENSIBLE COOLING | | | | | | | | | | | | LATENT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room No. | Room Name | Room Peak Mo/hr | Design Room Temp. °F | Roof Btu/h | Walls Btu/h | Partitions Btu/h | Floors Btu/h | People Btu/h | Lights Btu/h | Equip-ment Btu/h | Infilt-ration Btu/h | Room Sensible Btu/h | Factor of Safety | Total Room Peak Sensible Btu/h | People Btu/h | Infilt-ration Btu/h | Equip-ment Btu/h | Room Latent Btu/h | Factor of Safety | Total Room Peak Latent Btu/h |
| Note 1 | Note 1 | Note 2 | Note 1 | Note 6 | Note 7 | Note 8 | Note 9 | Note 10 | Note 11 | Note 12 | Note 13 | Note 14 | Note 15 | Note 16 | Note 10 | Note 13 | Note 12 | Note 17 | Note 15 | Note 18 |
| 1014 | Maintenance Room | All | 79 | 0 | 0 | 12,165 | 0 | 0 | 10,376 | 27,378 | 0 | 49,919 | 1.2 | 59,903 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1016 | CTM Maintenance Room | All | 90 | 0 | 0 | 2,620 | 0 | 0 | 9,215 | 1,952 | 0 | 13,787 | 1.2 | 16,544 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1018 | Electrical Room (Normal Power) | 6/23 | 90 | 0 | 9,521 | 0 | 0 | 0 | 25,734 | 118,271 | 643 | 154,169 | 1.2 | 185,003 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1018A | Battery Room (Normal Power) | 9/21 | 77 | 0 | 5,820 | 4,850 | 0 | 0 | 4,505 | 0 | 2,456 | 17,631 | 1.2 | 21,157 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1019 | HVAC Room (ITS HEPA Exhaust Train B) | 9/22 | 90 | 0 | 5,511 | 0 | 0 | 0 | 33,038 | 62,678 | 321 | 101,548 | 1.2 | 121,858 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1019A | HVAC Room (ITS HEPA Exhaust for Battery Room Train B) | 9/21 | 90 | 0 | 3,485 | 0 | 0 | 0 | 6,143 | 9,751 | 750 | 20,130 | 1.2 | 24,156 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1028 | Freight Elevator | 6/16 | 90 | 1,150 | 10,811 | 0 | 0 | 0 | 2,130 | 0 | 0 | 14,091 | 1.2 | 16,909 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1029 | Elevator Lobby | 9/15 | 82 | 0 | 5,237 | 1,920 | 0 | 0 | 3,522 | 102 | 31,612 | 42,394 | 1.2 | 50,873 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002E | Corridor | All | 82 | 0 | 0 | 10,680 | 0 | 0 | 18,184 | 512 | 0 | 29,376 | 1.2 | 35,250 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002F | Corridor | 6/15 | 82 | 0 | 557 | 7,628 | 0 | 0 | 5,324 | 102 | 6,072 | 19,684 | 1.2 | 23,621 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002G | Corridor | All | 82 | 0 | 0 | 1,824 | 0 | 0 | 1,474 | 102 | 0 | 3,401 | 1.2 | 4,081 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2006 | HVAC Room (HEPA Exhaust for Support, Decon and LLW Areas) | 6/17 | 90 | 2,272 | 9,459 | 0 | 0 | 0 | 21,707 | 53,784 | 5,465 | 92687 | 1.2 | 111,224 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2009 | HVAC Room South (Process Area Supply) | 6/23 | 90 | 2,494 | 12,804 | 0 | 0 | 0 | 25,734 | 6,175 | 2,036 | 49,243 | 1.2 | 59,092 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2010 | HVAC Room South (Process Area Supply) | 9/22 | 90 | 2,149 | 9,150 | 0 | 0 | 0 | 33,038 | 12,472 | 1,607 | 58,416 | 1.2 | 70,099 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2011 | HVAC Room South (Process Area Supply) | 9/22 | 90 | 1,407 | 6,498 | 0 | 0 | 0 | 21,638 | 6,638 | 1,179 | 37,360 | 1.2 | 44,832 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2029 | Elevator Lobby | 9/15 | 82 | 0 | 8,566 | 3,104 | 0 | 0 | 3,276 | 102 | 20,896 | 35,945 | 1.2 | 43,134 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 3001 | Corridor | Tertiary | 82 | 1,225 | 2,858 | 874 | 0 | 0 | 2,294 | 0 | 3,751 | 11,001 | 1.2 | 13,201 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 3029 | Elevator Lobby | Tertiary | 82 | 0 | 4,465 | 1,029 | 0 | 0 | 5,406 | 0 | 19,825 | 30,724 | 1.2 | 36,869 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| R001 | Freight Elevator Machine Room | Tertiary | 90 | 4,158 | 6,507 | 0 | 0 | 0 | 7,700 | 3,412 | 0 | 21,777 | 1.2 | 26,132 | 0 | 0 | 0 | 0 | 1.2 | 0 |

| | | | SENSIBLE COOLING | | | | | | | | | | | | LATENT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room No. | Room Name | Room Peak Mo/hr | Design Room Temp. °F | Roof Btu/h | Walls Btu/h | Partitions Btu/h | Floors Btu/h | People Btu/h | Lights Btu/h | Equip-ment Btu/h | Infilt-ration Btu/h | Room Sensible Btu/h | Factor of Safety | Total Room Peak Sensible Btu/h | People Btu/h | Infilt-ration Btu/h | Equip-ment Btu/h | Room Latent Btu/h | Factor of Safety | Total Room Peak Latent Btu/h |
| Note 1 | Note 1 | Note 2 | Note 1 | Note 6 | Note 7 | Note 8 | Note 9 | Note 10 | Note 11 | Note 12 | Note 13 | Note 14 | Note 15 | Note 16 | Note 10 | Note 13 | Note 12 | Note 17 | Note 15 | Note 18 |
| AHU-D (AHU-00006 & 7) | | | | | | | | | | | | | | | | | | | | |
| 1013 | Loading Room | All | 100 | 0 | 0 | 0 | 0 | 0 | 12,901 | 132,327 | 0 | 145,228 | 1.2 | 174,274 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1015 | Cask Unloading Room | All | 100 | 0 | 0 | 0 | 0 | 0 | 11,468 | 87,277 | 0 | 98,745 | 1.2 | 118,494 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1017 | Cask Preparation Room | 6/15 | 79 | 7,104 | 10,753 | 39,813 | 0 | 1,500 | 45,939 | 375,760 | 23,825 | 504,694 | 1.2 | 605,633 | 1200 | 0 | 0 | 1,200 | 1.2 | 1,440 |
| 1017A | Cask Preparation Annex | 9/19 | 79 | 0 | 4,810 | 10,640 | 0 | 500 | 10,717 | 2,083 | 0 | 28,749 | 1.2 | 34,499 | 400 | 0 | 0 | 400 | 1.2 | 480 |
| Totals | | | | 47,164, | 265,578 | 276,520 | 0 | 3,750 | 708,245 | 1,532,697 | 253,451 | 3,069,692 | 1.2 | 3,683,630 | 3,000 | 0 | 0 | 3000 | 1.2 | 3,600 |

NOTES:

1. Obtained from the Room Load Information Sheets in Appendix A
2. Determined using the Cooling and Heating Load Calculation Methodology on a room-by-room basis, outlined in Section 6.1.3. "All" means that the load is constant, room has no exterior exposure
3. Not Used
4. Not Used
5. Not Used
6. Roof loads come from Table F-1 in Appendix F
7. Wall loads come from Table F-2 in Appendix F
8. The sum of all of the partition loads from Appendix A information and Equation C-5 in Appendix C
9. There are no heat loads thru the floors
10. People loads (sensible and latent) are calculated using Equations C-7 and C-8 from Appendix C, where input values come from the Room Load Information Sheets in Appendix A
11. Lighting loads are calculated using EquationC-6 from Appendix C, where input values from the Room Load Information Sheets in Appendix A are multiplied by 3.413 to convert from Watts to Btu/h
12. Equipment loads are calculated using Equations C-9, C-10 and C-11 from Appendix C, where input values come from the Room Load Information Sheets in Appendix A
13. Infiltration loads come from Table H-1 in Appendix H
14. Summation of roof, walls, partitions, ceiling, floor, people, lighting equipment, and infiltration/cascade sensible loads
15. Factor of safety is assumed to be 20% (Assumption 3.1.3)
16. Total room sensible load with safety factor
17. Summation of people, equipment and infiltration latent loads
18. Total room latent load with safety factor

### 6.1.4 Room-by-Room Heating Load Calculation

The room-by-room heating loads are calculated using the equations presented in Appendix C. As stated in Section 4.3 the heating loads are calculated using the method presented in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3). Heating load due to conduction through the floors is calculated using the perimeter heat loss factor equation. Room information is taken from the Room Load Information Sheets presented in Appendix A.

Partition loads are handled in a simplified and conservative manner in this calculation. Partition loads due to wall partitions and ceiling partitions are considered only when there is a heat loss from the room or space. Heat gain is not considered for the spaces on the side of the partition that may experience it. This method was chosen in this calculation to make the hand calculations simpler yet conservative by not having to track down every heat gain or loss from the multiple partitions and temperature differences that could be experienced by any single room. If all partition and ceiling gains and losses were accounted for, then this total would be equal to zero.

A summary of the components of the heating load and the Total Room Heat Load for each space is presented in Table 4. For conservatism, a 20% factor of safety has been added to the room heat loads to account for any unknowns at this stage of the design.

Table 4. Heating Load Summary

| | | HEATING LOAD, Btu/h | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Room No.** Note 1 | **Room Name** Note 1 | **Roof** Note 2 | **Wall** Note 2 | **Partition** Note 2 | **Floor** Note 3 | **Infil-tration** Note 4 | **Room Heat Load** Note 5 | **Factor of Safety** Note 6 | **Room Total Heat Load** Note 7 |
| AHU-B (AHU-00001, 2 & 3) | | | | | | | | | |
| 1002 | Lid Bolting Room | 2,517 | 24,805 | 0 | 1,287 | 38,952 | 67,560 | 1.2 | 81,072 |
| 1003A | Corridor | 0 | 1,173 | 0 | 269 | 24,398 | 25,840 | 1.2 | 31,008 |
| 1003B | Corridor | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1003C | Corridor | 0 | 992 | 0 | 239 | 16,694 | 17,925 | 1.2 | 21,510 |
| 1003D | Corridor | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1004 | HVAC Room (ITS HEPA Exhaust Train A) | 0 | 9,561 | 0 | 0 | 1,284 | 10,845 | 1.2 | 13,014 |
| 1004A | HVAC Room (ITS HEPA Exh for Battery Room Train A) | 0 | 6,314 | 0 | 1,497 | 2,996 | 10,807 | 1.2 | 12,968 |
| 1212 to 1224 | Support Areas [Excluding Room 1221] | 0 | 16,368 | 16,855 | 1,542 | 63,642 | 98,407 | 1.2 | 118089 |
| 1221 and 1205 | Support Areas | 2,090 | 0 | 0 | 0 | 0 | 2,090 | 1.2 | 2,508 |
| 2001 | Operations/Maintenance Storage Room | 2,275 | 24,534 | 0 | 0 | 6,421 | 33,230 | 1.2 | 39,876 |
| 2002A | Corridor | 0 | 1,173 | 0 | 0 | 14,553 | 15,726 | 1.2 | 18,871 |
| 2002B | Corridor | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002C | Corridor | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002D | Corridor | 0 | 1,297 | 0 | 0 | 85,608 | 86,905 | 1.2 | 104,286 |
| 2003 | HVAC Room North (Process Area Supply) | 6,152 | 15,875 | 0 | 0 | 6,421 | 28,447 | 1.2 | 34,137 |
| 2004 | HVAC Room North (Process Area Supply) | 4,029 | 11,275 | 0 | 0 | 4,708 | 20,013 | 1.2 | 24,015 |
| 2005 | Instrument and Electrical Shop | 5,453 | 33,645 | 0 | 0 | 10,273 | 49,370 | 1.2 | 59,244 |
| | | | | | | | | | |
| 2007 | Canister Transfer Room | 9,876 | 106,707 | 0 | 0 | 4,280 | 120,863 | 1.2 | 145,035 |
| 2012 | Receiver/Dryer Equipment Room | 5,453 | 33,915 | 0 | 0 | 10,273 | 49,641 | 1.2 | 59,569 |
| | | | | | | | **Sub-system Total** | | **755,241** |
| AHU-C (AHU-00004 & 5) | | | | | | | | | |
| 1003E | Corridor | 0 | 695 | 0 | 329 | 0 | 1,024 | 1.2 | 1,229 |
| 1003F | Corridor | 0 | 1,173 | 0 | 269 | 14,125 | 15,567 | 1.2 | 18,681 |
| 1003G | Corridor | 0 | 902 | 0 | 0 | 25,254 | 26,156 | 1.2 | 31,388 |
| 1003H | Utility Chase | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1012 | LLW Staging Room | 0 | 33,837 | 0 | 2,604 | 18,406 | 54,847 | 1.2 | 65,816 |
| 1014 | Maintenance Room | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1016 | CTM Maintenance Room | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1018 | Electrical Room (Normal Power) | 0 | 22,460 | 0 | 1,347 | 2,568 | 26,375 | 1.2 | 31,650 |
| 1018A | Battery Room (Normal Power) | 0 | 8,996 | 0 | 2,244 | 6,087 | 17,326 | 1.2 | 20,792 |
| 1019 | HVAC Room (ITS HEPA Exhaust Train B) | 0 | 9,561 | 0 | 0 | 1,284 | 10,845 | 1.2 | 1,3014 |
| 1019A | HVAC Room (ITS HEPA Exhaust for Battery Room Train B) | 0 | 6,314 | 0 | 1,497 | 2,996 | 10,807 | 1.2 | 12,968 |

| | | HEATING LOAD, Btu/h | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Room No.** Note 1 | **Room Name** Note 1 | **Roof** Note 2 | **Wall** Note 2 | **Partition** Note 2 | **Floor** Note 3 | **Infil-tration** Note 4 | **Room Heat Load** Note 5 | **Factor of Safety** Note 6 | **Room Total Heat Load** Note 7 |
| 1026 | Stair #4 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1028 | Freight Elevator | 693 | 10,841 | 0 | 0 | 0 | 11,534 | 1.2 | 13,841 |
| 1029 | Elevator Lobby | 0 | 3,428 | 0 | 688 | 75,763 | 79,880 | 1.2 | 95,856 |
| 2002E | Corridor | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2002F | Corridor | 0 | 1,173 | 0 | 0 | 14,553 | 15,726 | 1.2 | 18,871 |
| 2002G | Corridor | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2006 | HVAC Room (HEPA Exh for Support, Decon & LLW Area) | 4,042 | 48,401 | 0 | 0 | 21,830 | 74,272 | 1.2 | 89,127 |
| 2009 | HVAC Room South (Process Area Supply) | 4,436 | 29,676 | 0 | 0 | 8,133 | 42,244 | 1.2 | 50,693 |
| 2010 | HVAC Room South (Process Area Supply) | 6,152 | 15,875 | 0 | 0 | 6,421 | 28,447 | 1.2 | 34,137 |
| 2011 | HVAC Room South (Process Area Supply) | 4,029 | 11,275 | 0 | 0 | 4,708 | 20,013 | 1.2 | 24,015 |
| 2026 | Stair #4 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 2029 | Elevator Lobby | 0 | 6,255 | 0 | 0 | 50,081 | 56,335 | 1.2 | 67,602 |
| 3001 | Corridor | 746 | 2,270 | 0 | 0 | 8,989 | 12,005 | 1.2 | 14,406 |
| 3026 | Stair #4 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 3029 | Elevator Lobby | 0 | 4,262 | 0 | 0 | 47,512 | 51,775 | 1.2 | 62,130 |
| R001 | Firefight Elevator Machine Room | 2,505 | 8,061 | 0 | 0 | 0 | 10,567 | 1.2 | 12,680 |
| R026 | Firefight Elevator Machine Stair | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| | | | | | | | **Sub-system Total** | | **678,896** |
| AHU-D (AHU-00006 & 7) | | | | | | | | | |
| 1013 | Loading Room | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1015 | Cask Unloading Room | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 0 |
| 1017 | Cask Preparation Room | 8,554 | 21,197 | 0 | 0 | 49,653 | 79,403 | 1.2 | 95,284 |
| 1017A | Cask Preparation Annex | 0 | 6,043 | 0 | 629 | 0 | 6,672 | 1.2 | 8,006 |
| | | | | | | | Sub-system Total | | 103,290 |
| | **Totals (Note 8)** | **60,448** | **513,089** | **16,855** | **13,812** | **599,213** | **1,203,414** | | **1,547,388** |

NOTES:

1. From information and data contained in Room Load Information Sheets in Appendix A. See the Room Load Information Sheets for any additional remarks about loads per room.
2. From Equation C-12 in Appendix C and specific values from Room Load Information Sheets in Appendix A.
3. From Equation C-13 and C-14 in Appendix C and data from Room Load Information Sheets in Appendix A.
4. From Equation C-15 in Appendix C and data from Room Load Information Sheets in Appendix A.
5. Sum of Roof, Wall, Partition, Floor, and Infiltration loads.
6. Factor of safety to account for unknowns.
7. Total of Room Heat Load multiplied by factor of safety.
8. Totals are given for informational purposes in order to get an indication of the overall loads in RF. They are not necessarily meant to indicate the heating load for any single HVAC subsystem.

## 6.2 SUBSYSTEM AIRFLOW RATES

### 6.2.1 Space Airflow Rates

To calculate the airflow rates required by each room the Total Sensible Heat Equation (Equation D-14, Appendix D) is rearranged to solve for CFM.

$$CFM = \frac{Q_s}{60 \cdot d \cdot (0.24 + 0.444W) \cdot (T_L - T_E)} \qquad \text{(Eq. 2)}$$

where

$CFM$ = airflow rate, cu. ft./min
$Q_s$ = sensible heat gain, Btu/h
$d$ = density of incoming air, lb/cu. ft. @ $T_E$
$W$ = humidity ratio, lb water vapor/lb dry air
$T_L$ = dry bulb temperature of leaving air, °F
$T_E$ = dry bulb temperature of entering air, °F
60 = minutes per hour
0.24 = specific heat of dry air, Btu/lb °F
0.444 = specific heat of water vapor, Btu/lb °F.

For each room, the sensible heat gain, $Q_s$, is taken from the Total Room Peak Sensible value presented in Table 3. The density of air at 3,310 feet elevation can be calculated using the psychometric equations presented in Appendix D. For all rooms served directly by air-handling units, the entering air to the room is equal to the leaving coil temperature because the air-handling units are assumed to be configured with a blow-thru fan arrangement (Assumption 3.2.9). The room entering air temperature, $T_E$, is assumed at 51°F dry bulb and a corresponding wet bulb temperature shown in Appendix G based on the leaving cooling coil conditions (Assumption 3.1.5). The density of the entering air is equal to 0.068 lb/cu. ft. The humidity ratio of the incoming air is determined at the same conditions in lb water vapor/lb dry air shown in Appendix G. The quantity 0.444W equals 0.0029 and is treated as negligible. The leaving air temperature for each room is taken as the room design temperature for each particular room as indicated in the Room Load Information Sheets in Appendix A.

The rooms being cooled with cascaded air from adjacent rooms is dependent upon the temperature of the adjacent room from where the air comes. The values used in calculating the airflow rates and the results of the calculation are given in Table 5. Adjusted room sensible loads based on the rounded airflow rates are presented in Table 5. They represent the sensible cooling load capability of the airflow values selected for use in each room.

Subsystem designations are added in Table 5 to identify anticipated zoning of rooms with respective air-handling units. This allows a determination of total airflow requirements for subsystems as presented in Section 6.2.2.

Table 5. Space Airflow Rates

| Input Data | | | | Cascade Airflow In | | | | | | Supply Air Flow | | | Cascade Airflow Out | | | Infiltration | Return Air | Exhaust Air | Exhaust Sub-system Note 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room No. Note 1 | Room Name Note 1 | Design Room Temp $T_L$ °F Note 5 | Room Total Peak Sensible Btu/h Note 2 | Airflow cfm Note 11 | Density of Entering Air, $\rho$ lb/ft³ Note 3 | Constant 60 x $\rho$ x 0.24 Note 4 | $T_E$ °F Note 6 | Sensible Load Btu/h Note 13 | From Note 12 | Required Airflow cfm Note 7 | Use Airflow cfm Note 8 | Adjusted Room Sensible Load Btu/h Note 9 | Airflow cfm Note 11 | $T_L$ °F Note 5 | To Note 14 | Outside Air Infiltration @102°F cfm Note 1 | Airflow cfm Note 15 | Airflow cfm Note 16 | |
| AHU-B (AHU-00001, 2 & 3) Note 10 | | | | | | | | | | | | | | | | | | | |
| 1002 | Lid Bolting Room | 90 | 204,838 | 540 | | | 102 | Note 26 | Note 19 | 5,364 | 5,370 | 205,074 | 910 | 90 | Rm 1013 | 370 | 0 | 5,370 | EXH-D |
| 1003A | Corridor | 82 | 26,111 | 0 | - | - | - | 0 | - | 860 | 870 | 26,409 | 0 | - | - | 570 | Note 18 | Note 18 | |
| 1003B | Corridor | 82 | 19,370 | 0 | - | - | - | 0 | - | 638 | 640 | 19,427 | 770 | 82 | Rm 1005 | 0 | Note 18 | Note 18 | |
| 1003C | Corridor | 82 | 16,919 | 0 | - | - | - | 0 | - | 557 | 560 | 16,999 | 200 | 82 | Rm 1017 & 1017A | 390 | Note 18 | Note 18 | |
| 1003D | Corridor | 82 | 23,766 | 0 | - | - | - | 0 | - | 783 | 790 | 23,981 | 200 | 82 | Rm 1014 | 0 | Note 18 | Note 18 | |
| Corridor Totals | | | | 0 | | | | 0 | | | 2,860 | 86,816 | 1,170 | | | 960 | 2,650 | 0 | |
| 1004 | HVAC Room (ITS HEPA Exhaust Train A) | 90 | 122,437 | 800 | 0.064 | 0.922 | 82 | -5,898 | Rm 2002A, B, C & D | 3,052 | 3,060 | 116,858 | 0 | - | - | 30 | 0 | 3,890 | EXH-D |
| 1004A | HVAC Room (ITS HEPA Exhaust for Battery Room Train A) | 90 | 21,128 | 200 | 0.064 | 0.922 | 82 | -1,475 | Rm 2002A, B, C & D | 515 | 520 | 19,859 | 0 | - | - | 70 | 0 | 790 | To ITS Train A Battery Room Exhaust |
| 1212 to 1224 | C2 Support Areas, Excluding 1221 (Assumption 3.1.20) | 75 | 152,082 | 1,270 Note 20 | | | 102 | Note 26 | Rms 1203 & 1021A/B | 6471 | 6480 | 152285 | 0 | - | - | | 6350 | 1,400 | EXH-D |
| 1221 &1205 | C2 Support Areas | 75 | 15,758 | 0 | - | - | - | 0 | - | 671 | 680 | 15981 | 0 | - | - | 0 | 580 | 100 | EXH-D |
| 2001 | Operations/Maint. Storage Room | 90 | 28,926 | 0 | - | - | - | 0 | - | 757 | 760 | 29,023 | 0 | - | - | 150 | 910 | 0 | |
| 2002A | Corridor | 82 | 23,621 | 0 | - | - | - | 0 | - | 778 | 780 | 23,677 | 0 | - | - | 340 | Note 18 | Note 18 | |
| 2002B | Corridor | 82 | 30,268 | 0 | - | - | - | 0 | - | 997 | 1,000 | 30,355 | 0 | - | - | 0 | Note 18 | Note 18 | |
| 2002C | Corridor | 82 | 4,081 | 0 | - | - | - | 0 | - | 134 | 140 | 4,250 | 0 | - | - | 0 | Note 18 | Note 18 | |
| 2002D | Corridor | 82 | 60,414 | 390 | 0.063 | 0.907 | 90 | 2,830 | Rm 2005 | 2,083 | 2,090 | 63,442 | 1,000 | 82 | Rm1004 &1004A | 2,000 | Note 18 | Note 18 | |
| Corridor Totals | | | | 390 | | | | 2,830 | | | 4,010 | 121,704 | 1,000 | | | 2,340 | 5,740 | 0 | |
| 2003 | HVAC Room North (Process Area Supply) | 90 | 70,616 | 0 | - | - | - | 0 | - | 1,850 | 1,860 | 71,031 | 0 | - | - | 150 | 1,860 | 150 | EXH-D |
| 2004 | HVAC Room North (Process Area Supply) | 90 | 44,452 | 0 | - | - | - | 0 | - | 1,164 | 1,170 | 44,681 | 0 | - | - | 110 | 1,170 | 110 | EXH-D |
| 2005 | Instrument and Electrical Shop | 90 | 57,071 | 0 | - | - | - | 0 | - | 1,494 | 1,500 | 57,283 | 390 | 90 | Rm 2002 A, B, C & D | 240 | 1350 | 0 | |

| Input Data | | | | Cascade Airflow In | | | | | | Supply Air Flow | | | Cascade Airflow Out | | | Infiltration | Return Air | Exhaust Air | Exhaust Sub-system Note 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room No. Note 1 | Room Name Note 1 | Design Room Temp $T_L$ °F Note 5 | Room Total Peak Sensible Btu/h Note 2 | Airflow cfm Note 11 | Density of Entering Air, $\rho$ lb/ft$^3$ Note 3 | Constant 60 x $\rho$ x 0.24 Note 4 | $T_E$ °F Note 6 | Sensible Load Btu/h Note 13 | From Note 12 | Required Airflow cfm Note 7 | Use Airflow cfm Note 8 | Adjusted Room Sensible Load Btu/h Note 9 | Airflow cfm Note 11 | $T_L$ °F Note 5 | To Note 14 | Outside Air Infiltration @102°F cfm Note 1 | Airflow cfm Note 15 | Airflow cfm Note 16 | |
| 2007 | Canister Transfer Room | 79 | 541,900 | 400 | 0.064 | 0.922 | 82 | 1,106 | Rm 1028A, 1029, 2029, 3029 & 3001 | 19,805 | 19,810 | 543,142 | 1,300 | 79 | Rm 1013 | 100 | 17,710 | | |
| | | | | | | | | | | | | | 1,300 | 79 | Rm 1015 | | | | |
| | Canister Transfer Room Total | | | 400 | | | | 1,106 | | 19,805 | 19,810 | 543,142 | 2,600 | 79 | | 100 | 17,710 | 0 | |
| 2012 | Receiver /Dryer Equipment Room | 90 | 206,878 | 0 | - | - | - | - | - | 5,417 | 5.420 | 206,983 | 0 | - | - | 240 | 0 | 5,660 | EXH-D |
| | Sub-system Totals | | | 3,600 | | | | -3,437 | | Total | 53,500 | 1,670,090 | 6070 | | | 4,760 | 38,320 | | |
| AHU-C (AHU-00004 & 5) NOTE 10 | | | | | | | | | | | | | | | | | | | |
| 1012 | LLW Staging Room | 90 | 46,261 | 450 Note 22 | 0.063 | 0.907 | 90 | 0 | Rm 1014 | 1,211 | 1,220 | 46,590 | | | | 180 | 0 | 1,850 | EXH-D |
| 1014 | Maintenance Room | 79 | 59,903 | 200 | 0.064 | 0.922 | 82 | 553 | Rm 1003A thru D | 2,205 | 2,210 | 60,593 | 200 | 90 | Rm 1012 | 0 | 0 | 2,210 | EXH-D |
| 1016 | CTM Maintenance Room | 90 | 16,544 | 0 | - | - | - | - | - | 433 | 440 | 16,803 | 440 | 90 | Rm 1017 | 0 | 0 | 0 | |
| 1018 | Electrical Room (Normal Power) | 90 | 185,003 | 0 | - | - | - | - | - | 4,844 | 4,850 | 185,215 | 60 | 90 | Rm 1018A | 60 | 4,850 | | |
| 1018A | Battery Room (Normal Power) | 77 | 21,157 | 60 | 0.063 | 0.907 | 90 | 708 | Rm 1018 | 859 | 860 | 21,895 | | | | 110 | | 1,030 | To ITS Train B Battery Room Exhaust |
| 1003E | Corridor | 82 | 31,574 | - | - | - | - | - | - | 1,040 | 1,050 | 31,873 | 770 | 82 | Rm 1020 | 0 | Note 18 | Note 18 | |
| 1003F | Corridor | 82 | 20,780 | - | - | - | - | - | - | 685 | 690 | 20,945 | | | | 330 | Note 18 | Note 18 | |
| 1003G | Corridor | 82 | 24,680 | - | - | - | - | - | - | 813 | 820 | 24,891 | | | | 590 | Note 18 | Note 18 | |
| 1003H | Utility Chase | 90 | 16,625 | - | - | - | - | - | - | 435 | 440 | 16,803 | | | | 0 | Note 18 | Note 18 | |
| 2002E | Corridor | 82 | 35250 | - | - | - | - | - | - | 1,160 | 1,160 | 35,250 | | | | 0 | Note 18 | Note 18 | |
| 2002F | Corridor | 82 | 23,621 | 50 Note 21 | | | 102 | Note 26 | Rm 2008 | 778 | 780 | 23,677 | | | | 290 | Note 18 | Note 18 | |
| 2002G | Corridor | 82 | 4,081 | - | - | - | - | - | - | 134 | 140 | 4,250 | | | | 0 | Note 18 | Note 18 | |
| Sub-total of Rms 2003E, F, & G | | 82 | | 3,860 | 0.064 | 0.922 | 82 | 0 | Rm 1029, 2029 & 3029 | | | | 1,000 Note 25 | 82 | | | Note 18 | Note 18 | |
| | Corridor Total | | | 3,910 | | | | 0 | | | 5,000 | 155,223 | 1,770 | | | 1,210 | 8,430 | 0 | |
| 2006 | HVAC Room (HEPA Exhaust for Support, Decon and LLW areas | 90 | 111,224 | 0 | - | - | - | - | - | 2,912 | 2,920 | 111,511 | 0 | - | - | 510 | 0 | 3,430 | EXH-D |

| Input Data | | | | Cascade Airflow In | | | | | | Supply Air Flow | | | Cascade Airflow Out | | | Infiltration | Return Air | Exhaust Air | Exhaust Sub-system Note 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room No. Note 1 | Room Name Note 1 | Design Room Temp $T_L$ °F Note 5 | Room Total Peak Sensible Btu/h Note 2 | Airflow cfm Note 11 | Density of Entering Air, $\rho$ lb/ft$^3$ Note 3 | Constant 60 x $\rho$ x 0.24 Note 4 | $T_E$ °F Note 6 | Sensible Load Btu/h Note 13 | From Note 12 | Required Airflow cfm Note 7 | Use Airflow cfm Note 8 | Adjusted Room Sensible Load Btu/h Note 9 | Airflow cfm Note 11 | $T_L$ °F Note 5 | To Note 14 | Outside Air Infiltration @102°F cfm Note 1 | Airflow cfm Note 15 | Airflow cfm Note 16 | |
| 2009 | HVAC Room South (Process Area Supply) | 90 | 59,092 | 0 | - | - | - | - | - | 1,547 | 1,550 | 59,193 | 0 | - | - | 190 | 1,590 | 150 | EXH-D |
| 2010 | HVAC Room South (Process Area Supply) | 90 | 70,099 | 0 | - | - | - | - | - | 1,836 | 1,840 | 70,267 | 0 | - | - | 150 | 1,840 | 150 | EXH-D |
| 2011 | HVAC Room South (Process Area Supply) | 90 | 44,832 | 0 | - | - | - | - | - | 1,174 | 1,180 | 45,063 | 0 | - | - | 110 | 1,140 | 150 | EXH-D |
| 1028 | Freight Elevator | 90 | 16,909 | 0 | - | - | - | - | - | 443 | 450 | 17,185 | 0 | - | | 0 | 450 | 0 | |
| 1029 | Elevator Lobby | 82 | 50,873 | 0 | - | - | - | - | - | 1,676 | 1,680 | 50,997 | 1,770 | - | Rms 1003E, F & G | 1,770 | 1,680 | 0 | |
| 2029 | Elevator Lobby | 82 | 43,134 | 0 | - | - | - | - | - | 1,421 | 1,430 | 25,516 | 1,170 | - | Rms 2003E, F & G | 1,170 | 1,430 | 0 | |
| 3029 | Elevator Lobby | 82 | 36,869 | 0 | - | - | - | - | - | 1,215 | 1,220 | 37,033 | 920 | 82 | Rm 2003E, F & G | 1,110 | 1,410 | 0 | |
| 3001 | Corridor | 82 | 13,201 | 0 | - | - | - | - | - | 435 | 440 | 13,356 | 400 | 82 | Rm 2007 | 210 | 250 | 0 | |
| 1019 | HVAC Room (ITS HEPA Exhaust Train B) | 90 | 121,858 | 800 | 0.063 | 0.907 | 82 | -5,804 | Rm 1003E, F,G & 2002E, F & G | 3,038 | 3,100 Note 24 | 118,385 | 0 | - | - | 30 | 0 | 3930 | EXH-D |
| 1019A | HVAC Room (ITS HEPA Exhaust for Battery Room Train B) | 90 | 24,156 | 200 | 0.063 | 0.907 | 82 | -1,451 | Rm 1003E, F,G & 2002E, F & G | 594 | 610 Note 24 | 23,295 | 0 | - | - | 70 | 0 | 880 | To ITS Train B Battery Room Exhaust |
| R0001 | Freight Elevator Machine Room | 90 | 26,132 | 0 | - | - | - | - | - | 684 | 690 | 26,350 | 0 | - | - | 0 | 0 | 690 | EXH-D |
| | Sub-system Totals | | | 5,620 | | | | -8,022 | | Total | 31,770 | 1,094,970 | 7,330 | | | 7,180 | 23,070 | 29,240 | TOTAL EXH-D |
| AHU-D (AHU-00006 & 7) Note 10 | | | | | | | | | | | | | | | | | | | |
| 1013 | Loading Room | 100 | 174,274 | 1,300 | 0.065 | 0.936 | 79 | -25,553 | Rm 2007 | 3,100 | 3,100 | 148,740 | | | | | | | |
| | | 100 | | 910 | 0.063 | 0.907 | 90 | -8,256 | Rm 1002 | -172 | -180 | -8,637 | | | | | | | |
| | Loading Room Total | | | 2,210 | | | | -33,809 | | | 2,920 | 140,103 | 0 | | | 0 | 0 | 5,130 | EXH-E |
| 1015 | Cask Unloading Room | 100 | 118,494 | 1,300 | 0.065 | 0.936 | 79 | -25553 | Rm 2007 | 1,937 | 1,940 | 93,083 | 0 | - | - | 0 | 0 | 3,240 | EXH-E |
| 1017 | Cask Preparation Room | 79 | 605,633 | 800 | | | 102 | Note 26 | Rm 1021 Note 23 | 22,089 | 22,090 | 605,654 | 0 | - | - | 360 | 0 | 23,190 | EXH-E |

| Input Data | | | | Cascade Airflow In | | | | | | Supply Air Flow | | | Cascade Airflow Out | | | Infiltration | Return Air | Exhaust Air | Exhaust Sub-system Note 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room No. Note 1 | Room Name Note 1 | Design Room Temp $T_L$ °F Note 5 | Room Total Peak Sensible Btu/h Note 2 | Airflow cfm Note 11 | Density of Entering Air, $\rho$ lb/ft$^3$ Note 3 | Constant 60 x $\rho$ x 0.24 Note 4 | $T_E$ °F Note 6 | Sensible Load Btu/h Note 13 | From Note 12 | Required Airflow cfm Note 7 | Use Airflow cfm Note 8 | Adjusted Room Sensible Load Btu/h Note 9 | Airflow cfm Note 11 | $T_L$ °F Note 5 | To Note 14 | Outside Air Infiltration @102°F cfm Note 1 | Airflow cfm Note 15 | Airflow cfm Note 16 | |
| 1017A | Cask Preparation Annex | 79 | 34,499 | 200 | 0.064 | 0.922 | 82 | 553 | Rm 1003A, B, C & D | 1,278 | 1,280 | 35,095 | 0 | - | - | 0 | 0 | 1,540 | |
| | | | | 440 | 0.063 | 0.907 | 90 | 4,390 | Rm 1016 | 160 | 160 | 4,386 | 0 | - | - | 0 | 0 | 600 | |
| Cask Preparation Annex Total | | | - | 640 | | | | 4,943 | | | 1,440 | 39,481 | 0 | - | - | 0 | 0 | 2,140 | EXH-E |
| Sub-system Totals | | | | 4,950 | | | | -54,419 | | | 28,390 | 878,321 | 0 | | | 360 | 0 | 33,700 | TOTAL EXH-E |

NOTES:

1. From the Room Load Information Sheets in Appendix A.
2. From Table 3, Cooling Load Summary.
3. Density of the entering cascade air. Refer to Appendix D for the appropriate equations to calculate air density.
4. Constant based on the density of cascade air entering the room. Refer to Equation 2 in Section 6.2.1.
5. Temperature of Return Air leaving the room (dry bulb). This is the same as the design room temperature (dry bulb), which comes from the Room Load Information Sheets in Appendix A.
6. Temperature of Cascade Air entering the room. For conservatism of cooling load calculation, air cascaded from C1 areas used as outdoor air temperature instead of actual room temperature.
7. From Equation 2, using the "Room Total Peak Sensible" column, an entering air temperature 51°F, a density of air at 51°F, and accounting for the cascade load.
8. Airflow rates rounded up to the nearest 10 cfm.
9. Adjusted room sensible load comes from using the rounded airflow rates in Equation 2.
10. The supply (AHU) or exhaust (EXH) Sub-system serving the listed room.
11. Cascade air to balance room airflow and for proper airflow direction, see Assumption 3.1.10.
12. Room the cascaded air is coming from.
13. From Equation 2.
14. Room the cascaded air is going to.
15. Amount of air returned to the AHU.
16. Amount of air exhausted to the atmosphere.
17. These values are calculated using the mixed air equations in Appendix D.
18. Connected corridors can be considered as one space for exhaust and return airflow rates.
19. 540 cfm is cascaded from C1 Room 1001.
20. Value consists of 870 cfm cascaded from C1 Room 1021A/B and 400 cfm cascaded from C1 Room 1203.
21. 50 cfm is cascaded from C1 Room 2008.
22. Value includes 250 cfm cascaded from C1 Room 1011. (250 cfm is part of 430 cfm total infiltration to Room 1012).
23. 800 cfm is cascaded from C1 Room 1021. (800 cfm is part of 1160 cfm total infiltration to Room 1017).
24. For conservatism, the airflow rate value is retained from previous revision.
25. 800 cfm to Room 1019 and 200 cfm from Room 1019A.
26. The cascaded airflow loads is already accounted for in the room total peak sensible load.

### 6.2.2 Subsystem Airflow Rate

The total airflow rate for each Air Handling Unit in this calculation is determined by summing the peak room airflow rates in Table 5 for all the rooms that will be served by a system. The total airflow rates calculated in Table 5 for each expected subsystem as shown below in Table 6.

Table 6. Subsystem Airflow Rates

| Subsystem No. | Area Served | Total Airflow Rate (cfm) Note 1 |
|---|---|---|
| AHU-B (AHU-00001, 2 & 3) | 1st and 2nd Floor North Areas | 53,500 |
| AHU-C (AHU-00004 & 5) | 1st and 2nd Floor South Areas | 31,770 |
| AHU-D (AHU-00006 & 7) | Loading and Unloading rooms, Cask Preparation room and Annex | 28,390 |

NOTE:

1. From summation of all rooms assigned to a subsystem number in Table 5.

### 6.2.3 Required Outdoor Air Ventilation Rate

The required outdoor air ventilation rate is calculated after analyzing the system exhaust rates, and the minimum required outdoor air rates. It is assumed in Assumption 3.1.19 that the *ASHRAE Standard 62.1-2004* (Reference 2.2.2) required outdoor air rate are satisfied with the amount of infiltration and exhaust make-up coming into the rooms and zones of the building. The exhaust rates for the rooms requiring exhaust are presented in Table 5.

The total infiltration air in this calculation (excluding the non-confinement areas) is 14,910 CFM, shown in Appendix H.

The ventilation air for Subsystem AHU-B serving the Northside ground and second level of the RF facility including C2 support areas is 15,180 cfm (supply airflow minus return airflow) as presented in Table 5.

The ventilation air for Subsystem AHU-C serving the Southside ground and second level of the RF facility is 8,700 cfm (supply airflow minus return airflow) as presented in Table 5.

The ventilation air for Subsystem AHU-D is 28,390 cfm. This subsystem is 100% makeup air supply to Rooms 1013, 1015, 1017, and 1017A which are exhausted 100% directly to atmosphere.

Exhaust for Battery Room 1018A is based on Chapter 25 of *2007 ASHRAE Applications* (Reference 2.2.8) where it states that "the recommended $H_2$ concentration in the battery room is 2% or less of room volume. When no battery design information is available, a general ventilation requirement exhaust rate of 2 to 4 air changes per hour (ACH) may be adequate for preventing the hydrogen concentration in the battery room from reaching the explosive limits". However, from p. 26.8 of ASHRAE HVAC Applications – 2003 the minimum number of air changes per hour is five.

For conservatism of this calculation 5 ACH will be used to calculate for the ventilation air requirement for the battery room to prevent the hydrogen concentration in battery room from reaching explosive limit. The battery room ventilation required for hydrogen concentration dilution will be:

$$Q_{VENT} = \frac{Volume \times ACH}{60}$$

where

$Q_{VENT}$ = required ventilation airflow rate, CFM

Volume = 7,700 ft$^3$ (volume of the battery room, obtained from area and height shown on Appendix A)

ACH = 5 air changes per hour required to prevent the hydrogen concentration in the battery room from reaching the explosive limits.

60 = conversion for 60 minutes per hour

$$Q_{VENT} = \frac{7{,}700 \times 5}{60}$$

$$Q_{VENT} = 642 \text{ CFM}$$

The ventilation airflow to the battery room is exhausted to outdoors, this is consistent with sound and practical engineering practice that: (1) exhausting the ventilation air will avoid accumulation of combustible $H_2$ gas in the space and (2) maintaining the room at negative pressure will prevent the escape/migration of combustible gas into the adjacent rooms.

As indicated in Table 5, the required airflow rate due to calculated heat load and maintain the non-ITS Battery Room (1018A) at indoor design temperature of 77°F is = 860 CFM. The total exhaust airflow rate from the non-ITS Battery Room is 860 CFM + 110 CFM (outside air infiltration to Room 1018A, see Appendix H) + 60 CFM (cascading air into the room from adjoining electrical equipment room) = 1,030 CFM. This value is greater than the required exhaust of 642 CFM.

## 6.3 COOLING AND HEATING COIL LOADS

### 6.3.1 Cooling Coil Load

The total cooling load is the load required by the chilled water coil. In this calculation, it is determined by calculating the load required to cool the return/mixed air or 100% outside air down to the leaving coil conditions. The conditions of the return air are required to determine the cooling load. This is accomplished by tracking the conditions of the air as it leaves the cooling coil and makes its way back to the air handling unit. The dry bulb temperature of the air leaving the cooling coil is assumed to be 51°F (Assumption 3.1.5) and the wet bulb temperature is as shown in Appendix G for each corresponding air handling unit. The properties of the air leaving the coil are also presented in Appendix G.

Thermodynamic properties of moist air for each system were determined using psychrometric equations presented in Appendix D. The process of cooling the air from entering the coil to leaving coil conditions (supply air) is constant sensible cooling load process, where dew point temperature and humidity ratio are constant as shown in Appendix G.

As the supply air passes through the supply fan, it gains 6°F of sensible heat per Assumption 3.1.6. The properties of the air leaving the supply fan are presented in Appendix G.

#### 6.3.1.1 Sub-Systems AHU-B and AHU-C

These air handling units are recirculating systems with a quantity of outside air mixed with return air. The cooling coil load is determined by using Equation D-16 in Appendix D. Air supply flow rates as determined on Table 5, density of air entering the coil, enthalpy of air entering the coil, and enthalpy of air leaving the coil are as shown in Appendix G. Summary of Sub-system cooling coil loads and airflow rates are shown in Table 7 below.

#### 6.3.1.2 Sub-system AHU-D

These air handling units are 100% outside air. In this calculation, Cooling coil capacity is determined by calculating the load required to cool the 100% outdoor air down to the leaving coil conditions to maintain the room indoor design conditions. The cooling coil load is determined by using equation 16 in Appendix D. Air flow rates as determined in Table 5, density of air entering the coil, enthalpy of air entering the coil, and enthalpy of air leaving the coil are as shown on Appendix G. Summary of Sub-system cooling coil loads and airflow rates are shown in Table 7 below.

Table 7. Subsystem Total Cooling Loads

| System No. | Total Airflow Rate cfm Note 1 | Air Density Note 2 | 60 min/hr Note 3 | $h_1$ Note 4 | $h_2$ Note 5 | Total Cooling Load Note 6 |
|---|---|---|---|---|---|---|
| AHU-B (AHU-00001, 2 & 3) | 53,500 | 0.063 | 60 | 29.33 | 19.23 | 2,042,523 |
| AHU-C (AHU-00004 & 5) | 31,770 | 0.063 | 60 | 30.15 | 19.23 | 1,311,389 |
| AHU-D (AHU-00006 & 7) | 28,390 | 0.061 | 60 | 33.08 | 19.23 | 1,439,117 |

NOTES:

1. From Table 6
2. Density of air entering the coil in pounds per cubic feet from Appendix G.
3. Minutes per hour conversion
4. Enthalpy of air entering the coil in Btu/lb from Appendix G.
5. Enthalpy of air leaving the coil in Btu/lb from Appendix G.
6. Total cooling load for each subsystem

### 6.3.2. Heating Coil Load

The Sub-system heating load (total of room by room) plus the outside ventilation air is the load required by the hot water coil. Ventilation load is determined by using equation C-15 and outside ventilation air cfm shown in Appendix G and based on winter outdoor and indoor air design conditions of 24°F and 65°F respectively. The density of outside air at 24°F dry bulb and 3,310 feet elevation is approximately 0.0725 lbs/cu.ft. The summary of the subsystem total heating load is shown in Table 8.

Table 8. Subsystem Total Heating Loads

| System No. | **Outside air cfm** Note 1 | **Air Density** Note 2 | **T1** Note 3 | **T2** Note 4 | **Ventilation Load Btu/h** Note 5 | **Room Heating Load Btu/h** Note 6 | **Total Heating Load Btu/h** Note 7 |
|---|---|---|---|---|---|---|---|
| AHU-B (AHU-00001, 2 & 3) | 15,180 | 0.0725 | 66.13 | 24 | 667,673 | 755,241 | 1,422,914 |
| AHU-C (AHU-00004 & 5) | 8,700 | 0.0725 | 65 | 24 | 372,394 | 678,896 | 1,051,290 |
| AHU-D (AHU-00006 & 7) | 28,390 | 0.0725 | 65 | 24 | 1,215,206 | 103,290 | 1,318,496 |

NOTES:

1. From Appendix G.
2. Density of air entering the coil in pounds per cubic feet
3. Winter rooms inside mixed air design condition per Appendix D, Equation D-13.
4. Winter outside air design condition.
5. Ventilation Load per Appendix C, Equation C-15
6. Total Room Heating Load for each subsystem from Table 4.
7. Total Heating Load is the sum of Room Load Heating Load and Ventilation Load.

# 7. RESULTS AND CONCLUSIONS

The room by room cooling and heating loads were calculated in Sections 6.1.3 and 6.1.4. The results are shown in Tables 4 and 5, respectively, and not repeated here.

The room-by-room and subsystem airflow rates were calculated in Table 5 and in Section 6.2.2. The subsystem airflow rates are summarized in Table 6.

The required outdoor air rates were calculated in Section 6.2.3. The infiltration air rates are shown in Appendix H and the ventilation air rates for each subsystem are shown in Appendix G.

The total cooling and heating loads for each subsystem were calculated in Section 6.3. The results are summarized in Table 9, below.

Table 9. Summary of Subsystem Airflow Rates, Cooling Loads, and Heating Loads

| **Subsystem** | **Supply Airflow Rate cfm** Note 1 | **Outdoor Air Rate cfm** Note 5 | **Total Sensible Cooling Load Btu/h** Note 2 | **Total Latent Cooling Load Btu/h** Note 2 | **Grand Total Cooling Load Btu/h** Note 3 | **Total Heating Load Btu/h** Note 4 |
|---|---|---|---|---|---|---|
| AHU-B (AHU-00001, 2 & 3) | 53,500 | 15,180 | 2,042,523 | 1,680 | 2,044,203 | 1,422,914 |
| AHU-C (AHU-00004 & 5) | 31,770 | 8,700 | 1,311,389 | 0 | 1,311,389 | 1,051,290 |
| AHU-D (AHU-00006 & 7) | 28,390 | 28,390 | 1,439,117 | 1,920 | 1,437,489 | 1,318,496 |
| **Grand Totals:** | | | | | **4,793,081** | **3,792,700** |
| **1 ton = 12,000 Btu/h** | | | | | **= 400 tons** | |

NOTES:

1. From Table 6
2. From Table 3
3. From Table 7
4. From Table 8
5. From Table G-1

The room by room exhaust flow rates were calculated and are shown in Table 5, respectively, and not repeated here. Table 10 contains the summary of airflow rates by exhaust subsystem.

Table 10. Summary Exhaust Airflow Rate

| Exhaust Sub-system | Area Served | Exhaust Airflow (cfm) |
|---|---|---|
| EXH-D (EXH-00001, 2 & 13) | See Table 5 for areas served | 29,240 |
| EXH-E (EXH-00005 & 6) | Loading Room 1013, Cask Unloading Room 1015, Cask Preparation Room 1017, and Cask Preparation Annex 1017A | 33,700 |
| ITS Train A Battery Room EXH (EXH-00009 & 10) | HVAC Room 1004A (ITS HEPA Exhaust for Battery Room Train A) | 1,670 Note 1 |
| ITS Train B Battery Room EXH (EXH-00011 & 12) | HVAC Room 1019A (ITS HEPA Exhaust for Battery Room Train B), and Battery Room 1018A (Normal Power) | 2,760 Note 2 |

NOTES:

Exhaust airflow will be combined with the ITS Train A Battery Room exhaust (Reference 2.4.6)

Exhaust airflow will be combined with the ITS Train B Battery Room exhaust (Reference 2.4.6)

All results are calculated using the best information available at the present stage of the design. The results of this calculation are reasonable for inputs. As the design progresses, all internal and external heat gains/losses will be re-evaluated.

## APPENDIX A: ROOM LOAD INFORMATION SHEETS AND U-VALUES

The following room load information sheets were assembled using a variety of references:

Room Number and Name: From the General Arrangement Drawings (Assumption 3.1.1).

Room Area: Floor area take-off is from the General Arrangement Drawings (Assumption 3.1.1), where distance is measured from center of wall to center of wall and the total area is rounded to the nearest 10 square feet.

Room Height: Room height is from the General Arrangement Drawings (Assumption 3.1.1), where room height is measured from top of floor to the top of floor above or top of roof/partition.

Room Design Temperature (Summer/Winter): Assigned using the information presented in Section 6.1.2.

Room Design Relative Humidity (Summer/Winter): No requirement, not controlled.

Ventilation Confinement Classification: Assumption 3.1.7.

Roof U-Value: See the end of this appendix for U-Value calculations.

Roof Area: Taken to be equal to room area. Note, that for corridors with a 14 ft ceiling height, and an interstitial space or chase with a roof above the ceiling, the roof area above the interstitial space or chase is added to the roof area for the adjacent room, in order to account for that external load.

Roof Color: Roof color is not known at the time of this calculation. Conservatively, a dark roof color is assumed in this calculation (Assumption 3.2.3).

Wall Height: From the General Arrangement Drawings (Assumption 3.1.1). All wall heights are measured from top of floor to the top of floor above or top of roof/partition.

Wall Width: From the General Arrangement Drawings (Assumption 3.1.1), where distance is measured from center of wall to center of wall.

Wall Orientation: Relative to the true north arrow on the General Arrangement Drawings (Assumption 3.1.1).

Wall U-Value: See the end of this appendix for U-Value calculations.

Wall Area: Product of Wall Height and Wall Width or as noted. Also, for conservatism, the areas of any vents, grilles, pipes, and all doors are included in the wall area. Note, that for corridors with a 14 ft ceiling height, external exposure, and an interstitial space or chase above the ceiling, the wall area for the interstitial space or chase is added to the wall area for the adjacent room, in order to account for that external load.

Wall Group: Wall group type is determined by comparing the wall types from the General Arrangement Drawings (Assumption 3.1.1) with the wall types presented in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, Table 3.9, p. 3.20).

Wall Color: Wall color is not known at the time of this calculation. Conservatively, a dark wall color is assumed in this calculation (Assumption 3.2.3).

Floor F-Value: Taken conservatively as F = 0.73 (Assumption 3.2.4).

Floor Perimeter: Taken from the General Arrangement Drawings (Assumption 3.1.1), where distance is measured from center of wall to center of wall.

Partition U-Value: See the end of this appendix for U-Value calculations. When a room has multiple partitions, the two highest U-Values are used to calculate the room partition load. Exceptions are as noted on the individual Room Load Information Sheet.

Partition Area: Partition lengths and heights are taken from the General Arrangement Drawings (Assumption 3.1.1). All partition heights are measured from top of floor to top of partition, for conservatism. Exceptions are as noted on any individual Room Load Information Sheet.

Partition Temperature Difference: Taken as the temperature difference between the design room temperatures of the spaces on each side of the partition.

Ceiling U-Value: See the end of this appendix for U-Value calculations. When a room has multiple ceiling partitions, the two highest U-Values are used to calculate the room ceiling partition load.

Ceiling Area: Ceiling area is taken from the General Arrangement Drawings (Assumption 3.1.1).

Ceiling Partition Temperature Difference: Taken as the temperature difference between the design room temperatures of the spaces on each side of the ceiling partition.

Large Interior and Exterior Door U-Value, Area, and Temperature Difference: The U-Value for all of these doors is 1.15 Btu/h-ft$^2$-°F and the areas are taken from RF Air Leakage Calculation (Assumption 3.1.12). Temperature difference is taken as the temperature difference between the design room or exterior temperatures of the spaces on each side of the door.

Light Type: The types of light fixtures are not known at this time. A two lamp fluorescent fixture is assumed and a ballast factor of 1.2 is used in rooms and corridors with a 14 ft ceiling height or lower. The lighting for all of the remaining spaces is assumed to be High Bay, Incandescent-type. (Assumption 3.1.2.)

Light Total Wattage: The light total wattage is not known at this time. A lighting density of 2 W/sq. ft is assumed in all rooms (Assumption 3.1.2), with 100% of all lighting load going to the space (Assumption 3.2.5). The Room Area value is used to determine the Lights Total Wattage for a room, even in instances where the area of the ceiling may be greater due to the presence of tunnel-type corridors and battery rooms with ceilings that do not go up to structure.

Light Ballast Factor: From Assumption 3.1.2 for Fluorescent lighting.

People Activity Type: Activity type is assigned by comparison of the type of space with the representative rates at which heat and moisture are given off by human beings in different states of activity, as presented in *ASHRAE Fundamentals* (Reference 2.2.4, Table 1, p. 30.4).

Number of People: Indicated on the Room Load Information Sheets of this appendix (Assumption 3.1.15).

People Q Sensible: Sensible heat gain is from *ASHRAE Fundamentals* (Reference 2.2.4, Table 1, p. 30.4).

People Q Latent: Latent heat gain is from *ASHRAE Fundamentals* (Reference 2.2.4, Table 1, p. 30.4).

Equipment: Equipment heat gain, sensible and latent, comes from Appendix E (Assumption 3.1.4).

Infiltration: Infiltration rates are based on the RF Air Leakage Calculation (Assumption 3.1.8).

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1002 Lid Bolting Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1980 | Rm. Height (ft) | 64 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 1980 | | | Roof Type 12, 1'-6" concrete |
| Wall | 64 | 43 | NW | 0.22 | 2750 | B | | Wall 1, 4' concrete |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 43 Feet |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT °F | Remarks |
|---|---|---|---|---|
| Partition (summer) | 0.2 | 1470 | 10 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| Large Interior Door (summer) | 1.15 | 560 | 10 | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 3960 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| Standing, Light work, Walking | 4 | 250 | 200 | See Assumption 3.1.15 |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 132,327 | 0 | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 910 | See Assumption 3.1.8. Infiltration airflow rate includes 540 cfm cascaded from C1 Room 1001. |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1003A Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 640 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 9 | NE | 0.22 | 130 | B | | Wall 1, 4' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 9 Feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT °F | Remarks |
|---|---|---|---|---|
| NE Partition (summer) | 0.2 | 990 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| SE Partition and Ceiling (summer) | 0.3 | 1620 | 8 | Partition 2, Gypsum Board |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1536 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 307 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 570 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1003B Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1030 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT °F | Remarks |
|---|---|---|---|---|
| NE Partition and Ceiling (summer) | 0.3 | 2270 | 8 | Partition 2, Gypsum Board |
| Partition (winter) | | | | No heat loss through partitions |
| SW Partition (summer) | 0.2 | 570 | 18 | Partition 1, 4' Concrete |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 2472 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 205 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1003C Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 620 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 8 | NE | 0.22 | 110 | B | | Wall 1, 4' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 8 Feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT °F | Remarks |
|---|---|---|---|---|
| Partition (summer) | 0.2 | 990 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling (summer/winter) | | | | No heat gain/loss through partition |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1488 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 390 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

| ROOM LOAD INFORMATION SHEET | | | | | | |
|---|---|---|---|---|---|---|
| **Room Number and Name:** 1003D Corridor | | | | | | |
| | | | | | | Remarks |
| Room Area (sf) | 1330 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT °F | Remarks |
|---|---|---|---|---|
| NW and SE Partition 1 (summer) | 0.2 | 1150 | 18 | Partition 1, 4' Concrete |
| NW and SE Partition 2 (summer) | 0.2 | 920 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling (summer) | 0.31 | 1330 | 8 | Concrete Floor (2nd Floor), 1'- 6" Thick |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 3192 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1003E Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1760 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 11 | SW | 0.113 | 150 | G | | Wall 2, Metal Wall |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 11 Feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT °F | Remarks |
|---|---|---|---|---|
| NE and NW Partitions (summer) | 0.2 | 1580 | 8 | Partition 1, 4' Concrete |
| SW Partitions and Ceiling (summer) | 0.3 | 3390 | 8 | Partition 2, Gypsum Board |
| Partition (winter) | | | | No heat loss through partitions |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 4224 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 102 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

| ROOM LOAD INFORMATION SHEET | | | | | | |
|---|---|---|---|---|---|---|
| **Room Number and Name:** 1003F Corridor | | | | | | |
| | | | | | | Remarks |
| Room Area (sf) | 640 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 9 | SW | 0.22 | 130 | B | | Wall 1, 4' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 9 Feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT °F | Remarks |
|---|---|---|---|---|
| SE Partition and Ceiling (summer) | 0.3 | 1620 | 8 | Partition 2, Gypsum Board |
| NW Partition (summer) | 0.2 | 990 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1536 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 205 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 330 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1003G Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 620 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 7 | SW | 0.22 | 100 | B | | Wall 1, 4' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT °F | Remarks |
|---|---|---|---|---|
| SE Partition and Ceiling (summer) | 0.3 | 1100 | 8 | Partition 2, Gypsum Board |
| NW Partitions (summer) | 0.2 | 1010 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1488 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 307 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 590 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

| ROOM LOAD INFORMATION SHEET | | | | | |
|---|---|---|---|---|---|
| **Room Number and Name:** 1003H Utility Chase | | | | | |
| | | | | | Remarks |
| Room Area (sf) 1330 | Rm. Height (ft) | 18 | | | |
| Indoor Design Conditions | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT °F | Remarks |
|---|---|---|---|---|
| NW and SE Partitions (summer) | 0.2 | 1480 | 10 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling (summer/winter) | | | | No heat gain/loss through partition |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 3192 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

| ROOM LOAD INFORMATION SHEET | | | | | |
|---|---|---|---|---|---|
| **Room Number and Name:** 1004 HVAC Room (ITS HEPA Exhaust Train A) | | | | | |
| | | | | | Remarks |
| Room Area (sf) | 4840 | Rm. Height (ft) | 32 | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 18 | 59 | NE | 0.22 | 1060[1] | B | | Wall 1, 4' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT °F | Remarks |
|---|---|---|---|---|
| Partition (summer) | 0.2 | 1310 | 10 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1.0 | 9680 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 62,678 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 30 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Minus the area of the 1003A Corridor entrance (130 sq. ft.) and the amount of wall that is Room 1004A's exterior (700 sq. ft.)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1004A HVAC Room (ITS HEPA Exhaust for Battery Room Train A)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 750 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 50 | NE | 0.22 | 700 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 50 Feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1800 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 8,794 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 70 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1012 LLW Staging Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 3180 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 32 | 43 | NE | 0.22 | 1380 | B | | Wall 1, 4' Concrete |
| Wall | 32 | 44[1] | NW | 0.37 | 1410 | B | | Wall 3, 2' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 87 feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | 0.2 | 1310 | 10 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 6360 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 2,455 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 430 | See Assumption 3.1.8. Infiltration airflow rate includes 250 cfm cascaded from C1 Room 1011. |
| | |

**Notes/Remarks**

1. Minus the width of Room 1011's exterior (30 ft)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1013 Loading Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1890 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 100 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partitions |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 3780 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 132,327 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1014 Maintenance Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1520 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 79 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | 0.2 | 1470 | 21 | Partition 1, 4' Concrete |
| Partition (summer) | 0.2 | 2400 | 11 | Partition 1, 4' Concrete |
| Partition (summer) | 0.2 | 1185 | 3 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 3040 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 27,378 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1015 Cask Unloading Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1680 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 100 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partitions |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 3360 | See assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 87,277 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1016 CTM Maintenance Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1350 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | 0.2 | 1310 | 10 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partitions |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 2700 | See assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 1,952 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1017 Cask Preparation Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 6730 | Rm. Height (ft) | 72 | | | |
| Indoor Design Conditions | | Summer DB, °F | 79 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 6730 | | | Roof Type 12, 1'-6" concrete |
| Wall | 12[1] | 74 | SE | 0.22 | 890 | B | | Wall 1, 4' Concrete |
| Wall | 8[2] | 91 | NE | 0.22 | 730 | B | | Wall 1, 4' Concrete |
| Wall | 8[2] | 91 | SW | 0.22 | 730 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | 0.2 | 3790 | 3 | Partition 1, 4' Concrete |
| Partition (summer) | 0.2 | 7840 | 11 | Partition 1, 4' Concrete |
| Partition (summer) | 0.2 | 1310 | 21 | Partition 1, 4' Concrete |
| Large Interior Door (summer) | 1.15 | 100 | 11 | |
| Large Interior Door (summer) | 1.15 | 560 | 21 | |
| Partition (winter) | | | | No heat loss through partitions |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 13460 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| Standing, Light work, Walking | 6 | 250 | 200 | See Assumption 3.1.15 |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 375,760 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 1160 | See Assumption 3.1.8. Infiltration airflow rate includes 800 cfm cascaded from C1 Room 1021. |
| | |

**Notes/Remarks**

1. Minus the height of the adjacent support rooms and HVAC room (60 ft).
2. Minus the height of the adjacent ground and second floors (64 ft).

| ROOM LOAD INFORMATION SHEET | | | | | | |
|---|---|---|---|---|---|---|
| Room Number and Name: 1017A Cask Preparation Annex | | | | | | |
| | | | | | | Remarks |
| Room Area (sf) | 1570 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 79 | Relative Humidity | Not controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 32 | 21[1] | SE | 0.22 | 670 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 21 feet |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Large Interior Door (summer) | 1.15 | 510 | 11 | See Note 2 |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling (summer) | 0.31 | 470 | 3 | Concrete Floor (2nd Floor), 1'- 6" Thick |
| Ceiling (summer) | 0.31 | 1100 | 11 | Concrete Floor (2nd Floor), 1'- 6" Thick |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 3140 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| Standing, Light work, Walking | 2 | 250 | 200 | See Assumption 3.1.15 |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 2,083 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

1. Minus the width of the adjacent support areas (9 feet)
2. Since there are more than two partitions only the door is considered for the SW wall.
3. Adjacent corridor (1003G) is not considered, since the area is small and the temperature difference is low.

## ROOM LOAD INFORMATION SHEET

**Room Number and Name:** 1018 Electrical Room (Normal Power)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 3770 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 32 | 57 | NW | 0.22 | 1660[2] | B | | Wall 1, 4' Concrete |
| Wall | 18 | 46 | SW | 0.22 | 830 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter= 45 Feet[1] |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 7540 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 118,271 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 60 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Perimeter does not include the exterior area that is adjacent to Room 1018A
2. Minus the exterior area of the adjacent Room 1018A

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1018A Battery Room (Normal Power)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 550 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 77 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 77 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 46 | SW | 0.22 | 640 | B | | Wall 1, 4' Concrete |
| Wall | 14 | 12 | NW | 0.22 | 170 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter= 58 Feet |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition and ceiling (summer) | 0.3 | 1200 | 13 | Partition 2, Gypsum Board |
| SE Partition (summer) | 0.2 | 170 | 5 | Partition 1, 4' Concrete |
| | | | | |
| | | | | |
| Partition (winter) | | | | |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1320 | See assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 110 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1019 HVAC Room (ITS HEPA Exhaust Train B)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 4840 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 18 | 59 | SW | 0.22 | 1060[1] | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 9680 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 62,678 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 30 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Minus the area of the 1003F Corridor entrance (130 sq. ft.) and the amount of wall that is Room 1019A's exterior (700 sq. ft.)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1019A HVAC Room (ITS HEPA Exhaust for Battery Room Train B)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 750 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 50 | SW | 0.22 | 700 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 50 Feet |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1800 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 9,751 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 70 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1026 Stair #4[1]

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 400 | Rm. Height (ft) | 16 | | | |
| Indoor Design Conditions | | Summer DB, °F | 102 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | |
| Partition (winter) | | | | |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

1. This is a non-conditioned space (Assumption 3.1.14)

| ROOM LOAD INFORMATION SHEET | | | | | |
|---|---|---|---|---|---|
| **Room Number and Name:** 1028 Freight Elevator | | | | | |
| | | | | | Remarks |
| Room Area (sf) | 260 | Rm. Height (ft) | 90 | | |
| Indoor Design Conditions | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.065 | 260 | | | Roof Type 1, Metal Roofing |
| Wall | 72 | 15 | NW | 0.113 | 1080 | G | | Wall No. 2, Metal Wall |
| Wall | 72 | 11 | SW | 0.113 | 790 | G | | Wall No. 2, Metal Wall |
| Wall | 26 | 18 | NE | 0.113 | 470 | G | | Wall No. 2, Metal Wall |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 624 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1029 Elevator Lobby

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 430 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 32 | 23[1] | SW | 0.113 | 740 | G | | Wall 2, Metal Wall |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Door | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 23 Feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| NE Partition (summer) | 0.2 | 480 | 8 | Partition 1, 4' Concrete |
| NW Partition (summer) | 0.3 | 480 | 8 | Partition 2, Gypsum Board |
| Partition (winter) | | | | No heat loss through partition. |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1.2 | 1032 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 102 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 1770 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Assumption 3.1.15

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1212 to 1224 Support Areas [Excluding Room 1221] (Assumption 3.1.20)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 4290 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 75 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 72 | Ventilation Confinement Classification | | Tertiary |

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 32 | 52 | NE | 0.22 | 1550[1] | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | F=0.73 | | | Perimeter = 44 feet |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Corridor Partition and Ceiling (summer) | 0.3 | 1800 | 7 | Partition 2, Gypsum Board |
| NW Partition (summer) | 0.2 | 1270 | 15 | Partition 1, 4' Concrete |
| Ceiling (summer) | 0.31 | 4290 | 15 | Concrete Floor, 1'-6" Thick |
| Corridor Partition and Ceiling (winter) | 0.3 | 1800 | 7 | Partition 2, Gypsum Board |
| NW and SW Partition (winter) | 0.2 | 2690 | 7 | Partition 1, 4' Concrete |
| Ceiling (winter) | 0.31 | 4290 | 7 | Concrete Floor, 1'-6" Thick |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 10296 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| Standing, Light work, Walking | 3 | 250 | 200 | See Assumption 3.1.15 |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 23,659 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 1270[3] | See Assumption 3.1.8. Infiltration consists of 870 cfm from Rooms 1021A/B and 400 cfm from Room 1203. |
| | |

**Notes/Remarks**

1. Minus the exterior area of the 1003C corridor (112 sq. ft.)
2. Room 1017 is ignored for summer, since the one degree temperature differential is assumed negligible.
3. Reference 2.2.21, Section 7.2 indicates Rooms 1007A and 1006 which are now Rooms 1212 thru 1224 and 1205.

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 1221 and 1205 Support Areas (Assumption 3.1.20)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 670 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 75 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 72 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.065 | 670 | | | Roof Type 1, Metal Roofing |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1.2 | 1608 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 4027 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2001 Operations/Maintenance Storage Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 1790 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 1790 | | | Roof 1, 1'-6" concrete |
| Wall | 32 | 46 | NE | 0.22 | 1470 | B | | Wall 1, 4'concrete |
| Wall | 32 | 39 | NW | 0.22 | 1250 | B | | Wall 1, 4'concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 3580 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 341 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 150 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2002A Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 650 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 9[1] | NE | 0.22 | 130 | B | | Wall 1, 4'concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| SE Partition and Ceiling (summer) | 0.3 | 1660 | 8 | Partition 2, Gypsum Board. |
| NW Partitions (summer) | 0.2 | 1010 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partition. |
| Floor (summer) | 0.39 | 650 | 8 | Concrete Floor (2nd Floor): 1'- 6" Thick |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1560 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 102 | | From Equipment Heat Gain List, See Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 340 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Assumption 3.1.15

| ROOM LOAD INFORMATION SHEET | | | | | |
|---|---|---|---|---|---|
| Room Number and Name: 2002B Corridor | | | | | |
| | | | | | Remarks |
| Room Area (sf) | 1580 | Rm. Height (ft) | 14 | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| NE Partition and Ceiling (summer) | 0.3 | 3550 | 8 | Partition 2, Gypsum Board |
| NW Partition (summer) | 0.2 | 150 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partition. |
| Floor | 0.39 | 1030 | 8 | Concrete Floor (2nd Floor): 1'- 6" Thick |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 3792 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 307 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2002C Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 180 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Ceiling and Partitions (summer) | 0.3 | 580 | 8 | Partition 2, Gypsum Board |
| NW Partition (summer) | 0.2 | 270 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 432 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 102 | | From Equipment Heat Gain List, Assumption 3.1.4. |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

| ROOM LOAD INFORMATION SHEET | | | | | |
|---|---|---|---|---|---|
| **Room Number and Name:** 2002D Corridor | | | | | |
| | | | | | Remarks |
| Room Area (sf) | 950 | Rm. Height (ft) | 14 | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not controlled |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 10 | NE | 0.113 | 140 | G | | Wall No. 2, Metal Wall |
| Wall | 14 | 10 | SW | 0.113 | 140 | G | | Wall No. 2, Metal Wall |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| SE Partition and Ceiling (summer) | 0.3 | 2280 | 8 | Partition 2, Gypsum Board |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 2280 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 2000 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2002E Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 2220 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| SW Partition and Ceiling (summer) | 0.3 | 4450 | 8 | Partition 2, Gypsum Board |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 5328 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 512 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2002F Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 650 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 14 | 9 | NE | 0.22 | 130 | B | | Wall 1, 4'concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| SE Partition and Ceiling (summer) | 0.3 | 1660 | 8 | Partition 2, Gypsum Board. |
| NW Partitions (summer) | 0.2 | 1010 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partition. |
| Floor (summer) | 0.39 | 650 | 8 | Concrete Floor (2nd Floor): 1'- 6" Thick |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1560 | See assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 102 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 340 | See Assumption 3.1.8. Infiltration airflow rate includes 50 cfm cascaded from C1 Room 2008. |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2002G Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 180 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Ceiling and Partitions (summer) | 0.3 | 580 | 8 | Partition 2, Gypsum Board |
| NW Partition (summer) | 0.2 | 270 | 8 | Partition 1, 4' Concrete |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 432 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 102 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2003 HVAC Room North (Process Area Supply)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 4840 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 4840 | | | Roof 1, 1'-6' concrete |
| Wall | 32 | 59 | NE | 0.22 | 1760[1] | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 9680 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 15,916 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 150 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Minus the exterior area of the adjacent corridor 2002A (130 sq. ft.)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2004 HVAC Room North (Process Area Supply)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 3170 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 3170 | | | Roof 1, 1'-6' Concrete |
| Wall | 32 | 39 | NE | 0.22 | 1250 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 6340 | See Assumptions 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 8,532 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 110 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

## ROOM LOAD INFORMATION SHEET

**Room Number and Name:** 2005 Instrument and Electrical Shop

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 4290 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 4290 | | | Roof 1, 1'-6" concrete |
| Wall | 32 | 52 | NE | 0.22 | 1660 | B | | Wall 1, 4' concrete |
| Wall | 28 | 74 | SE | 0.22 | 2070 | B | | Wall 1, 4' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 8580 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 341 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 240 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2006 HVAC Room (HEPA Exhaust for Support, Decon and LLW Areas)

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Remarks |
| Room Area (sf) | 3180 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 3180 | | | Roof 1,1'-6" concrete |
| Wall | 32 | 43 | NE | 0.22 | 1380 | B | | Wall 1, 4' concrete |
| Wall | 32 | 74 | NW | 0.37 | 2370 | B | | Wall 3, 2' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 6360 | See assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 53,784 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 510 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2007 Canister Transfer Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 7770 | Rm. Height (ft) | 68 | | | |
| Indoor Design Conditions | | Summer DB, °F | 79 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 7770 | | | Roof 1, 1'-6" Concrete |
| Wall | 36 | 105 | NE | 0.22 | 3780 | B | | Wall 1, 4' concrete |
| Wall | 36 | 105 | SW | 0.22 | 3320[1] | B | | Wall 1, 4' concrete |
| Wall | 36 | 74 | NW | 0.22 | 2660 | B | | Wall 1, 4' concrete |
| Wall | 28 | 74 | SE | 0.22 | 2070 | B | | Wall 1, 4' concrete |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partitions Next to Corridors (summer) | 0.2 | 2300 | 3 | Partition 1, 4' Concrete |
| Large Second Floor Partitions (summer) | 0.2 | 6790 | 11 | Partition 1, 4' Concrete |
| Floor (summer) | 0.39 | 4200 | 21 | Concrete Floor (2nd Floor): 1'- 6" Thick |
| Floor (summer) | 0.39 | 3570 | 11 | Concrete Floor (2nd Floor): 1'- 6" Thick |
| Partition (winter) | | | | No heat loss through partition. |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 15540 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 250,687 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 100 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Minus the exterior area of Room 3001 (460 ft.)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2009 HVAC Room South (Process Area Supply)

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Remarks |
| Room Area (sf) | 3770 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 3490[1] | | | Roof 1, 1'-6" concrete |
| Wall | 32 | 46 | SW | 0.22 | 1470 | B | | Wall 1, 4' Concrete |
| Wall | 32 | 57 | NW | 0.22 | 1820 | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 7540 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 6,175 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 190 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Minus the area of Room 3001 (280 sq. ft.)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2010 HVAC Room South (Process Area Supply)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 4840 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 4840 | | | Roof 1, 1'-6" Concrete |
| Wall | 32 | 59 | SW | 0.22 | 1760[1] | B | | Wall 1, 4' Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 9680 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 12,472 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 150 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

1. Minus the exterior area of Corridor 2002F (130 sq. ft.)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2011 HVAC Room South (Process Area Supply)

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (ft) | 3170 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 3170 | | | Roof 1, 1'-6" concrete |
| Wall | 32 | 39 | SW | 0.22 | 1250 | B | | Wall, 4' concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 6340 | See assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 6638 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 110 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2012 Receiver/Dryer Equipment Room

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (ft) | 4290 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.031 | 4290 | | | Roof 1, 1'-6" Concrete |
| Wall | 28 | 52 | SW | 0.22 | 1460 | B | | Wall 1, 4" Concrete |
| Wall | 32 | 72 | SE | 0.22 | 2300 | B | | Wall 1, 4" Concrete |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| High Bay | 2 | 1 | 8580 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 120,425 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 240 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

| ROOM LOAD INFORMATION SHEET | | | | | |
|---|---|---|---|---|---|
| **Room Number and Name:** 2026 Stair#4[1] | | | | | |
| | | | | | Remarks |
| Room Area (sf) | 400 | Rm. Height (ft) | 16 | | |
| Indoor Design Conditions | | Summer DB, °F | 102 | Relative Humidity Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | |
| Partition (winter) | | | | |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

1. This is a non-conditioned space (Assumption 3.1.14)

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 2029 Elevator Lobby

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (ft) | 400 | Rm. Height (ft) | 32 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 32 | 33 | SW | 0.113 | 1060 | G | | Wall 2. Metal Wall |
| Wall | 32 | 9 | NW | 0.113 | 290 | G | | Wall 2. Metal Wall |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| NE and SE Partitions (summer) | 0.2 | 1220 | 8 | Partition 1, 4' Concrete |
| NW Partition (summer) | 0.3 | 480 | 8 | Partition 2, Gypsum Board |
| Partition (winter) | | | | No heat loss through partition. |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 960 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 102 | | From Equipment Heat Gain List, Assumption 3.1.4 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 1170 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 3001 Corridor

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 280 | Rm. Height (ft) | 14 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.065 | 280 | | | Roof 2, Metal Roofing |
| Wall | 14 | 21 | SW | 0.113 | 290 | G | | Wall 2. Metal Wall |
| Wall | 14 | 14 | SE | 0.113 | 200 | G | | Wall 2. Metal Wall |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Floor (summer) | 0.39 | 280 | 8 | Concrete Floor (2nd Floor): 1'- 6" Thick |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 672 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 210 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** 3026 Stair #4[1]

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 400 | Rm. Height (ft) | 16 | | | |
| Indoor Design Conditions | | Summer DB, °F | 102 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | |
| Partition (winter) | | | | |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

1. This is a non-conditioned space (Assumption 3.1.14)

| ROOM LOAD INFORMATION SHEET | | | | | | |
|---|---|---|---|---|---|---|
| **Room Number and Name:** 3029 Elevator Lobby | | | | | | |
| | | | | | | Remarks |
| Room Area (sf) | 660 | Rm. Height (ft) | 12 | | | |
| Indoor Design Conditions | | Summer DB, °F | 82 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orientation | U Btu/h-ft$^2$ F | Area ft$^2$ | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | 12 | 33 | SW | 0.113 | 400 | G | | Wall 2. Metal Wall |
| Wall | 12 | 9 | NW | 0.113 | 110 | G | | Wall 2. Metal Wall |
| Wall | 12 | 10 | SE | 0.113 | 120 | G | | Wall 2. Metal Wall |
| Wall | 12 | 24 | NE | 0.113 | 290 | G | | Wall 2. Metal Wall |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft$^2$ F | Area ft$^2$ | ΔT F | Remarks |
|---|---|---|---|---|
| NW Partition (summer) | 0.3 | 180 | 8 | Partition 2, Gypsum Board |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling (summer) | 0.113 | 660 | 8 | Wall 2. Metal Wall |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 1584 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| 1110 | See Assumption 3.1.8 |
| | |

**Notes/Remarks**

| ROOM LOAD INFORMATION SHEET | | | | | |
|---|---|---|---|---|---|
| **Room Number and Name:** R001 Firefight Elevator Machine Room | | | | | |
| | | | | | Remarks |
| Room Area (sf) | 940 | Rm. Height (ft) | 14 | | |
| Indoor Design Conditions | | Summer DB, °F | 90 | Relative Humidity | Not Controlled |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | 0.065 | 940 | | | Roof 2, Metal Roofing |
| Wall | 14 | 43 | NE | 0.113 | 600 | G | | Wall 2. Metal Wall |
| Wall | 14 | 24 | SE | 0.113 | 340 | G | | Wall 2. Metal Wall |
| Wall | 14 | 33 | SW | 0.113 | 460 | G | | Wall 2. Metal Wall |
| Wall | 14 | 24 | NW | 0.113 | 340 | G | | Wall 2. Metal Wall |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | No heat gain through partition. |
| Partition (winter) | | | | No heat loss through partition. |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| Fluorescent | 2 | 1.2 | 2256 | See Assumption 3.1.2 |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| 3412 | | See Assumption 3.1.18 |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

**ROOM LOAD INFORMATION SHEET**

**Room Number and Name:** R026 Firefight Elevator Machine Stair[1]

| | | | | | | Remarks |
|---|---|---|---|---|---|---|
| Room Area (sf) | 400 | Rm. Height (ft) | 26 | | | |
| Indoor Design Conditions | | Summer DB, °F | 102 | Relative Humidity | Not Controlled | |
| | | Winter DB, °F | 65 | Ventilation Confinement Classification | | Tertiary |

**External Conduction**

| Item | Height ft | Width ft | Orien-tation | U Btu/h-ft² F | Area ft² | Wall Group | Color | Remarks |
|---|---|---|---|---|---|---|---|---|
| Roof | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Wall | | | | | | | | |
| Floor | | | | | | | | |

**Internal Conduction**

| Item | U Btu/h-ft² F | Area ft² | ΔT F | Remarks |
|---|---|---|---|---|
| Partition (summer) | | | | |
| Partition (winter) | | | | |
| Ceiling | | | | |

**Lights**

| Type | W/sq. ft. | Ballast Factor | Total Watts | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**People**

| Activity Type | No. of People | Q Sensible Btu/h Ea. | Q Latent Btu/h Ea. | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Equipment Heat Gain**

| Q Sensible Btu/h | Q Latent Btu/h | Remarks |
|---|---|---|
| | | |
| | | |
| | | |

**Infiltration**

| Airflow cfm | Remarks |
|---|---|
| | |
| | |

**Notes/Remarks**

1. This is a non-conditioned space (Assumption 3.1.14)

# Calculation of U-Values

## Roof Assembly U-Value

The elements of construction come from the General Arrangement Drawings (Assumption 3.1.1). Values of resistance come from *ASHRAE Fundamentals* (Reference 2.2.4, Chapter 25). Where a range of resistance is given, the average resistance value is used in this calculation. The concrete density of 150 pounds per cubic foot comes from Section 4.2.11.6.6 of the *Project Design Criteria Document* (Reference 2.2.1). Roof deck thickness comes from Assumption 3.1.1.

Table A-1. Roof Type 12: 1'-6" Thick Concrete, with R-30 Insulation

| Element | Reference | Resistance, R ft2-°F-h/Btu |
|---|---|---|
| Moving Air, Any Position. At 7.5 mph wind – Summer (Assumption 3.2.2) | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.25 |
| R-30 Insulation | | 30.00 |
| Concrete 18" thick at density of 150 lb/ft3 | ASHRAE Fundamentals 2005, Table 4, p25.8 | 1.35 |
| Still Air, Horizontal-Downward Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.92 |
| | Total Resistance, $R_T$ = | 32.52 |
| | **U-Factor = 1/$R_T$, Btu/h-ft$^2$-°F** | **0.031** |

Table A-2. Roof Type 1: Metal Roofing

| Element | Reference | Resistance, R ft$^2$-°F-h/Btu |
|---|---|---|
| | See Assumption 3.1.9 | |
| | **U-Factor = Btu/h-ft$^2$-°F** | **0.065** |

## Wall Assembly U-Value

The elements of construction come from the General Arrangement Drawings (Assumption 3.1.1). Values of resistance come from *ASHRAE Fundamentals* (Reference 2.2.4, Chapter 25) and *ASHRAE Std. 90.1-2004* (Reference 2.2.6, Table A9.2B). The concrete density of 150 pounds per cubic foot comes from Section 4.2.11.6.6 of the *Project Design Criteria Document* (Reference 2.2.1).

Table A-3. Wall No. 1: 4'-0" Thick Concrete, no insulation

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| Moving Air, Any Position. At 7.5 mph wind Summer (Assumption 3.2.2) | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.25 |
| Concrete 48" thick at density of 150 lb/$ft^3$ (Reference 2.2.1, Section 4.2.11.6.6) | ASHRAE Fundamentals 2005, Table 4, p25.8 | 3.60 |
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| | Total Resistance, $R_T$ = | 4.53 |
| | **U-Value = 1/$R_T$, Btu/h-$ft^2$-°F** | **0.22** |

Table A-4. Wall No. 2: Metal Wall

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| | See Assumption 3.1.9 | |
| | **U-Value = Btu/h-$ft^2$-°F** | **0.113** |

Table A-5. Wall No. 3: 2'-0" Thick Concrete, no insulation

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| Moving Air, Any Position. At 7.5 mph wind Summer (Assumption 3.2.2) | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.25 |
| Concrete 48" thick at density of 150 lb/$ft^3$ (Reference 2.2.1, Section 4.2.11.6.6) | ASHRAE Fundamentals 2005, Table 4, p25.8 | 1.80 |
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| | Total Resistance, $R_T$ = | 2.73 |
| | **U-Value = 1/$R_T$, Btu/h-$ft^2$-°F** | **0.37** |

## Partition U-Values

The elements of construction come from the General Arrangement Drawings (Assumption 3.1.1). Values of resistance come from *ASHRAE Fundamentals* (Reference 2.2.4, Chapter 25) and *ASHRAE Std. 90.1-2004* (Reference 2.2.6, Table A9.2B). The concrete density of 150 pounds per cubic foot comes from Section 4.2.11.6.6 of the *Project Design Criteria Document* (Reference 2.2.1).

Table A-6. Partition No. 1: 4'- 0" Thick Concrete, no insulation

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| Concrete 48" thick at density of 150 lb/$ft^3$ | ASHRAE Fundamentals 2005, Table 4, p25.8 | 3.60 |
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| | Total Resistance, $R_T$ = | 4.96 |
| | **U-Value = 1/$R_T$, Btu/h-$ft^2$-°F** | **0.20** |

Table A-7. Partition No. 2: Gypsum Board, One-Hour Fire Rated

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| 5/8" gypsum board | ASHRAE Fundamentals 2005, Table 4, p25.5 | 0.56 |
| 4" metal stud, 24" O.C. with air space. No insulation. | ASHRAE 90.1 - 2004, Table A9.2B, Effective resistance. (Reference 2.1.13) | 0.91 |
| 5/8" gypsum board | ASHRAE Fundamentals 2005, Table 4, p25.5 | 0.56 |
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| | Total Resistance, $R_T$ = | 3.39 |
| | **U-Value = 1/$R_T$, Btu/h-$ft^2$-°F** | **0.30** |

Table A-8. Partition No. 3: 2'- 0" Thick Concrete, no insulation

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| Concrete 24" thick at density of 150 lb/$ft^3$ | ASHRAE Fundamentals 2005, Table 4, p25.8 | 1.80 |
| Still Air, Horizontal Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.68 |
| | Total Resistance, $R_T$ = | 3.16 |
| | **U-Value = 1/$R_T$, Btu/h-$ft^2$-°F** | **0.32** |

Table A-9. Concrete Floor (2nd Floor): 1'- 6" Thick

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| Still Air, Downward Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.92 |
| Concrete 18" thick at density of 150 lb/$ft^3$ | ASHRAE Fundamentals 2005, Table 4, p25.8 | 1.35 |
| Still Air, Downward Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.92 |
| | Total Resistance, $R_T$ = | 3.19 |
| | **U-Value = 1/$R_T$, Btu/h-$ft^2$-°F** | **0.31** |

Table A-10. Concrete Floor (2nd Floor): 1'- 6" Thick

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| Still Air, Upward Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.61 |
| Concrete 18" thick at density of 150 lb/$ft^3$ | ASHRAE Fundamentals 2005, Table 4, p25.8 | 1.35 |
| Still Air, Upward Flow | ASHRAE Fundamentals 2005, Table 1, p25.2 | 0.61 |
| | Total Resistance, $R_T$ = | 2.57 |
| | **U-Value = 1/$R_T$, Btu/h-$ft^2$-°F** | **0.39** |

## Interior and Exterior Roll-up Door U-Value

Table A-11. Door: Metal Roll-up

| Element | Reference | Resistance, R $ft^2$-°F-h/Btu |
|---|---|---|
| | See Assumption 3.1.12 | |
| | **U-Value = Btu/h-$ft^2$-°F** | **1.15** |

## Floor F-Factor

For calculating the heat loss during winter, for slab-on-grade construction, the floor F-Factor is 0.73, according to *Energy Standard for Buildings Except Low-Rise Residential Buildings* (Reference 2.2.6, Table 5.5-5 and Appendix B) based on climate zone and building envelope requirements.

# APPENDIX B: ASHRAE TABLE VALUES FOR CLTD AND CORRECTION TABLES FOR LATITUDE AND MONTH

Table B-1 presents the unadjusted Cooling Load Temperature Difference (CLTD) and Cooling Load Factor (CLF) values used in this calculation. The unadjusted roof CLTD values come from Table 3.8 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, p. 3.19). The unadjusted wall CLTD values come from Table 3.10, p. 3.21, of the same reference. The CLF for Lights, People, and Equipment are based on the similar tables in Chapter 4 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, pp. 4.4, 4.6, and 4.9). All Cooling Load Factors are equal to 1.0, based on Assumption 3.2.6, Assumption 3.2.7, and Assumption 3.2.8. See Section 6.1.3 of this calculation for determination of roof and wall types and additional information on correcting the unadjusted values for latitude-month, color, indoor design temperature, and outdoor design temperature.

Table B-2 presents the CLTD correction for latitude and month related to the design latitude for this building, as given in Section 6.1.1. The CLTD correction values were interpolated from the 32 degree and 40 degree North latitude values given in Table 3.12 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, p. 3.23). Table B-3 presents the winter outdoor design temperature of 24°F dry bulb and 20°F wet bulb and the summer outdoor design temperature of 102°F dry bulb and 65°F wet bulb. For the summer the four months: June, July, August, and September, are assigned for conservatism. All $K$ factors for roof and wall color are taken at a value of 1.0, per Assumption 3.2.3. The $f$ factor for the roof CLTD correction is taken at a value of 1.0, for conservatism.

For flat roofs, the following formula (Reference 2.2.3, Table 3.8, Note 2, p. 3.19) is used to correct the roof CLTD values:

$$CLTD_{roof,corr} = [(CLTD + LM) \times K + (78°\text{F} - T_r) + (T_o - 85°\text{F})] \times f \qquad \text{(Eq. B-1)}$$

where

$CLTD$ = from Table B-1

$LM$ = Latitude-month correction from Table B-2, for a horizontal surface

$K$ = Color adjustment factor, equal to 1.0 (Assumption 3.2.3)

$T_r$ = Indoor design room temperature, °F

$T_o$ = Average outside temperature on design day, °F. $T_o$ = 102°F - (25.9/2) = 89.05°F for a 102°F outdoor design temperature

$f$ = factor for attic fan and/or ducts above ceiling taken at a value equal to 1.0 for no attic fan or ducts and a value equal to 0.75 for positive ventilation

For sunlit walls, the following formula (Reference 2.2.3, Table 3.10, Note 2, p. 3.21) is used to correct the wall CLTD values:

$$CLTD_{wall,corr} = (CLTD + LM) \times K + (78°\text{F} - T_r) + (T_o - 85°\text{F}) \qquad \text{(Eq. B-2)}$$

where

$CLTD$ = from Table B-1

$LM$ = Latitude-month correction from Table B-2

$K$ = Color adjustment factor, equal to 1.0 (Assumption 3.2.3)

$T_r$ = Indoor design room temperature, °F

$T_o$ = Average outside temperature on design day, °F. $T_o$ = 102°F - (25.9/2) = 89.05°F for a 102°F outdoor design temperature

Table B-1. Unadjusted CLTD Values and CLF Values (°F)

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ASHRAE TABLE VALUES FOR CLTD** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Hour** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** |
| Roof 1 (Type 12) (Note 1 & 7) | 31 | 28 | 25 | 22 | 20 | 17 | 15 | 14 | 14 | 16 | 18 | 22 | 26 | 31 | 36 | 40 | 43 | 45 | 45 | 44 | 42 | 40 | 37 | 34 |
| Roof 2 (Type 1) (Note 1 & 8) | 6 | 3 | 0 | -1 | -3 | -3 | -2 | 4 | 14 | 27 | 39 | 52 | 62 | 70 | 74 | 74 | 70 | 62 | 51 | 38 | 28 | 20 | 14 | 9 |
| Group B Wall -N (Note 2) | 15 | 14 | 14 | 13 | 12 | 11 | 11 | 10 | 9 | 9 | 9 | 8 | 9 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 14 | 15 | 15 | 15 |
| -NE (Note 2) | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 19 | 20 | 20 | 21 | 21 | 21 | 20 | 20 |
| -E (Note 2) | 23 | 22 | 21 | 20 | 18 | 17 | 16 | 15 | 15 | 15 | 17 | 19 | 21 | 22 | 24 | 25 | 26 | 26 | 27 | 27 | 26 | 26 | 25 | 24 |
| -SE (Note 2) | 23 | 22 | 21 | 20 | 18 | 17 | 16 | 15 | 14 | 14 | 15 | 16 | 18 | 20 | 21 | 23 | 24 | 25 | 26 | 26 | 26 | 26 | 25 | 24 |
| -S (Note 2) | 21 | 20 | 19 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 11 | 11 | 11 | 12 | 14 | 15 | 17 | 19 | 20 | 21 | 22 | 22 | 22 | 21 |
| -SW (Note 2) | 27 | 26 | 25 | 24 | 22 | 21 | 19 | 18 | 16 | 15 | 14 | 14 | 13 | 13 | 14 | 15 | 17 | 20 | 22 | 25 | 27 | 28 | 28 | 28 |
| -W (Note 2) | 29 | 28 | 27 | 26 | 24 | 23 | 21 | 19 | 18 | 17 | 16 | 15 | 14 | 14 | 14 | 15 | 17 | 19 | 22 | 25 | 27 | 29 | 29 | 30 |
| -NW (Note 2) | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 15 | 14 | 13 | 12 | 12 | 12 | 11 | 12 | 12 | 13 | 15 | 17 | 19 | 21 | 22 | 23 | 23 |
| Group G Wall -N (Note 2) | 3 | 2 | 1 | 0 | -1 | 2 | 7 | 8 | 9 | 12 | 15 | 18 | 21 | 23 | 24 | 24 | 25 | 26 | 22 | 15 | 11 | 9 | 7 | 5 |
| -NE (Note 2) | 3 | 2 | 1 | 0 | -1 | 9 | 27 | 36 | 39 | 35 | 30 | 26 | 26 | 27 | 27 | 26 | 25 | 22 | 18 | 14 | 11 | 9 | 7 | 5 |
| -E (Note 2) | 4 | 2 | 1 | 0 | -1 | 11 | 31 | 47 | 54 | 55 | 50 | 40 | 33 | 31 | 30 | 29 | 27 | 24 | 19 | 15 | 12 | 10 | 8 | 6 |
| -SE (Note 2) | 4 | 2 | 1 | 0 | -1 | 5 | 18 | 32 | 42 | 49 | 51 | 48 | 42 | 36 | 32 | 30 | 27 | 24 | 19 | 15 | 12 | 10 | 8 | 6 |
| -S (Note 2) | 4 | 2 | 1 | 0 | -1 | 0 | 1 | 5 | 12 | 22 | 31 | 39 | 45 | 46 | 43 | 37 | 31 | 25 | 20 | 15 | 12 | 10 | 8 | 5 |
| -SW (Note 2) | 5 | 4 | 3 | 1 | 0 | 0 | 2 | 5 | 8 | 12 | 16 | 26 | 38 | 50 | 59 | 63 | 61 | 52 | 37 | 24 | 17 | 13 | 10 | 8 |
| -W (Note 2) | 6 | 5 | 3 | 2 | 1 | 1 | 2 | 5 | 8 | 11 | 15 | 19 | 27 | 41 | 56 | 67 | 72 | 67 | 48 | 29 | 20 | 15 | 11 | 8 |
| -NW (Note 2) | 5 | 3 | 2 | 1 | 0 | 0 | 2 | 5 | 8 | 11 | 15 | 18 | 21 | 27 | 37 | 47 | 55 | 55 | 41 | 25 | 17 | 13 | 10 | 7 |
| Glass (Note 3) | 1 | 0 | -1 | -2 | -2 | -2 | -2 | 0 | 2 | 4 | 7 | 9 | 12 | 13 | 14 | 14 | 13 | 12 | 10 | 8 | 6 | 4 | 3 | 2 |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| **ASHRAE TABLE VALUES FOR CLF** | | | | | | | | | | | | | | | | | | | | | | | | |
| Lights (Note 4) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| People (Note 5) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Equipment hooded (N/A) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Equip. non-hooded (Note 6) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Notes:
1. From Table 3.8 in Reference 2.2.3.
2. From Table 3.10 in Reference 2.2.3.
3. From Table 3.23 in Reference 2.2.3.
4. From Assumption 3.2.6.
5. From Assumption 3.2.7.
6. From Assumption 3.2.8.
7. The unadjusted values listed here are for a Type 12 roof. But because the RF insulated concrete roof has a much higher resistance (See U-Value Calculation in Appendix A) compared to the Type12 roof listed in Table 3.8 of the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, page 3.19) Note 4 of Table 3.8 is used to determine that an effective CLTD of 29°F should be used in the Cooling Load Calculation.
8. The roof type selected in this calculation for the sheet metal roof is Type 1. The unadjusted CLTD values in this table are from a Type 2 roof because the requirement from Note 4 of Table 3.8 in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3, page 3.19) was used. Since, the RF metal roof has a higher value by over R-7 and less than R-14 (See U-Value Calculation in Appendix A) the CLTD data was analyzed and the Type 2 CLTD data was chosen as the best set of values to use in this calculation.

Table B-2. CLTD Correction For Latitude and Month Applied to Walls and Roofs (°F)

| North Latitude | Month | N | NNE NNW | NE NW | ENE WNW | E W | ESE WSW | SE SW | SSE SSW | S | HOR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 36.62 | Dec | -5.58 | -7.58 | -10.00 | -12.16 | -9.16 | -6.16 | 0.85 | 7.85 | 10.85 | -19.31 |
| | Jan/Nov | -5.00 | -7.00 | -9.58 | -11.58 | -8.58 | -5.16 | 1.42 | 8.42 | 11.42 | -17.31 |
| | Feb/Oct | -4.58 | -6.58 | -7.58 | -8.58 | -5.16 | -2.58 | 3.42 | 8.00 | 11.58 | -12.31 |
| | Mar/Sep | -3.58 | -4.58 | -4.58 | -5.16 | -2.58 | -1.00 | 3.58 | 6.16 | 8.73 | -6.73 |
| | Apr/Aug | -2.00 | -2.58 | -1.58 | -2.00 | 0.00 | -0.42 | 1.16 | 2.16 | 2.73 | -2.16 |
| | May/Jul | 0.42 | 0.42 | 0.42 | 0.00 | 0.00 | -0.42 | -0.42 | -1.27 | -0.69 | 1.00 |
| | Jun | 1.00 | 1.42 | 1.42 | 0.42 | 0.58 | -0.85 | -0.85 | -2.27 | -2.27 | 2.00 |

NOTE:

All values from interpolation of Table 3.12 in Reference 2.2.3.

Table B-3. Monthly Outdoor Design Temperatures

| | Outside Design Temperature | |
|---|---|---|
| **Month** | **db F** | **wb F** |
| JAN | 24 | 20 |
| JUN | 102 | 65 |
| JUL | 102 | 65 |
| AUG | 102 | 65 |
| SEP | 102 | 65 |
| DEC | 24 | 20 |

NOTE:

The summer outdoor design temperature of 102°F dry bulb and 65°F wet bulb are assigned for the four months: June, July, August, and September, for conservatism.

# APPENDIX C: COOLING/HEATING LOAD EQUATIONS

Table C-1 contains the equations used by the CLTD/CLF cooling load calculation method discussed in the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3). The table references given after the definition of the equation variable in Table C-1 are specific to the *Cooling and Heating Calculation Manual*. In many instances, newer sources and other sources have been used. See the main body of the calculation for those sources.

Table C-1. Cooling Load Equations

| Load Source | Cooling Load Equation | Equation No. | Reference, Tables, Description [From *ASHRAE GRP 158, Cooling and Heating Load Manual* (Reference 2.2.3)] |
|---|---|---|---|
| Roof | $q = U \times A \times CLTD$ | Equation C-1 | U = Design Heat transmission Coefficients, Btu/(hr $ft^2$ °F) - Tables 3.1 - 3.5; A3.1 and A3.2,<br>A = Areas Calculated from Building Plans, $ft^2$<br>CLTD = Cooling Load Temperature Difference at Base Condition for Roofs, °F - Table 3.8 and Notes<br>Note 2 - Correction for color of Exterior surface<br>Note 2 - Correction for Outside Dry Bulb Temperature and Daily Range - Table 3.13<br>Note 2 - Correction for Inside Dry Bulb Temperature - Table 3.13<br>Note 2 - Application of Latitude and Month - Table 3.12<br>Note 4 – For a more conservative roof load result, corrections for additional insulation are not used. |
| Walls | $q = U \times A \times CLTD$ | Equation C-2 | U = Design Heat transmission Coefficients, Btu/(hr $ft^2$ °F) - Tables 3.1 - 3.4; A3.1 and A3.2<br>A = Areas Calculated from Building Plans, $ft^2$<br>CLTD = Cooling Load Temperature Difference at Base Condition for Wall Group, °F - Table 3.9, 3.10 + Notes<br>Note 2 - Correction for color of Exterior surface<br>Note 2 - Correction for Outside Dry Bulb Temperature and Daily Range - Table 3.13<br>Note 2 - Correction for Inside Dry Bulb Temperature - Table 3.13<br>Note 2 - Application of Latitude and Month - Table 3.12 |
| Glass Conduction | $q = U \times A \times CLTD$ | Equation C-3 | U = Overall Heat Transmission Coefficient for type of Glass and Interior Shading, if used, Btu/(hr $ft^2$ °F) - Tables 3.14 - 3.16 & A3.4<br>A = Glass Areas Calculated from Building Plans, $ft^2$<br>CLTD = Cooling Load Temp. Difference for Conduction Load through Glass, °F - Table 3.23<br>Correction for Outside Dry Bulb Temperature and Daily Range - Table 3.13<br>Correction for Inside Dry Bulb Temp. Table 3.13 |

| Load Source | Cooling Load Equation | Equation No. | Reference, Tables, Description [From *ASHRAE GRP 158, Cooling and Heating Load Manual* (Reference 2.2.3)] |
|---|---|---|---|
| Glass Solar | q = A × SC × SHGF × CLF | Equation C-4 | A = Glass Area Calculated from Building Plans, $ft^2$<br>SC = Shading coefficients for combined type of Glass and type of shading - Table 3.17 - 3.22<br>SHGF = Solar Heat Gain Factor for specific orientation of surface, Btu/(hr $ft^2$)<br>Latitude and Month - Table 3.25 for no external shading<br>Externally shaded - Location less than 24 deg Latitude - Table 3.26<br>Location at or more than 24 deg Latitude - Table 3.25-N orient.<br>CLF = Cooling Load Factor<br>With no interior shading - Table 3.27<br>With interior shading - Table 3.28<br>For glass areas shaded externally, use north orientation with either Table 3.27 or 3.28. |
| Partitions, Ceilings, Floors | q = U × A × TD | Equation C-5 | U = Design Heat transmission Coefficients, Btu/(hr $ft^2$ °F) - Tables 3.1 - 3.5 & A3.1<br>A = Areas Calculated from Building Plans, $ft^2$<br>TD = Design Temperature Difference between rooms, °F |
| Internal Lights | q = Input × CLF | Equation C-6 | Input = Input rating from electrical Plans or Lighting Fixture data, Btu/h - Table 4.1<br>Coefficient "a" and "b" for type of fixture - Tables 4.2 & 4.3<br>CLF = Cooling Load Factor based on total hours of operation and time - Table 4.4<br>Note 1: Correction for Schedule of Operation of Lights and Cooling System, CLF=1when cooling system is operated only when lights are on or when lights are on 24 hrs/day. |
| People Sensible | q = No. × Sens. HG × CLF | Equation C-7 | No. = Number of People in space, from survey or Table 5.3<br>Sens. HG = Sensible Heat Gains from Occupants, Btu/h - Table 4.5<br>CLF = Cooling Load Factor - based on duration of occupancy and time of entry - Table 4.6 |
| People Latent | q = No. × Latent HG | Equation C-8 | No. = Number of People in space, from survey or Table 5.3<br>Latent HG = Latent Heat Gain from Occupants, Btu/h - Table 4.5 |
| Equipment/ Appliances Sensible | q = Heat Gain × CLF | Equation C-9 | Heat Gain = Recommended rate of heat gain - sensible heat, Btu/h - Tables 4.8 & 4.9<br>CLF = Cooling Load Factor<br>For use with hood - Table 4.10<br>For use without hood - Table 4.11 |

| Load Source | Cooling Load Equation | Equation No. | Reference, Tables, Description [From *ASHRAE GRP 158, Cooling and Heating Load Manual* (Reference 2.2.3)] |
|---|---|---|---|
| Equipment/ Appliances Latent | q = Heat Gain | Equation C-10 | Heat Gain = Recommended rate of heat gain, Btu/h<br>Latent heat without hood - Tables 4.8 & 4.9<br>Set Equal to zero when hood is used over appliances. |
| Power | q = Heat Gain × CLF | Equation C-11 | Heat Gain = Manufacturer's Data or Tables 4.12 & 4.13, Btu/h<br>CLF = Cooling Load Factor - Table 4.11 or CLF = 1.0 if cooling system is not operated continuously |

Table C-2 contains the equations used by the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3) to calculate the heating load for roofs, walls, glass, and floors over exterior spaces. The table references given after the definition of the equation variable in Table C-2 are specific to the *Cooling and Heating Calculation Manual*. In many instances, newer sources and other sources have been used. See the main body of the calculation for those sources. The equation for calculating the heating load from slab-on-grade floors is from *2005 ASHRAE Fundamentals* (Reference 2.2.4, Chapter 29, p. 29.13).

Table C-2. Heating Load Equations

| Heating Load | Heating Load Equation | Equation No. | Reference, Tables, Description |
|---|---|---|---|
| Roofs, Walls, Partitions, Glass | q = U × A × TD | Equation C-12 | [From *ASHRAE GRP 158, Cooling and Heating Load Manual* (Reference 2.2.3)]<br>U = Design Heat transmission Coefficients, Btu/(hr $ft^2$ °F) - Tables 3.1 - 3.5; A3.1 and A3.2,<br>A = Areas Calculated from Building Plans, $ft^2$<br>TD = Temperature Difference between inside design db and design outside db – Table 2.1 |
| Floors over exterior space | q = U × A × TD | Equation C-13 | [From *ASHRAE GRP 158, Cooling and Heating Load Manual* (Reference 2.2.3)]<br>U = Design Heat transmission Coefficients, Btu/(hr $ft^2$ °F) - Tables 3.1 - 3.5; A3.1 and A3.2,<br>A = Areas Calculated from Building Plans, $ft^2$<br>TD = Temperature Difference between inside design db and design outside db – Table 2.1 |
| Slab-on-grade floors | q = $F_p$ × P x TD | Equation C-14 | From ASHRAE Fundamentals (Reference 2.2.4, Chapter 29, Equations 39 and 40)<br>$F_p$ = Heat loss coefficient per foot of perimeter, Btu/(hr $ft^2$ °F)<br>P = Perimeter (exposed edge) of slab, ft.<br>TD = Temperature Difference between inside design db and ambient temperature, °F |

Table C-3 contains the equations used by the *Cooling and Heating Load Calculation Manual* (Reference 2.2.3) to calculate the sensible and latent heating and cooling loads for infiltration and ventilation. The table references given after the definition of the equation variable in Table C-3 are specific to the *Cooling and Heating Calculation Manual*. In many instances, newer sources and other sources have been used. See the main body of the calculation for those sources.

Table C-3. Infiltration and Ventilation Cooling and Heating Load Equations

| Heating Load | Equation | Equation No. | Reference, Tables, Description |
|---|---|---|---|
| Sensible<br>Latent<br>Total | q = density x 0.24 x 60 x Airflow cfm x TD<br>q = 4840 x Airflow cfm x ($W_1 - W_2$)<br>q = 4.5 x Airflow cfm x ($H_1 - H_2$) | Equation C-15 | [From *ASHRAE GRP 158, Cooling and Heating Load Manual* (Reference 2.2.3)]<br>Airflow cfm = Ventilation/Infiltration Air, Standard Airflow cfm, Chapter 5<br>TD = Temperature Difference between inside design db and Outside temperatures, °F<br>Inside – Outside Humidity Ratio, lb. water/lb dry air, Table 2.1 & Table 2.3<br>Inside – Outside Air Enthalpy, Btu/lb. dry air, Table 2.1 & Table 2.3 |

# APPENDIX D: PSYCHROMETRIC CALCULATION EQUATIONS

The following methods and equations are used to numerically calculate the various thermodynamic properties of moist air. These equations are derived from Chapter 6 of the *2005 ASHRAE Handbook, Fundamentals* (Reference 2.2.4). These equations are used throughout the calculation whenever individual air properties, mixed air properties, sensible heat gain, latent heat gain, and total heat gain need to be calculated.

## 1. Barometric Pressure, *P* - [Equation 3, p. 6.1]

$$P = K \cdot \left[1 - 6.8754 \times 10^{-6} Z\right]^{5.2559} \qquad \text{(Eq. D-1)}$$

where

$P$ = barometric pressure (in. w.g.; in. Hg; or psia)

$Z$ = elevation above sea level (ft)

$K$ = a constant (407.1894 in. w.g./atm, 29.921 in. Hg/atm., or 14.696 psia/atm.)

## 2. Water Vapor Saturation Pressure, Pws (for Temperature < 32°F) [Equation 5, p. 6.2]

$$\ln P_{ws} = C1/R + C2 + C3 \cdot R + C4 \cdot R^2 + C5 \cdot R^3 + C6 \cdot R^4 + C7 \cdot \ln R$$

(Eq. D-2)

or

$$P_{ws} = e^{\ln P_{ws}}$$

where

$P_{ws}$ = saturation pressure, psia (at the dry bulb or wet bulb temperature)
$R$ = absolute Temp, °R = (T + 459.67)
$T$ = dry or wet bulb temperature, °F
$C1$ = -1.0214165E+04
$C2$ = -4.8932428E+00
$C3$ = -5.3765794E-03
$C4$ = 1.9202377E-07
$C5$ = 3.5575832E-10
$C6$ = -9.0344688E-14
$C7$ = 4.1635019E+00

**3. Water Vapor Saturation Pressure, Pws (for Temperature = or > 32°F) [Equation 6, p. 6.2]**

$$\ln P_{ws} = C8/R + C9 + C10 \cdot R + C11 \cdot R^2 + C12 \cdot R^3 + C13 \cdot \ln R \qquad \text{(Eq. D-3)}$$

or

$$Pws = e^{\ln Pws}$$

where

$P_{ws}$ = saturation pressure, psia (at the dry bulb or wet bulb temperature)
$R$ = absolute Temp, °R = (T + 459.67)
$T$ = dry or wet bulb temperature, °F
$C8$ = -1.0440397E+04
$C9$ = -1.1294650E+01
$C10$ = -2.7022355E-02
$C11$ = 1.2890360E-05
$C12$ = -2.4780681E-09
$C13$ = 6.5459673E+00

**4. Humidity Ratio or Moisture Content, W [Equation 35, p. 6.13]**

$$W = \frac{(1093 - 0.556T_{wb}) \cdot Ws - 0.24 \cdot (T_{db} - T_{wb})}{1093 + 0.444T_{db} - T_{wb}} \qquad \text{(Eq. D-4)}$$

where

$W$ = humidity Ratio or Moisture content, lb water/lb dry air
$Ws$ = 0.62198 [($P_{ws}$/($P - P_{ws}$)]
$Pws$ = saturation pressure (for $T_{db}$), psia (from Equation D-2 or Equation D-3 above)
$P$ = barometric pressure, psia (from Equation B-1 above)
$T_{db}$ = dry bulb temperature, °F
$T_{wb}$ = wet bulb temperature, °F

**5. Water Vapor Partial Pressure, Pw [Equation 38, p. 6.13]**

$$P_W = (P \cdot W)/(0.62198 + W) \qquad \text{(Eq. D-5)}$$

where

$P_W$ = water vapor partial pressure, psia
$P$ = barometric pressure, psia (from Equation D-1 above)
$W$ = humidity ratio, lb water/lb dry air (from Equation D-4 above)

## 6. Relative Humidity [Equation 24, p. 6.12]

$$RH = (P_w / P_{ws}) \cdot 100 \qquad \text{(Eq. D-6)}$$

where

$RH$ = relative humidity, percent
$P_w$ = water vapor partial pressure, psia (from Equation D-5 above)
$P_{ws}$ = saturation pressure (for $T_{db}$), psia (from Equation D-2 or Equation D-3 above)

## 7. Specific Volume [Equation 28, p. 6.12]

$$v = [0.3704 \cdot (T_{db} + 459.67) \cdot (1 + 1.6078 \cdot W) / P] \qquad \text{(Eq. D-7)}$$

where

$v$ = specific volume, cu. ft./lb dry air
$T_{db}$ = dry bulb temperature, °F
$W$ = humidity ratio, lb water/lb dry air (from Equation D-4 above)
$P$ = total pressure, psia (from Equation B-1 above)

## 8. Density of moist air mixture, d [Equation 11, p. 6.2]

$$d = (1/v) \cdot (1 + W) \qquad \text{(Eq. D-8)}$$

where

$d$ = density, lb/cu. ft.
$v$ = specific volume, cu. ft./lb dry air (from Equation D-7 above)
$W$ = humidity ratio, lb water/lb dry air (from Equation D-4 above)

## 9. Enthalpy, h [Equation 32, p. 6.13]

$$h = (0.24 \cdot T_{db}) + [W \cdot (1061 + (0.444 \cdot T_{db})] \qquad \text{(Eq. D-9)}$$

where

$h$ = enthalpy, Btu/lb dry air
$T_{db}$ = dry bulb temperature, °F
$W$ = humidity ratio, lb water/lb dry air (from Equation D-4 above)

**10. Dew Point, Td (for Temperature < 32°F) [Equation 40, p. 6.13]**

$$T_d = 90.12 + [26.142 \cdot Ln(P_w)] + [0.8927 \cdot (Ln(P_w))^2] \qquad \text{(Eq. D-10)}$$

where

$T_d$ = dew point temperature, °F
$Ln$ = natural logarithm
$P_w$ = water vapor partial pressure, psia (from Equation D-5 above)

**11. Dew Point, Td (for Temperature = or > 32°F) [Equation 39, p. 6.13]**

$$T_d = 100.45 + [33.193 \cdot Ln(P_w)] + [2.319 \cdot (Ln(P_w))^2] + [0.17074 \cdot (Ln(P_w))^3] + [1.2063 \cdot (P_w)^{0.1984}]$$

(Eq. D-11)

where

$T_d$ = dew point temperature, °F
$Ln$ = natural logarithm
$P_w$ = water vapor partial pressure, psia (from Equation D-5 above)

**12. Mass of dry air, Mass**

$$M = CFM / v \qquad \text{(Eq. D-12)}$$

where

$M$ = mass of air, lb/min
*Airflow cfm* = airflow rate, cu. ft./min
$v$ = specific volume, cu. ft./lb dry air (from Equation D-7 above)

**13. Mixed Air Psychometric (Adiabatic Mixing) [Equation 46, p. 6.17]**

$$\text{MProp} = [(\text{Prop1} \cdot \text{Mass1}) + (\text{Prop2} \cdot \text{Mass2})]/[\text{Mass1} + \text{Mass2}]$$

(Eq. D-13)

where

Mprop = property of mixed air, enthalpy (h) or humidity ratio (W)
Prop1 = property of air stream #1, enthalpy (h) or humidity ratio (W)
Mass1 = mass of dry air stream #1, lb/min (from Equation D-12 above)
Prop2 = property of air stream #2, enthalpy (h) or humidity ratio (W)
Mass2 = mass of air stream #2, lb/min (from Equation D-12 above)

NOTE: It should be noted that only the enthalpy and the humidity ratio follows the above equation. Knowing two properties ($h$ and $W$), the rest of the other psychometric properties are determined using the equations found in Items 1 to 12. Also, wet bulb temperature calculation using the humidity ratio equation above will require trial and error because the saturated water pressure ($P_{ws}$) based on wet bulb temperature is required in the humidity ratio calculation. For initial value of the wet bulb temperature, the value determined from the mixed air equation above may be used, and then adjusted accordingly until the values converge.

## 14. Total Sensible Heat and Air flow Equation [Equation 43, p. 6.16]

From Equation D-16,

$$Q = (CFM \cdot d) \cdot 60 \cdot (h_L - h_E);$$

Substituting the value of enthalpy, h from Equation D-9 equation (with $W_E = W_L$):

$$Q_s = CFM \cdot 60 \cdot d_E \cdot (0.24 + 0.444W) \cdot (T_L - T_E) \qquad \text{(Eq. D-14)}$$

where

| | | |
|---|---|---|
| $Qs$ | = sensible heat gain, Btu/h |
| *Airflow cfm* | = airflow rate, cu. ft./min |
| $d_E$ | = density of incoming air, lb/cu. ft. @ $T_E$ |
| $W$ | = humidity ratio, lb water vapor/lb dry air |
| $T_L$ | = dry bulb temperature of leaving air, °F |
| $T_E$ | = dry bulb temperature of entering air, °F |
| 60 | = minutes per hour |
| 0.24 | = specific heat of dry air, Btu/lb °F |
| 0.444 | = specific heat of water vapor, Btu/lb °F |

The value of $0.444W$ being very small is disregarded.

## 15. Latent Heat and Air flow Equation [Equation 43, p. 6.16]

From Equation B-16,

$$Q = (CFM \cdot d) \cdot 60 \cdot (h_L - h_E);$$

Substituting the value of enthalpy, h from Equation D-9 equation (with $T_E = T_L$):

$$Q_L = CFM \cdot 60 \cdot d_E \cdot (1061 + 0.444T_E) \cdot (W_L - W_E) \qquad \text{(Eq. D-15)}$$

where

| | |
|---|---|
| $Q_L$ | = latent heat gain, Btu/h |
| $d_E$ | = density of incoming air, lb/cu. ft. @ $T_E$ |
| $T_E$ | = dry bulb temperature of entering air, °F |
| $W_L$ | = humidity ratio of leaving air, lb water vapor/lb dry air |
| $W_E$ | = humidity ratio of entering air, lb water vapor/lb dry air |
| 60 | = minutes per hour |
| 1061 | = energy content of water vapor at 50% RH and 75°F, Btu/lb °F |
| 0.444 | = specific heat of water vapor, Btu/lb °F |

**16. Grand Total Heat and Air flow Equation [Equation 45, p. 6.16]**

$$Q_T = CFM \cdot d_E \cdot 60 \cdot (h_L - h_E) - [(W_L - W_E) \cdot h_{WL}] \qquad \text{(Eq. D-16)}$$

where

| | |
|---|---|
| $Q_T$ | = Grand Total heat gain, Btu/h |
| *Airflow cfm* | = airflow rate in cu. ft/min |
| $d_E$ | = density of incoming air, lb/cu. ft. |
| 60 | = minutes per hour |
| $h_L$ | = enthalpy of leaving air, Btu/lb dry air (from Equation D-9 above) |
| $h_E$ | = enthalpy of entering air, Btu/lb dry air (from Equation D-9 above) |
| $W_L$ | = humidity ratio of leaving air, lb water vapor/lb dry air |
| $W_E$ | = humidity ratio of entering air, lb water vapor/lb dry air |
| $h_{WL}$ | = enthalpy of condensed water leaving, Btu/lb water. |

NOTE: The value of $[(W_L - W_S) \cdot h_{WL}]$ is negligible and is ignored.

# APPENDIX E: ROOM EQUIPMENT HEAT GAIN LIST

The Room Equipment Heat Gain List was originally assembled by asking each group/discipline to provide a list of equipment; they specified equipment room-by-room with their corresponding heat load and approximate number of hours or usage within a 24-hour period. After some follow-up conversations with each group/discipline, a Room Equipment Heat Gain List was assembled. Confirmation responses and original e-mails from each group/discipline are contained in Attachments 1 through 6 and Attachment 8.

Table E-1. Equipment Heat Gain List

(See Assumption 3.1.4)

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1002 | LID BOLTING ROOM | SITE TRANSPORTER | 1 | 0.25 | 0.85 | 75.0 | HP | A | 212,000 | | | X | 11,263 | | Mechanical Handling | See Attachment 8 & Note 15 |
| 1002 | LID BOLTING ROOM | CASK PREPARATION PLATFORM | 1 | 1.00 | 0.85 | 5.0 | HP | A | 15,500 | | X | | 0 | | Mechanical Handling | See Attachment 8 |
| 1002 | LID BOLTING ROOM | LOADING ROOM SHIELD DOOR | 1 | 0.10 | 1.00 | (2) 7.5 | HP | A | 22,700 each | | X | | 1,135 | | Mechanical Handling | See Attachment 6 & Note 15 |
| 1002 | LID BOLTING ROOM | TAD | 1 | 1.00 | 1.00 | 25.0 | KW | N/A | 85,325 | | | X | 85,325 | | Thermal Analysis | See Attachment 1 |
| 1002 | LID BOLTING ROOM | LID BOLTING RM. CRANE (VFD) RATED 10 TON | 1 | 0.35 | 1.00 | 25 | HP | A | 72,300 | | X | | 6,326 | | Mechanical Handling | See Attachment 6 & Note 15 |
| 1002 | LID BOLTING ROOM | LID BOLTING RM. CRANE ASD | 1 | 0.35 | 1.00 | 25 | HP | A | 2388 | | X | | 209 | | | See Note 15 |
| 1002 | LID BOLTING ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1002 | LID BOLTING ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1174 | | ES&H | See Attachment 3 |
| 1002 | LID BOLTING ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 1002 | LID BOLTING ROOM | MISC. EQUIPMENT | 1 | 1.00 | 1.00 | | | | 26,117 | x | | | 26,117 | | Mechanical Handling | See Note 16 |
| 1002 | LID BOLTING ROOM | | | | | | | | | | | | | 132,327 | | |
| 1003A | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 3 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 307 | | ES&H | See Attachment 3 |
| 1003A | CORRIDOR | | | | | | | | | | | | | 307 | | |
| 1003B | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 2 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 205 | | ES&H | See Attachment 3 |
| 1003B | CORRIDOR | | | | | | | | | | | | | 205 | | |
| 1003E | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 1003E | CORRIDOR | | | | | | | | | | | | | 102 | | |
| 1003F | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 2 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 205 | | ES&H | See Attachment 3 |
| 1003F | CORRIDOR | | | | | | | | | | | | | 205 | | |
| 1003G | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 3 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 307 | | ES&H | See Attachment 3 |
| 1003G | CORRIDOR | | | | | | | | | | | | | 307 | | |
| 1004 | HVAC ROOM (ITS HEPA | EXH-G EXHAUST FAN | 1 | 1.00 | 1.00 | 200 | HP | C | 50,300 | X | | | 50,300 | | HVAC | See Attachment 5 and |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EXHAUST TRAIN A) | | | | | | | | | | | | | | | Assumption 3.1.22 |
| 1004 | HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | EXH-G EXHAUST FAN ASD | 1 | 1.00 | 1.00 | 200 | HP | C | 10,426 | X | | | 10,426 | | HVAC | See Attachment 5 and Note 14 |
| 1004 | HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1004 | HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,174 | | ES&H | See Attachment 3 |
| 1004 | HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 1004 | HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | | | | | | | | | | | | | 62,678 | | |
| 1004A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN A) | 200-VCTO-EXH-00009 EXHAUST FAN | 1 | 1.00 | 1.00 | 5 | HP | C | 2,790 | X | | | 2,790 | | HVAC | See Attachment 5, Assumption 3.1.22 & Note 17 |
| 1004A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN A) | 200-VCTO-EXH-00009 EXHAUST FAN ASD | 1 | 1.00 | 1.00 | 5 | HP | C | 1,471 | X | | | 1,471 | | HVAC | See Attachment 5, Note 14 & Note 17 |
| 1004A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN A) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1004A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN A) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 150 | Watts | N/A | 512 | X | | | 4,096 | | ES&H | See Attachment 3 |
| 1004A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN A) | | | | | | | | | | | | | 8,794 | | |
| 1012 | LLW STAGING ROOM | AREA RADIATION MONITOR | 10 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 546 | | ES&H | See Attachment 3 |
| 1012 | LLW STAGING ROOM | CONTINUOUS AIR MONITOR | 10 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,466 | | ES&H | See Attachment 3 |
| 1012 | LLW STAGING ROOM | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 1012 | LLW STAGING ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 1012 | LLW STAGING ROOM | LLW LIQUID SUMP PUMP | 1 | 1.00 | 1.00 | 2 | HP | C | 1350 | | X | | 0 | | Mechanical Process | See Attachment 5 |
| 1012 | LLW STAGING ROOM | LLW SAMPLING PUMP | 1 | 1.00 | 1.00 | 0.5 | HP | C | 850 | | X | | 0 | | Mechanical Process | See Attachment 5 |
| 1012 | LLW STAGING ROOM | | | | | | | | | | | | | 2,455 | | |
| 1013 | LOADING ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1013 | LOADING ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1174 | | ES&H | See Attachment 3 |
| 1013 | LOADING ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 1013 | LOADING ROOM | TAD | 1 | 1.00 | 1.00 | 25.0 | KW | N/A | 85,325 | | | X | 85,325 | | Thermal | See Attachment 1 |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Analysis | |
| 1013 | LOADING ROOM | SITE TRANSPORTER | 1 | 0.25 | 0.85 | 75.0 | HP | A | 212,000 | | | X | 45,050 | | Mechanical Handling | See Attachment 8 |
| 1013 | LOADING ROOM | | | | | | | | | | | | | 132,327 | | |
| 1014 | MAINTENANCE ROOM | CHW PUMP | 1 | 1.00 | 1.00 | 50 | HP | C | 15,700 | X | | | 15,700 | | Mechanical Process | See Attachment 5 and Assumption 3.1.22 |
| 1014 | MAINTENANCE ROOM | CHW PUMP ASD | 1 | 1.00 | 1.00 | 50 | HP | C | 3,538 | X | | | 3,538 | | Mechanical Process | See Attachment 5 and Note 14 |
| 1014 | MAINTENANCE ROOM | TBD HW PUMP | 1 | 1.00 | 1.00 | 15 | HP | C | 6,210 | X | | | 6,210 | | Mechanical Process | See Attachment 5 and Assumption 3.1.22 |
| 1014 | MAINTENANCE ROOM | TBD HW PUMP ASD | 1 | 1.00 | 1.00 | 15 | HP | C | 1,930 | X | | | 1,930 | | Mechanical Process | See Attachment 5 and Note 14 |
| 1014 | MAINTENANCE ROOM | | | | | | | | | | | | | 27,378 | | |
| 1015 | CASK UNLOADING ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1015 | CASK UNLOADING ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1174 | | ES&H | See Attachment 3 |
| 1015 | CASK UNLOADING ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 1015 | CASK UNLOADING ROOM | TAD | 1 | 1.00 | 1.00 | 25.0 | KW | N/A | 85,325 | | | X | 85,325 | | Thermal Analysis | See Attachment 1 |
| 1015 | CASK UNLOADING ROOM | CASK TRANSFER TROLLEY | 1 | 1.00 | 1.00 | 5.0 | HP | A | 15,500 | | | X | 0 | | Mechanical Handling | See Attachment 6: air operated motor |
| 1015 | Cask Unloading Room | | | | | | | | | | | | | 87,277 | | |
| 1016 | CTM MAINTENANCE ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1016 | CTM MAINTENANCE ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1174 | | ES&H | See Attachment 3 |
| 1016 | CTM MAINTENANCE ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 1016 | CTM MAINTENANCE ROOM | | | | | | | | | | | | | 1,952 | | |
| 1017 | CASK PREPARATION ROOM | AREA RADIATION MONITOR | 12 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 655 | | ES&H | See Attachment 3 |
| 1017 | CASK PREPARATION ROOM | CONTINUOUS AIR MONITOR | 12 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1761 | | ES&H | See Attachment 3 |
| 1017 | CASK PREPARATION ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 1017 | CASK PREPARATION ROOM | CASK PREPARATION PLATFORM | 1 | 0.45 | 1.00 | (2) 10 | HP | A | 29,900 each | | X | | 6,728 | | Mechanical Handling | See Attachment 6 & Note 15 |
| 1017 | CASK PREPARATION ROOM | CASK HANDLING CRANE (VFD) RATED: 200 TON | 1 | 0.45 | 1.00 | 90 | HP | A | 254,600 | | | X | 28,642 | | Mechanical Handling | See Attachment 6 & Note 15.-Equip Load interpolated between 75 & 100 hp of Table 4.12 (Ref. 2.2.4) |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1017 | CASK PREPARATION ROOM | CASK HANDLING CRANE ASD | 1 | 0.45 | 1.00 | 90 | HP | A | 5374 | | X | | 604 | | Mechanical Handling | See Note 15 |
| 1017 | CASK PREPARATION ROOM | TRANSPORTATION CASK WITH TAD ON RAIL CAR | 1 | 1.00 | 1.00 | 25.0 | KW | N/A | 85,325 | | | X | 85,325 | | Waste Package | See Attachment 1 |
| 1017 | CASK PREPARATION ROOM | CASK UNLOADING ROOM SHIELD DOOR | 1 | 0.10 | 1.00 | (2) 7.5 | HP | A | 22,700 each | | X | | 1,135 | | Mechanical Handling | See Attachment 6 & Note 15 |
| 1017 | CASK PREPARATION ROOM | MISC. EQUIPMENT | 1 | 1.00 | 1.00 | | | | 250,569 | X | | | 250,569 | | Mechanical Handling | See Note 16 |
| 1017 | CASK PREPARATION ROOM | | | | | | | | | | | | | 375,760 | | |
| 1017A | CASK PREPARATION ANNEX | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1017A | CASK PREPARATION ANNEX | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1174 | | ES&H | See Attachment 3 |
| 1017A | CASK PREPARATION ANNEX | CASK PREP. ROOM EQUIP CONFINEMENT DOOR SOUTH | 1 | 0.10 | 1.00 | (2) 3 | HP | A | 9,430 each | | X | | 472 | | Mechanical Handling | See Attachment 6 & Note 15 |
| 1017A | CASK PREPARATION ANNEX | | | | | | | | | | | | | 2,083 | | |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 480 V LOAD CENTER | 1 | 1.00 | 1.00 | 11.16 | KW | N/A | 38,089 | X | | | 38,089 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 480 V MCC 1A | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 480 V MCC 1B | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 480 V MCC 1C | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 480 V MCC 1D | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 480 V MCC 1E | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 480 V MCC 1F | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | LIGHTING PANEL | 1 | 1.00 | 1.00 | 0.5 | KW | N/A | 1,707 | X | | | 1,707 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | LIGHTING PANEL | 1 | 1.00 | 1.00 | 0.5 | KW | N/A | 1,707 | X | | | 1,707 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 75 KVA XFMR | 1 | 1.00 | 1.00 | 2.695 | KW | N/A | 9,198 | X | | | 9,198 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | DISTRIBUTION PANEL | 1 | 1.00 | 1.00 | 0.5 | KW | N/A | 1,707 | X | | | 1,707 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | 75 KVA XFMR | 1 | 1.00 | 1.00 | 2.695 | KW | N/A | 9,198 | X | | | 9,198 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | DISTRIBUTION PANEL | 1 | 1.00 | 1.00 | 0.5 | KW | N/A | 1,707 | X | | | 1,707 | | Electrical | See Attachment 2 |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | DCMIS PANEL | 1 | 1.00 | 1.00 | 0.4 | KW | N/A | 1,365 | X | | | 1,365 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | DCMIS PANEL | 1 | 1.00 | 1.00 | 0.4 | KW | N/A | 1,365 | X | | | 1,365 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | PLC PANELS | 1 | 1.00 | 1.00 | 0.34 | KW | N/A | 1,160 | X | | | 1,160 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | PLC PANELS | 1 | 1.00 | 1.00 | 0.34 | KW | N/A | 1,160 | X | | | 1,160 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | UPS 05A | 1 | 1.00 | 1.00 | 6.556 | KW | N/A | 22,376 | X | | | 22,376 | | Electrical | See Attachment 2 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | MAINTENANCE BYPASS XFMR (40 KVA) | 1 | 1.00 | 1.00 | 0.5 | KW | N/A | 1,707 | X | | | 1,707 | | Electrical | See Attachment 2 |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | CABLE TRAY 36", 350' | 1 | 1.00 | 1.00 | 3.78 | KW | N/A | 12,901 | X | | | 12,901 | | Electrical | See Attachment 2 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 1018 | ELECTRICAL ROOM (NORMAL POWER) | | | | | | | | | | | | | 118,271 | | |
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | EXH-H EXHAUST FAN | 1 | 1.00 | 1.00 | 200 | HP | C | 50,300 | X | | | 50,300 | | HVAC | See Attachment 5 and Assumption 3.1.22 |
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | EXH-H EXHAUST FAN ASD | 1 | 1.00 | 1.00 | 200 | HP | C | 10,426 | X | | | 10,426 | | HVAC | See Attachment 5 and Note 14 |
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,174 | | ES&H | See Attachment 3 |
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | | | | | | | | | | | | | 62,678 | | |
| 1019A | HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN B) | 200-VCTO-EXH-00011 EXHAUST FAN | 1 | 1.00 | 1.00 | 15 | HP | C | 6,210 | X | | | 6,210 | | HVAC | See Attachment 5 and Assumption 3.1.22 |
| 1019A | HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN B) | 200-VCTO-EXH-00011 EXHAUST FAN ASD | 1 | 1.00 | 1.00 | 15 | HP | C | 1,930 | X | | | 1,930 | | HVAC | See Attachment 5 and Note 14 |
| 1019A | HVAC ROOM (ITS HEPA | AREA RADIATION | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EXHAUST FOR BATTERY ROOM TRAIN B) | MONITOR | | | | | | | | | | | | | | |
| 1019A | HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN B) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,174 | | ES&H | See Attachment 3 |
| 1019A | HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN B) | | | | | | | | | | | | | 9,751 | | |
| 1029 | ELEVATOR LOBBY | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 1029 | ELEVATOR LOBBY | | | | | | | | | | | | | 102 | | |
| 1212 | RP GEAR SUPPLY ROOM | PC | 4 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 410 | | ES&H | See Attachment 3 |
| 1215 | RP EQUIPMENT ROOM | PC | 4 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 410 | | ES&H | See Attachment 3 |
| 1216 | RESPIRATOR ROOM | PC | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 1216 | RESPIRATOR ROOM | RESPIRATOR DRYING EQUIPMENT | 1 | 1.00 | 1.00 | 2,760 | Watts | N/A | 9,420 | | X | | 0 | | ES&H | See Attachment 3 |
| 1216 | RESPIRATOR ROOM | RESPIRATOR WASHING EQUIPMENT | 1 | 1.00 | 1.00 | 2,760 | Watts | N/A | 9,420 | | X | | 0 | | ES&H | See Attachment 3 |
| 1217 | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 5 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 512 | | ES&H | See Attachment 3 |
| 1218 | RP LAB/COUNT ROOM | ALPHA SPECTOMETER | 1 | 1.00 | 1.00 | 3 | Watts | N/A | 10 | X | | | 10 | | ES&H | See Attachment 3 |
| 1218 | RP LAB/COUNT ROOM | FRISKER STATION | 2 | 1.00 | 1.00 | 0 | Watts | N/A | 0 | X | | | 0 | | ES&H | See Attachment 3 |
| 1218 | RP LAB/COUNT ROOM | GAMMA SPECTOMETER | 2 | 1.00 | 1.00 | 1,200 | Watts | N/A | 4,096 | X | | | 8,191 | | ES&H | See Attachment 3 |
| 1218 | RP LAB/COUNT ROOM | LIQUID SCINTILATION COUNTER | 1 | 1.00 | 1.00 | 1,230 | Watts | N/A | 4,198 | X | | | 4,198 | | ES&H | See Attachment 3 |
| 1218 | RP LAB/COUNT ROOM | PROPORTIONAL COUNTER | 1 | 1.00 | 1.00 | 575 | Watts | N/A | 1,962 | X | | | 1,962 | | ES&H | See Attachment 3 |
| 1218 | RP LAB/COUNT ROOM | SWIPE COUNTER | 2 | 1.00 | 1.00 | 575 | Watts | N/A | 1,962 | X | | | 3,925 | | ES&H | See Attachment 3 |
| 1219 | RP LAB/SAMPLE PREPARATION ROOM | FRISKER STATION | 1 | 1.00 | 1.00 | 0 | Watts | N/A | 0 | X | | | 0 | | ES&H | See Attachment 3 |
| 1219 | RP LAB/SAMPLE PREPARATION ROOM | SAMPLE PREPARATION HOOD | 1 | 1.00 | 1.00 | 0 | Watts | N/A | 0 | X | | | 0 | | ES&H | See Attachment 3 |
| 1220 | DECON ROOM | FRISKER STATION | 2 | 1.00 | 1.00 | 0 | Watts | N/A | 0 | X | | | 0 | | ES&H | See Attachment 3 |
| 1223 | GAS SAMPLING ROOM | 200-M60-MREO-00101-000 | 1 | 1.00 | 1.00 | 1 | HP | A | 3,390 | X | | | 3,390 | | Mechanical Process | See Attachment 5 and Assumption 3.1.22 |
| 1223 | GAS SAMPLING ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4; Room 1006 is now Room 1223 |
| 1223 | GAS SAMPLING ROOM | FRISKER STATION | 2 | 1.00 | 1.00 | 0 | Watts | N/A | 0 | X | | | 0 | | ES&H | See Attachment 3 |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1224 | RP INSTRUMENT ROOM | ELECTRONIC DOSIMETER CALIBRATOR | 1 | 1.00 | 1.00 | 1 | Watts | N/A | 3 | X | | | 3 | | ES&H | See Attachment 3 |
| 1224 | RP INSTRUMENT ROOM | PC | 2 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 205 | | ES&H | See Attachment 3 |
| Support Area 1212 thru 1224 | | | | | | | | | | | | | | 23,659 | | |
| 1221 | RA EXIT/ PCM ROOM | COMPUTER TERMINAL WALL DISPLAY | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 1221 | RA EXIT/ PCM ROOM | FRISKER | 1 | 1.00 | 1.00 | 0 | Watts | N/A | 0 | X | | | 0 | | ES&H | See Attachment 3 |
| 1221 | RA EXIT/ PCM ROOM | RADIATION AREA ACCESS CONTROL STATION | 4 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 410 | | ES&H | See Attachment 3 |
| 1221 | RA EXIT/ PCM ROOM | SMALL EQUIPMENT MONITOR | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 1221 | RA EXIT/ PCM ROOM | PERSONNEL PORTAL MONITOR | 4 | 1.00 | 1.00 | 250 | Watts | N/A | 853 | X | | | 3,413 | | ES&H | See Attachment 3 |
| 1221 | RA EXIT/ PCM ROOM | | | | | | | | | | | | | 4,027 | | |
| 2001 | OPERATIONS/MAINTENANCE STTORAGE ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2001 | OPERATIONS/MAINTENANCE STTORAGE ROOM | | | | | | | | | | | | | 341 | | |
| 2002A | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 2002A | CORRIDOR | | | | | | | | | | | | | 102 | | |
| 2002B | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 3 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 307 | | ES&H | See Attachment 3 |
| 2002B | CORRIDOR | | | | | | | | | | | | | 307 | | |
| 2002C | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 2002C | CORRIDOR | | | | | | | | | | | | | 102 | | |
| 2002E | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 5 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 512 | | ES&H | See Attachment 3 |
| 2002E | CORRIDOR | | | | | | | | | | | | | 512 | | |
| 2002F | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 2002F | CORRIDOR | | | | | | | | | | | | | 102 | | |
| 2002G | CORRIDOR | RADIATION AREA | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ACCESS CONTROL STATION | | | | | | | | | | | | | | |
| 2002G | CORRIDOR | | | | | | | | | | | | | 102 | | |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,174 | | ES&H | See Attachment 3 |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | AHU-C AIR HANDLING UNIT ASD | 1 | 1.00 | 1.00 | 125 | HP | C | 6,982 | X | | | 6,982 | | HVAC | See Attachment 5 and Note 14 |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | AHU-D AIR HANDLING UNIT ASD | 1 | 1.00 | 1.00 | 125 | HP | C | 6,982 | X | | | 6,982 | | HVAC | See Attachment 5 and Note 14 |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | | | | | | | | | | | | | 15,916 | | |
| 2004 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 6 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 328 | | ES&H | See Attachment 3 |
| 2004 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 6 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 881 | | ES&H | See Attachment 3 |
| 2004 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2004 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | AHU-E AIR HANDLING UNIT ASD | 1 | 1.00 | 1.00 | 125 | HP | C | 6,982 | X | | | 6,982 | | HVAC | See Attachment 5 and Note 14 |
| 2004 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | | | | | | | | | | | | | 8,532 | | |
| 2005 | INSTRUMENT AND ELECTRICAL SHOP | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2005 | INSTRUMENT AND ELECTRICAL SHOP | | | | | | | | | | | | | 341 | | |
| 2006 | HVAC ROOM (HEPA EXHAUST FOR SUPPORT, DECON AND LLW AREAS) | AREA RADIATION MONITOR | 10 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 546 | | ES&H | See Attachment 3 |
| 2006 | HVAC ROOM (HEPA EXHAUST FOR SUPPORT, DECON AND LLW AREAS) | CONTINUOUS AIR MONITOR | 10 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,468 | | ES&H | See Attachment 3 |
| 2006 | HVAC ROOM (HEPA EXHAUST FOR SUPPORT, DECON AND LLW AREAS) | EXH-D & E EXHAUST FAN | 2 | 1.00 | 1.00 | 75 | HP | C | 21,200 | X | | | 42,400 | | HVAC | See Attachment 5 and Assumption 3.1.22 |
| 2006 | HVAC ROOM (HEPA EXHAUST FOR SUPPORT, DECON AND LLW AREAS) | EXH-D & E EXHAUST FAN ASD | 2 | 1.00 | 1.00 | 75 | HP | C | 4,685 | X | | | 9370 | | HVAC | See Attachment 5 and Note 14 |
| 2006 | HVAC ROOM (HEPA EXHAUST FOR SUPPORT, DECON AND LLW AREAS) | | | | | | | | | | | | | 53,784 | | |
| 2007 | CANISTER TRANSFER ROOM | CTM MAINTENANCE | 1 | 0.10 | 0.85 | 35 | HP | A | 99,850 | | X | | 2,122 | | Mechanical | See Attachment 6 & |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CRANE (VFD) RATED 15 TON | | | | | | | | | | | | | Handling | Note 15 -Equipment Load interpolated between 30 & 40 hp of Table 4.12 (Ref. 2.2.4) |
| 2007 | CANISTER TRANSFER ROOM | CTM MAINTENANCE CRANE ASD | 1 | 0.10 | 0.85 | 35 | HP | A | 2,849 | | | | 61 | | Mechanical Handling | See Note 15 |
| 2007 | CANISTER TRANSFER ROOM | CANISTER TRANSFER MACHINE (VFD): RATED: 450 TON | 1 | 0.20 | 1.00 | 60 | HP | A | 172,000 | | | X | 8,600 | | Mechanical Handling | See Attachment 6 |
| 2007 | CANISTER TRANSFER ROOM | CANISTER TRANSFER MACHINE ASD | 1 | 0.20 | 1.00 | 60 | HP | A | 3,996 | | | | 200 | | Mechanical Handling | See Note 15 |
| 2007 | CANISTER TRANSFER ROOM | CAST PORT SLIDE GATE | 1 | 0.10 | 1.00 | (2) 0.5 | HP | A | 2,120 each | | X | | 106 | | Mechanical Handling | See Attachment 6 & Note 15 |
| 2007 | CANISTER TRANSFER ROOM | A/O/STC PORT SLIDE GATE | 1 | 0.10 | 1.00 | (2) 0.5 | HP | A | 2,120 each | | X | | 106 | | Mechanical Handling | See Attachment 6 & Note 15 |
| 2007 | CANISTER TRANSFER ROOM | TAD | 1 | 1.00 | 1.00 | 25.0 | KW | N/A | 85,325 | | | X | 85,325 | | Thermal Analysis | See Attachment 1 |
| 2007 | CANISTER TRANSFER ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 2007 | CANISTER TRANSFER ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,174 | | ES&H | See Attachment 3 |
| 2007 | CANISTER TRANSFER ROOM | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2007 | CANISTER TRANSFER ROOM | MISC. EQUIPMENT | 1 | 1.00 | 1.00 | | | | 152,215 | X | | | 152,215 | | Mechanical Handling | See Note 16 |
| 2007 | Canister Transfer Room | | | | | | | | | | | | | 250,687 | | |
| 2009 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2009 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AHU-F AIR HANDLING UNIT ASD | 1 | 1.00 | 1.00 | 100 | HP | C | 5,834 | X | | | 5,834 | | HVAC | See Attachment 5 and Note 14 |
| 2009 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | | | | | | | | | | | | | 6,175 | | |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,174 | | ES&H | See Attachment 3 |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AHU-G AIR HANDLING UNIT ASD | 1 | 1.00 | 1.00 | 100 | HP | C | 5,834 | X | | | 5,834 | | HVAC | See Attachment 5 and |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AHU-H AIR HANDLING UNIT ASD | 1 | 1.00 | 1.00 | 75 | HP | C | 4,686 | X | | | 4,686 | | HVAC | See Attachment 5 and |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | | | | | | | | | | | | | 12,472 | | |
| 2011 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | Watts | N/A | 55 | X | | | 437 | | ES&H | See Attachment 3 |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | |
| 2011 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | Watts | N/A | 147 | X | | | 1,174 | | ES&H | See Attachment 3 |
| 2011 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | RIO | 1 | 1.00 | 1.00 | 100 | Watts | N/A | 341 | X | | | 341 | | I & C | See Attachment 4 |
| 2011 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AHU-I AIR HANDLING UNIT ASD | 1 | 1.00 | 1.00 | 75 | HP | C | 4,686 | X | | | 4,686 | | HVAC | See Attachment 5, and Assumption 3.1.22 |
| 2011 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY | | | | | | | | | | | | | 6,638 | | |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | 480V LOAD CENTER | 1 | 1.00 | 1.00 | 7.1 | KW | N/A | 24,232 | X | | | 24,232 | | ELECTRIC AL | See Attachment 2 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | 480V MCC | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | ELECTRIC AL | See Attachment 2 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | 480V MCC | 1 | 1.00 | 1.00 | 0.631 | KW | N/A | 2,154 | X | | | 2,154 | | ELECTRIC AL | See Attachment 2 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | 75 KVA XFMR | 1 | 1.00 | 1.00 | 2.695 | KW | N/A | 9,198 | X | | | 9,198 | | ELECTRIC AL | See Attachment 2 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | LIGHTING PANEL | 1 | 1.00 | 1.00 | 0.5 | KW | N/A | 1,707 | X | | | 1,707 | | ELECTRIC AL | See Attachment 2 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | DISTRIBUTION PANEL | 1 | 1.00 | 1.00 | 0.5 | KW | N/A | 1,707 | X | | | 1,707 | | ELECTRIC AL | See Attachment 2 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | CABLE TRAY 36", 350' | 1 | 1.00 | 1.00 | 3.78 | KW | N/A | 12,901 | X | | | 12,901 | | ELECTRIC AL | See Attachment 2 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | REFRIG. AIR DRYER AIR-COOLED CONDENSER HEAT REJECTION | 1 | 0.50 | 1.00 | 120,596 | BTU/H | N/A | 60,298 | | | X | 60,298 | | Mechanical Process | Reference 2.2.28 Assumption 3.1.23 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | IA DRYER PACKAGED | 1 | 0.50 | 1.00 | 3 | KW | N/A | 5120 | | | X | 5,120 | | Mechanical Process | See Attachment 5 |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | MISC. EQUIPMENT | 1 | 1.00 | 1.00 | | | | 954 | | | | 954 | | | |
| 2012 | RECIVER/DRYER EQUIPMENT ROOM | | | | | | | | | | | | | 120,425 | | |
| 2029 | ELEVATOR LOBBY | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | Watts | N/A | 102 | X | | | 102 | | ES&H | See Attachment 3 |
| 2029 | ELEVATOR LOBBY | | | | | | | | | | | | | 102 | | |

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load, Each Note 5 | Units Note 6 | Motor Location Note 7 | Equip Load Btu/h Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Equip Load by Process Btu/hr Note 12 | Equip Load USED, per Rm Btu/h Note 13 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

NOTES:

1. Description of equipment that gives up heat in a room.
2. Quantity of equipment in a room.
3. USE FACTOR means the approximate usage of equipment based on a 24 hour period.
4. LOAD FACTOR applies to equipment driven by electric motor such as Cranes, Trolleys and Site Transporter. The electric motor horsepower selection is based on the maximum capacity that the equipment can handle. In reality, these pieces of equipment are not lifting or pulling the maximum load all the time during a 24 hour period, therefore 85% load factor is a very conservative assumption.
5. Heat load that each equipment gives up into a room. Refer to next column for units (WATTS, KW or HP)
6. The conversion factor used to convert WATTS to Btu/hr is 3.413 and KW to Btu/hr is 3413. For HP, refer to Note 7.
7. Refer to Table 4.12 of ASHRAE Cooling and Heating Load Calculation Manual (Reference 2.2.4) for location of motor and driven equipment with respect to conditioned space or airstream (A - motor in, driven equipment in, B - motor out, driven equipment in, C - motor in, driven equipment out) and equivalent Btu/hr rating for listed motor hp.
8. Equipment heat load in Btu/hr
9. "Continuous Operation" means equipment is operating all the time 24 hour a day, heat load is constant.
10. "Intermittent Operation" means equipment is operating ON and OFF during a 24 hour period. The time of operation is not simultaneous with other equipment in a room which is also operating intermittently.
11. "Simultaneous Operation" means the equipment is also operating ON and OFF, but it operates at same time with other equipment which is also operating intermittently.
12. Heat load by an individual equipment based on the type of operation (continuous, intermittent or simultaneous).
13. The total equipment heat load per room (Obtained by adding all the equipment heat load in a room under the column "Equipment Load by Process"
14. Reference 2.2.25, Equation 34, p. 868
15. A 25% Diversity Factor is applied to the overall mechanical handling equipment (e.g. crane motors) heat gain per Attachment 9. (Example: Equip Load by Process = Use Factor x Load Factor x Equip Load X 0.25)
16. Miscellaneous Equipment are future additional load that are not known at this time. (See Assumption 3.1.24)
17. The brake horsepower for this exhaust fan increases from 5 to 5.65, however 5 brake horsepower was used in this calculation for this room only. The total heat load difference between 5 and 5.65 bhp is 252 Btu/h (approx. 7cfm) which is negligible.

# APPENDIX F: CALCULATED ROOF AND WALL COOLING LOADS

Tables F-1 and F-2 present the room-by-room roof and wall cooling load calculations, respectively, for the peak month and hour of each room.

Table F-1. Room-by-Room Calculated Roof Cooling Loads

| Room No. Note 1 | Room Name Note 1 | Room Peak Mo/hr Note 2 | Design Room Temp. °F Note 1 | Roof Area $ft^2$ Note 1 | Roof Type Note 1 | U-value of Roof Btu/h ft2 °F Note 1 | Unadjusted Roof CLTD °F Note 4 | CLTD Correction for Latitude And Month °F Note 5 | K Color Correction Factor Note 6 | CLTD Indoor Temperature Adjustment °F Note 7 | CLTD Outdoor Temperature Adjustment °F Note 8 | f-factor Note 9 | Adjusted Roof CLTD °F Note 10 | Calculated Roof Load Btu/h Note 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1002 | Lid Bolting Room | 6/15 | 90 | 1,980 | Type 12 | 0.031 | 29 | 2 | 1 | -12 | 4.05 | 1 | 23.05 | 1,415 |
| 1003A | Corridor | 6/15 | 82 | 0 | | | | | | | | | | 0 |
| 1003B | Corridor | All | 82 | 0 | | | | | | | | | | 0 |
| 1003C | Corridor | 6/15 | 82 | 0 | | | | | | | | | | 0 |
| 1003D | Corridor | All | 82 | 0 | | | | | | | | | | 0 |
| 1003E | Corridor | 9/16 | 82 | 0 | | | | | | | | | | 0 |
| 1003F | Corridor | 9/15 | 82 | 0 | | | | | | | | | | 0 |
| 1003G | Corridor | 9/15 | 82 | 0 | | | | | | | | | | 0 |
| 1003H | Utility Chase | All | 90 | 0 | | | | | | | | | | 0 |
| 1004 | HVAC Room (ITS HEPA Exhaust Train A) | 6/20 | 90 | 0 | | | | | | | | | | 0 |
| 1004A | HVAC Room (ITS HEPA Exhaust for Battery Room Train A) | 6/16 | 90 | 0 | | | | | | | | | | 0 |
| 1012 | LLW Staging Room | 6/17 | 90 | 0 | | | | | | | | | | 0 |
| 1013 | Loading Room | All | 100 | 0 | | | | | | | | | | 0 |
| 1014 | Maintenance Room | All | 79 | 0 | | | | | | | | | | 0 |
| 1015 | Cask Unloading Room | All | 100 | 0 | | | | | | | | | | 0 |
| 1016 | CTM Maintenance Room | All | 90 | 0 | | | | | | | | | | 0 |
| 1017 | Cask Preparation Room | 6/15 | 79 | 6,730 | Type 12 | 0.031 | 29 | 2 | 1 | -1 | 4.05 | 1 | 34.05 | 7,104 |
| 1017A | Cask Preparation Annex | 9/19 | 79 | 0 | | | | | | | | | | 0 |
| 1018 | Electrical Room (Normal Power) | 6/23 | 90 | 0 | | | | | | | | | | 0 |
| 1018A | Battery Room (Normal Power) | 9/21 | 77 | 0 | | | | | | | | | | 0 |
| 1019 | HVAC Room (ITS HEPA Exhaust Train B) | 9/22 | 90 | 0 | | | | | | | | | | 0 |
| 1019A | HVAC Room (ITS HEPA Exhaust for Battery Room Train B) | 9/21 | 90 | 0 | | | | | | | | | | 0 |
| 1028 | Freight Elevator | 6/16 | 90 | 260 | Type 1 | 0.065 | 74 | 2 | 1 | -12 | 4.05 | 1 | 68.05 | 1,150 |
| 1029 | Elevator Lobby | 9/15 | 82 | 0 | | | | | | | | | | 0 |
| 1212 to 1224 | Support Areas [Excluding Room 1221] (Assumption 3.1.20) | 6/15 | 78 | 0 | | | | | | | | | | 0 |
| 1221 & 1205 | Support Areas (Assumption 3.1.20) | 6/15 | 78 | 670 | Type 1 | 0.065 | 74 | 2 | 1 | 0 | 4.05 | 1 | 80.05 | 3,486 |
| | | | | | | | | | | | | | | |
| 2001 | Operations/Maintenance Storage Room | 6/21 | 90 | 1,790 | Type 12 | 0.031 | 29 | 2 | 1 | -12 | 4.05 | 1 | 23.05 | 1,279 |
| 2002A | Corridor | 6/15 | 82 | 0 | | | | | | | | | | 0 |
| 2002B | Corridor | All | 82 | 0 | | | | | | | | | | 0 |
| 2002C | Corridor | All | 82 | 0 | | | | | | | | | | 0 |
| 2002D | Corridor | 6/15 | 82 | 0 | | | | | | | | | | 0 |
| 2002E | Corridor | All | 82 | 0 | | | | | | | | | | 0 |
| 2002F | Corridor | 6/15 | 82 | 0 | | | | | | | | | | 0 |

| Room No. Note 1 | Room Name Note 1 | Room Peak Mo/hr Note 2 | Design Room Temp. °F Note 1 | Roof Area $ft^2$ Note 1 | Roof Type Note 1 | U-value of Roof Btu/h ft2 °F Note 1 | Unadjusted Roof CLTD °F Note 4 | CLTD Correction for Latitude And Month °F Note 5 | K Color Correction Factor Note 6 | CLTD Indoor Temperature Adjustment °F Note 7 | CLTD Outdoor Temperature Adjustment °F Note 8 | f-factor Note 9 | Adjusted Roof CLTD °F Note 10 | Calculated Roof Load Btu/h Note 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002G | Corridor | All | 82 | 0 | | | | | | | | | | 0 |
| 2003 | HVAC Room North (Process Area Supply) | 6/16 | 90 | 4,840 | Type 12 | 0.031 | 29 | 2 | 1 | -12 | 4.05 | 1 | 23.05 | 3,458 |
| 2004 | HVAC Room North (Process Area Supply) | 6/16 | 90 | 3,170 | Type 12 | 0.031 | 29 | 2 | 1 | -12 | 4.05 | 1 | 23.05 | 2,265 |
| 2005 | Instrument and Electrical Shop | 6/18 | 90 | 4,290 | Type 12 | 0.031 | 29 | 2 | 1 | -12 | 4.05 | 1 | 23.05 | 3,065 |
| 2006 | HVAC Room (HEPA Exhaust for Support, Decon and LLW Areas) | 6/17 | 90 | 3,180 | Type 12 | 0.031 | 29 | 2 | 1 | -12 | 4.05 | 1 | 23.05 | 2,272 |
| 2007 | Canister Transfer Room | 6/22 | 79 | 7,770 | Type 12 | 0.031 | 29 | 2 | 1 | -1 | 4.05 | 1 | 34.05 | 8,202 |
| 2009 | HVAC Room South (Process Area Supply) | 6/23 | 90 | 3,490 | Type 12 | 0.031 | 29 | 2 | 1 | -12 | 4.05 | 1 | 23.05 | 2,494 |
| 2010 | HVAC Room South (Process Area Supply) | 9/22 | 90 | 4,840 | Type 12 | 0.031 | 29 | -6.73 | 1 | -12 | 4.05 | 1 | 14.32 | 2,149 |
| 2011 | HVAC Room South (Process Area Supply) | 9/22 | 90 | 3,170 | Type 12 | 0.031 | 29 | -6.73 | 1 | -12 | 4.05 | 1 | 14.32 | 1,407 |
| 2012 | Receiver/Dryer Equipment Room | 9/21 | 90 | 4,290 | Type 12 | 0.031 | 29 | -6.73 | 1 | -12 | 4.05 | 1 | 14.32 | 1,904 |
| 2029 | Elevator Lobby | 9/15 | 82 | 0 | | | | | | | | | | 0 |
| | | | | | | | | | | | | | | |
| 3001 | Corridor | 9/15 | 82 | 280 | Type 1 | 0.065 | 74 | -6.73 | 1 | -4 | 4.05 | 1 | 67.32 | 1,225 |
| 3029 | Elevator Lobby | 6/15 | 82 | 0 | | | | | | | | | | 0 |
| | | | | | | | | | | | | | | |
| R001 | Firefight Elevator Machine Room | 6/16 | 90 | 940 | Type 1 | 0.065 | 74 | 2 | 1 | -12 | 4.05 | 1 | 68.05 | 4,158 |
| | | | | | | | | | | | | | Grand Total | 47,033 |

NOTES:

1. From information and data contained in the Room Load Information Sheets in Appendix A. See the Room Load Information Sheets for additional remarks about the loads per room.
2. Determined using the Cooling and Heating Load Calculation Methodology on a room-by-room basis, outlined in Section 6.1.3. "All" means that the load is constant, room has no exterior exposure.
3. Not Used.
4. From Appendix B, Table B-1.
5. From Appendix B, Table B-2.
6. See Assumption 3.2.3.
7. Appendix B, From Equation B-1. The value equals 78 oF minus the design room temperature.
8. Appendix B, From Equation B-1. The value equals the average outside temperature on design day minus 85 oF, where the average outside temperature is 89.05 oF for 102 oF.
9. From Appendix B text and part of Equation B-1.
10. Using Equation B-1 with information from the previous columns.
11. Product of "Roof Area", "U-Value of Roof," and "Adjusted Roof CLTD." (Equation C-1)

Table F-2. Room-by-Room Calculated Wall Cooling Loads

| Room No. Note 1 | Room Name Note 1 | Room Peak Mo/hr Note 2 | Design Room Temp. °F Note 1 | Wall Orientation Note 1 | U-value of Wall Btu/h ft2 °F Note 1 | Wall Area $ft^2$ Note 1 | Wall Group Note 1 | Unadjusted Wall CLTD °F Note 4 | CLTD Correction for Latitude And Month °F Note 5 | K Color Correction factor Note 6 | CLTD Indoor Temperature Adjustment °F Note 7 | CLTD Outdoor Temperature Adjustment °F Note 8 | Adjusted Wall CLTD °F Note 9 | Calculated Wall Load Btu/h Note 10 | Total Wall Load Btu/h Note 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1002 | Lid Bolting Room | 6/15 | 90 | NW | 0.22 | 2750 | B | 12 | 1.42 | 1 | -12 | 4.05 | 5.47 | 3,309 | 3,309 |
| 1003A | Corridor | 6/15 | 82 | NE | 0.22 | 130 | B | 18 | 1.42 | 1 | -4 | 4.05 | 19.47 | 557 | 557 |
| 1003B | Corridor | All | 82 | | | | | | | | | | | | 0 |
| 1003C | Corridor | 6/15 | 82 | NE | 0.22 | 110 | B | 18 | 1.42 | 1 | -4 | 4.05 | 19.47 | 471 | 471 |
| 1003D | Corridor | All | 82 | | | | | | | | | | | | 0 |
| 1003E | Corridor | 9/16 | 82 | SW | 0.113 | 150 | G | 63 | 3.58 | 1 | -4 | 4.05 | 66.63 | 1,129 | 1,129 |
| 1003F | Corridor | 9/15 | 82 | SW | 0.22 | 130 | B | 14 | 3.58 | 1 | -4 | 4.05 | 17.63 | 504 | 504 |
| 1003G | Corridor | 9/15 | 82 | SW | 0.22 | 100 | B | 14 | 3.58 | 1 | -4 | 4.05 | 17.63 | 388 | 388 |
| 1003H | Utility Chase | All | 90 | | | | | | | | | | | | 0 |
| 1004 | HVAC Room (ITS HEPA Exhaust Train A) | 6/20 | 90 | NE | 0.22 | 1060 | B | 21 | 1.42 | 1 | -12 | 4.05 | 14.47 | 3,374 | 3,374 |
| 1004A | HVAC Room (ITS HEPA Exhaust for Battery Room Train A) | 6/16 | 90 | NE | 0.22 | 700 | B | 19 | 1.42 | 1 | -12 | 4.05 | 12.47 | 1,920 | 1,920 |
| 1012 | LLW Staging Room | 6/17 | 90 | NE | 0.22 | 1380 | B | 19 | 1.42 | 1 | -12 | 4.05 | 12.47 | 3,786 | |
| | | 6/17 | 90 | NW | 0.37 | 1410 | B | 13 | 1.42 | 1 | -12 | 4.05 | 6.47 | 3,375 | |
| | | | | | | | | | | | | | | Total | 7,161 |
| 1013 | Loading Room | All | 100 | | | | | | | | | | | | 0 |
| 1014 | Maintenance Room | All | 79 | | | | | | | | | | | | 0 |
| 1015 | Cask Unloading Room | All | 100 | | | | | | | | | | | | 0 |
| 1016 | CTM Maintenance Room | All | 90 | | | | | | | | | | | | 0 |
| 1017 | Cask Preparation Room | 6/15 | 79 | SE | 0.22 | 890 | B | 21 | -0.85 | 1 | -1 | 4.05 | 23.2 | 4,543 | |
| | | 6/15 | 79 | NE | 0.22 | 730 | B | 18 | 1.42 | 1 | -1 | 4.05 | 22.47 | 3,609 | |
| | | 6/15 | 79 | SW | 0.22 | 730 | B | 14 | -0.85 | 1 | -1 | 4.05 | 16.2 | 2,602 | |
| | | | | | | | | | | | | | | Total | 10,753 |
| 1017A | Cask Preparation Annex | 9/19 | 79 | SE | 0.22 | 670 | B | 26 | 3.58 | 1 | -1 | 4.05 | 32.63 | 4,810 | 4,810 |
| 1018 | Electrical Room (Normal Power) | 6/23 | 90 | SW | 0.22 | 830 | B | 28 | -0.85 | 1 | -12 | 4.05 | 19.2 | 3,506 | |
| | | 6/23 | 90 | NW | 0.22 | 1660 | B | 23 | 1.42 | 1 | -12 | 4.05 | 16.47 | 6,015 | |
| | | | | | | | | | | | | | | Total | 9,521 |
| 1018A | Battery Room (Normal Power) | 9/21 | 77 | SW | 0.22 | 640 | B | 27 | 3.58 | 1 | 1 | 4.05 | 35.63 | 5,017 | |
| | | 9/21 | 77 | NW | 0.22 | 170 | B | 21 | -4.58 | 1 | 1 | 4.05 | 21.47 | 803 | |
| | | | | | | | | | | | | | | Total | 5,820 |
| 1019 | HVAC Room (ITS HEPA Exhaust Train B) | 9/22 | 90 | SW | 0.22 | 1060 | B | 28 | 3.58 | 1 | -12 | 4.05 | 23.63 | 5,511 | 5,511 |
| 1019A | HVAC Room (ITS HEPA Exhaust for Battery Room Train B) | 9/21 | 90 | SW | 0.22 | 700 | B | 27 | 3.58 | 1 | -12 | 4.05 | 22.63 | 3,485 | 3,485 |
| 1028 | Freight Elevator | 6/16 | 90 | NW | 0.113 | 1080 | G | 47 | 1.42 | 1 | -12 | 4.05 | 40.47 | 4,939 | |
| | | 6/16 | 90 | SW | 0.113 | 790 | G | 63 | -0.85 | 1 | -12 | 4.05 | 54.2 | 4,838 | |

| Room No. Note 1 | Room Name Note 1 | Room Peak Mo/hr Note 2 | Design Room Temp. °F Note 1 | Wall Orientation Note 1 | U-value of Wall Btu/h ft2 °F Note 1 | Wall Area $ft^2$ Note 1 | Wall Group Note 1 | Unadjusted Wall CLTD °F Note 4 | CLTD Correction for Latitude And Month °F Note 5 | K Color Correction factor Note 6 | CLTD Indoor Temperature Adjustment °F Note 7 | CLTD Outdoor Temperature Adjustment °F Note 8 | Adjusted Wall CLTD °F Note 9 | Calculated Wall Load Btu/h Note 10 | Total Wall Load Btu/h Note 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 6/16 | 90 | NE | 0.113 | 470 | G | 26 | 1.42 | 1 | -12 | 4.05 | 19.47 | 1,034 | |
| | | | | | | | | | | | | | | Total | 10,811 |
| 1029 | Elevator Lobby | 9/15 | 82 | SW | 0.113 | 740 | G | 59 | 3.58 | 1 | -4 | 4.05 | 62.63 | 5,237 | 5,237 |
| 1212 to 1224 | Support Areas [Excluding Room 1221] (Assumption 3.1.20) | 6/15 | 78 | NE | 0.22 | 1550 | B | 18 | 1.42 | 1 | 0 | 4.05 | 23.47 | 8,003 | 8,003 |
| 1221 & 1205 | Support Areas (Assumption 3.1.20) | 6/15 | 78 | | | | | | | | | | | | 0 |
| 2001 | Operations/Maintenance Storage Room | 6/21 | 90 | NE | 0.22 | 1470 | B | 21 | 1.42 | 1 | -12 | 4.05 | 14.47 | 4,680 | |
| | | 6/21 | 90 | NW | 0.22 | 1250 | B | 21 | 1.42 | 1 | -12 | 4.05 | 14.47 | 3,979 | |
| | | | | | | | | | | | | | | Total | 8,659 |
| 2002A | Corridor | 6/15 | 82 | NE | 0.22 | 130 | B | 18 | 1.42 | 1 | -4 | 4.05 | 19.47 | 557 | 557 |
| 2002B | Corridor | All | 82 | | | | | | | | | | | | 0 |
| 2002C | Corridor | All | 82 | | | | | | | | | | | | 0 |
| 2002D | Corridor | 6/15 | 82 | NE | 0.113 | 140 | G | 27 | 1.42 | 1 | -4 | 4.05 | 28.47 | 450 | |
| | | 6/15 | 82 | SW | 0.113 | 140 | G | 59 | -0.85 | 1 | -4 | 4.05 | 58.2 | 921 | |
| | | | | | | | | | | | | | | Total | 1,371 |
| 2002E | Corridor | All | 82 | | | | | | | | | | | | 0 |
| 2002F | Corridor | 6/15 | 82 | NE | 0.22 | 130 | B | 18 | 1.42 | 1 | -4 | 4.05 | 19.47 | 557 | 557 |
| 2002G | Corridor | All | 82 | | | | | | | | | | | | 0 |
| 2003 | HVAC Room North (Process Area Supply) | 6/16 | 90 | NE | 0.22 | 1760 | B | 19 | 1.42 | 1 | -12 | 4.05 | 12.47 | 4,828 | 4,828 |
| 2004 | HVAC Room North (Process Area Supply) | 6/16 | 90 | NE | 0.22 | 1250 | B | 19 | 1.42 | 1 | -12 | 4.05 | 12.47 | 3,429 | 3,429 |
| 2005 | Instrument and Electrical Shop | 6/18 | 90 | NE | 0.22 | 1660 | B | 20 | 1.42 | 1 | -12 | 4.05 | 13.47 | 4,919 | |
| | | 6/18 | 90 | SE | 0.22 | 2070 | B | 25 | -0.85 | 1 | -12 | 4.05 | 16.2 | 7,377 | |
| | | | | | | | | | | | | | | Total | 12,297 |
| 2006 | HVAC Room (HEPA Exhaust for Support, Decon and LLW Areas) | 6/17 | 90 | NE | 0.22 | 1380 | B | 19 | 1.42 | 1 | -12 | 4.05 | 12.47 | 3,786 | |
| | | 6/17 | 90 | NW | 0.37 | 2370 | B | 13 | 1.42 | 1 | -12 | 4.05 | 6.47 | 5,674 | |
| | | | | | | | | | | | | | | Total | 9,459 |
| 2007 | Canister Transfer Room | 6/22 | 79 | NE | 0.22 | 3780 | B | 21 | 1.42 | 1 | -1 | 4.05 | 25.47 | 21,181 | |
| | | 6/22 | 79 | SW | 0.22 | 3320 | B | 28 | -0.85 | 1 | -1 | 4.05 | 30.2 | 22,058 | |
| | | 6/22 | 79 | NW | 0.22 | 2660 | B | 22 | 1.42 | 1 | -1 | 4.05 | 26.47 | 15,490 | |
| | | 6/22 | 79 | SE | 0.22 | 2070 | B | 26 | -0.85 | 1 | -1 | 4.05 | 28.2 | 12,842 | |
| | | | | | | | | | | | | | | Total | 71,571 |
| 2009 | HVAC Room South (Process Area Supply) | 6/23 | 90 | SW | 0.22 | 1470 | B | 28 | -0.85 | 1 | -12 | 4.05 | 19.2 | 6,209 | |
| | | 6/23 | 90 | NW | 0.22 | 1820 | B | 23 | 1.42 | 1 | -12 | 4.05 | 16.47 | 6,595 | |
| | | | | | | | | | | | | | | Total | 12,804 |

| Room No. Note 1 | Room Name Note 1 | Room Peak Mo/hr Note 2 | Design Room Temp. °F Note 1 | Wall Orientation Note 1 | U-value of Wall Btu/h ft2 °F Note 1 | Wall Area $ft^2$ Note 1 | Wall Group Note 1 | Unadjusted Wall CLTD °F Note 4 | CLTD Correction for Latitude And Month °F Note 5 | K Color Correction factor Note 6 | CLTD Indoor Temperature Adjustment °F Note 7 | CLTD Outdoor Temperature Adjustment °F Note 8 | Adjusted Wall CLTD °F Note 9 | Calculated Wall Load Btu/h Note 10 | Total Wall Load Btu/h Note 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | HVAC Room South (Process Area Supply) | 9/22 | 90 | SW | 0.22 | 1760 | B | 28 | 3.58 | 1 | -12 | 4.05 | 23.63 | 9,150 | 9,150 |
| 2011 | HVAC Room South (Process Area Supply) | 9/22 | 90 | SW | 0.22 | 1250 | B | 28 | 3.58 | 1 | -12 | 4.05 | 23.63 | 6,498 | 6,498 |
| 2012 | Receiver/Dryer Equipment Room | 9/21 | 90 | SW | 0.22 | 1460 | B | 27 | 3.58 | 1 | -12 | 4.05 | 22.63 | 7,269 | |
| | | 9/21 | 90 | SE | 0.22 | 2300 | B | 26 | 3.58 | 1 | -12 | 4.05 | 21.63 | 10,945 | |
| | | | | | | | | | | | | | | Total | 18,214 |
| 2029 | Elevator Lobby | 9/15 | 82 | SW | 0.113 | 1060 | G | 59 | 3.58 | 1 | -4 | 4.05 | 62.63 | 7,502 | |
| | | 9/15 | 82 | NW | 0.113 | 290 | G | 37 | -4.58 | 1 | -4 | 4.05 | 32.47 | 1,064 | |
| | | | | | | | | | | | | | | Total | 8,566 |
| 3001 | Corridor | 9/15 | 82 | SW | 0.113 | 290 | G | 59 | 3.58 | 1 | -4 | 4.05 | 62.63 | 2,052 | |
| | | 9/15 | 82 | SE | 0.113 | 200 | G | 32 | 3.58 | 1 | -4 | 4.05 | 35.63 | 805 | |
| | | | | | | | | | | | | | | Total | 2,858 |
| 3029 | Elevator Lobby | 6/15 | 82 | SW | 0.113 | 400 | G | 59 | -0.85 | 1 | -4 | 4.05 | 58.2 | 2,631 | |
| | | 6/15 | 82 | NW | 0.113 | 110 | G | 37 | 1.42 | 1 | -4 | 4.05 | 38.47 | 478 | |
| | | 6/15 | 82 | SE | 0.113 | 120 | G | 32 | -0.85 | 1 | -4 | 4.05 | 31.2 | 423 | |
| | | 6/15 | 82 | NE | 0.113 | 290 | G | 27 | 1.42 | 1 | -4 | 4.05 | 28.47 | 933 | |
| | | | | | | | | | | | | | | Total | 4,465 |
| R001 | Firefight Elevator Machine Room | 6/16 | 90 | NE | 0.113 | 600 | G | 26 | 1.42 | 1 | -12 | 4.05 | 19.47 | 1,320 | |
| | | 6/16 | 90 | SE | 0.113 | 340 | G | 30 | -0.85 | 1 | -12 | 4.05 | 21.2 | 815 | |
| | | 6/16 | 90 | SW | 0.113 | 460 | G | 63 | -0.85 | 1 | -12 | 4.05 | 54.2 | 2,817 | |
| | | 6/16 | 90 | NW | 0.113 | 340 | G | 47 | 1.42 | 1 | -12 | 4.05 | 40.47 | 1,555 | |
| | | | | | | | | | | | | | | Total | 6,507 |
| | | | | | | | | | | | | | | Grand Total | 264,554 |

NOTES:

1. From information and data contained in the Room Load Information Sheets in Appendix A. See the Room Load Information Sheets for additional remarks about the loads per room.
2. Determined using the Cooling and Heating Load Calculation Methodology on a room-by-room basis, outlined in Section 6.1.3. "All" means that the load is constant, room has no exterior exposure.
3. Not Used.
4. From Appendix B, Table B-1.
5. From Appendix B, Table B-2.
6. See Assumption 3.2.3.
7. Appendix B, From Equation B-2. The value equals 78°F minus the design room temperature.
8. Appendix B, From Equation B-2. The value equals the average outside temperature on design day minus 85°F, where the average outside temperature is 89.05°F for 102°F.
9. Using Equation B-2 with information from the previous columns.
10. Product of "Wall Area," "U-Value of Wall," and "Adjusted Wall CLTD." (Equation C-2)
11. Sum of Calculated Wall Loads per room.

# APPENDIX G: CALCULATION OF THERMODYNAMIC PROPERTIES OF MOIST AIR

Table G-1. Thermodynamic Properties of Moist Air

| Description | Air Flow Cfm Note 1 | Elevation ft. Note 2 | Air Dry Bulb Temp. °F | Air Wet Bulb Temp. °F Note 3 | Air Dew Point Temp. °F Note 3 | Humidity Ratio *W* lb water/lb dry air Note 4 | Specific Volume *v* cu. ft./lb dry air Note 3 | Enthalpy *h* Btu/lb dry air Note 3 | Density *d* lb/cu. ft. Note 3 |
|---|---|---|---|---|---|---|---|---|---|
| **SYSTEM AHU-B (AHU-00001, 2 & 3) (Recirculating with Outside Air)** | | | | | | | | | |
| **Supply Air Leaving Coil** | 53,500 | 3,310 | 51 Note 5 | 46.36 | 42.5 | 0.00645 | 14.7 | 19.23 | 0.068 |
| **Air Leaving Supply Fan / Entering the Coil** | 53,500 | 3,310 | 92.56 Note 6 | 62.05 | 42.5 | 0.00645 | 15.87 | 29.33 | 0.063 |
| **Return Air** | 38,320 | 3,310 | 80.45 Note 7 | 57.97 | 42.5 | 0.00645 | 15.52 | 26.39 | 0.064 |
| **Mixed Air Ent. Fan** | 53,500 | 3,310 | 86.56 Note 8 | 60.07 | 42.5 | 0.00645 | 15.70 | 27.87 | 0.064 |
| **Outside Air** | 15,180 | 3,310 | 102 Note 2 | 65 | 42.5 | 0.00645 | 16.15 | 31.63 | 0.062 |
| **SYSTEM AHU-C (AHU-00004 & 5) (Recirculating with Outside Air)** | | | | | | | | | |
| **Supply Air Leaving Coil** | 31,770 | 3,310 | 51 Note 5 | 46.36 | 42.5 | 0.00645 | 14.7 | 19.23 | 0.068 |
| **Air Leaving Supply Fan / Entering the Coil** | 31,770 | 3,310 | 95.96 Note 6 | 63.13 | 42.5 | 0.00645 | 15.97 | 30.15 | 0.063 |
| **Return Air** | 23,070 | 3,310 | 85.42 Note 7 | 59.69 | 42.5 | 0.00645 | 15.67 | 27.60 | 0.064 |
| **Mixed Air Ent. Fan** | 31,770 | 3,310 | 89.96 Note 8 | 61.20 | 42.5 | 0.00645 | 15.80 | 28.70 | 0.063 |
| **Outside Air** | 8,700 | 3,310 | 102 Note 2 | 65 | 42.5 | 0.00645 | 16.15 | 31.63 | 0.062 |
| **SYSTEM AHU-D (AHU-00006 & 7) (100% Outside Air)** | | | | | | | | | |
| **Supply Air Leaving Coil** | 28,390 | 3,310 | 51 Note 5 | 46.36 | 42.5 | 0.00645 | 14.7 | 19.23 | 0.068 |
| **Air Leaving Supply Fan / Entering the Coil** | 28,390 | 3,310 | 108 Note 6 | 66.78 | 42.5 | 0.00645 | 16.32 | 33.08 | 0.061 |
| **Outside Air Ent. Fan** | 28,390 | 3,310 | 102 Note 2 | 65 | 42.5 | 0.00645 | 16.15 | 31.63 | 0.062 |

NOTES:

1. Taken from Table 5. Outside air is taken as the difference between the supply airflow and the return airflow.
2. Site elevation, see Section 6.1.1.
3. The thermodynamic properties of moist air are determined using psychrometric equations in Appendix D.
4. Assumption 3.1.11.
5. Assumption 3.1.5.
6. Air temperature entering fan plus 6°F (Assumption 3.1.6).
7. Mixed return air temperature from multiple rooms (individual airflow and temperature taken from Table 5), using equation D-13.
8. Mixed return/outside air temperature, using equation D-13.

# APPENDIX H: INFILTRATION AIR COOLING LOAD CALCULATION (ROOM-BY-ROOM)

Table H-1. Infiltration Air Cooling Load

| INPUT DATA | | | | | | | | SENSIBLE |
|---|---|---|---|---|---|---|---|---|
| | | Design Temperature | | | | | | |
| Room No. | Room Name | Outdoor °F | Adjacent Room °F | Room °F | Infiltration CFM | Constant 60 x 0.24 x 0.062 = 0.893 | Infiltration Load Btu/h |
| Note 1 | | Note 2 | Note 4 | Note 1 | Note 1 | Note 5 | Note 3 |
| 1002 | Lid Bolting Room | 102 | - | 90 | 910 | 0.893 | 9,752 |
| 1003A | Corridor | 102 | - | 82 | 570 | 0.893 | 10,180 |
| 1003B | Corridor | 102 | - | 82 | 0 | 0.893 | 0 |
| 1003C | Corridor | 102 | - | 82 | 390 | 0.893 | 6,965 |
| 1003D | Corridor | 102 | - | 82 | 0 | 0.893 | 0 |
| 1003E | Corridor | 102 | - | 82 | 0 | 0.893 | 0 |
| 1003F | Corridor | 102 | - | 82 | 330 | 0.893 | 5,894 |
| 1003G | Corridor | 102 | - | 82 | 590 | 0.893 | 10,537 |
| 1003H | Utility Chase | 102 | - | 90 | 0 | 0.893 | 0 |
| 1004 | HVAC Room (ITS HEPA Exhaust Train A) | 102 | - | 90 | 30 | 0.893 | 321 |
| 1004A | HVAC Room (ITS HEPA Exhaust for Battery Room Train A) | 102 | - | 90 | 70 | 0.893 | 750 |
| 1012 | LLW Staging Room | 102 | - | 90 | 430 | 0.893 | 4,608 |
| 1013 | Loading Room | 102 | - | 100 | 0 | 0.893 | 0 |
| 1014 | Maintenance Room | 102 | - | 79 | 0 | 0.893 | 0 |
| 1015 | Cask Unloading Room | 102 | - | 100 | 0 | 0.893 | 0 |
| 1016 | CTM Maintenance Room | 102 | - | 90 | 0 | 0.893 | 0 |
| 1017 | Cask Preparation Room | 102 | - | 79 | 1,160 | 0.893 | 23,825 |
| 1017A | Cask Preparation Annex | 102 | - | 79 | 0 | 0.893 | 0 |
| 1018 | Electrical Room (Normal Power) | 102 | - | 90 | 60 | 0.893 | 643 |
| 1018A | Non ITS Battery Room | 102 | - | 77 | 110 | 0.893 | 2,456 |
| 1019 | HVAC Room (ITS HEPA Exhaust Train B) | 102 | - | 90 | 30 | 0.893 | 321 |
| 1019A | HVAC Room (ITS HEPA Exhaust for Battery Room Train B | 102 | - | 90 | 70 | 0.893 | 750 |
| 1028 | Freight Elevator | 102 | - | 90 | 0 | 0.893 | 0 |
| 1029 | Elevator Lobby | 102 | - | 82 | 1,770 | 0.893 | 31,612 |
| 1212 to 1224 | C2 Support (Excluding 1221, Assumption 3.1.20) | 102 | - | 75 | 1,270 | 0.893 | 30,621 |
| 1221 &1205 | C2 Support | 102 | - | 75 | 0 | 0.893 | 0 |
| 2001 | Operations/Maintenance Storage Room | 102 | - | 90 | 150 | 0.893 | 1,607 |
| 2002A | Corridor | 102 | - | 82 | 340 | 0.893 | 6,072 |
| 2002B | Corridor | 102 | - | 82 | 0 | 0.893 | 0 |
| 2002C | Corridor | 102 | - | 82 | 0 | 0.893 | 0 |
| 2002D | Corridor | 102 | - | 82 | 2,000 | 0.893 | 35,720 |

| INPUT DATA | | | | | | | SENSIBLE |
|---|---|---|---|---|---|---|---|
| | | Design Temperature | | | | | |
| Room No. | Room Name | Outdoor °F | Adjacent Room °F | Room °F | Infiltration CFM | Constant 60 x 0.24 x 0.062 = 0.893 | Infiltration Load Btu/h |
| Note 1 | | Note 2 | Note 4 | Note 1 | Note 1 | Note 5 | Note 3 |
| 2002E | Corridor | 102 | - | 82 | 0 | 0.893 | 0 |
| 2002F | SW Corridor | 102 | - | 82 | 340 | 0.893 | 6,072 |
| 2002G | Corridor | 102 | - | 82 | 0 | 0.893 | 0 |
| 2003 | HVAC Room North (Process Area Supply) | 102 | - | 90 | 150 | 0.893 | 1,607 |
| 2004 | HVAC Room North (Process Area Supply) | 102 | - | 90 | 110 | 0.893 | 1,179 |
| 2005 | Instrument and Electrical Shop | 102 | - | 90 | 240 | 0.893 | 2,572 |
| 2006 | HVAC Room (HEPA Exhaust for Support, Decon and LLW Areas) | 102 | - | 90 | 510 | 0.893 | 5,465 |
| 2007 | Canister Transfer Rm | 102 | - | 79 | 100 | 0.893 | 2,054 |
| 2009 | HVAC Room South (Process Area Supply) | 102 | - | 90 | 190 | 0.893 | 2,036 |
| 2010 | HVAC Room South (Process Area Supply) | 102 | - | 90 | 150 | 0.893 | 1,607 |
| 2011 | HVAC Room South (Process Area Supply) | 102 | - | 90 | 110 | 0.893 | 1,179 |
| 2012 | Receiver /Dryer Equipment Room | 102 | - | 90 | 240 | 0.893 | 2,572 |
| 2029 | Elevator Lobby | 102 | - | 82 | 1,170 | 0.893 | 20,896 |
| 3001 | Corridor | 102 | - | 82 | 210 | 0.893 | 3,751 |
| 3029 | Elevator Lobby | 102 | - | 82 | 1,110 | 0.893 | 19,825 |
| R001 | Freight Elevator Machine Room | 102 | - | 90 | 0 | 0.893 | 0 |
| Totals | | | - | | 14,910 | | 253,451 |

NOTES:

1. Obtained from the Room Load Information Sheets in Appendix A
2. Outdoor dry bulb design temperature, Section 6.1.1
3. Infiltration loads are calculated using Equation C-15 from Appendix C, where input data comes from the Room Load Information Sheets in Appendix A.
4. This information is not used in the calculation of the infiltration loads
5. Constant based on Density of Air at 3310 ft. altitude (0.062 lbs./cu. ft.), Refer to Appendix D for the appropriate equations to calculate air density

# ATTACHMENT 1: EMAIL REGARDING WASTE PACKAGES AND CANISTERS HEAT GAIN INFORMATION

(2 pages)

This e-mail is from Delwin Mecham of BSC Thermal Analysis, dated 12/18/07, to Greg Gould of the BSC Mechanical HVAC Group. It confirms the use of Waste Cask heat load in the RF as an assumption requiring verification.

Delwin Mecham
12/18/2007 07:19 AM

To: Greg Gould/YM/RWDOE@CRWMS
cc:
Subject: Re: Fw: HVAC Heat Load input

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Based on the following, I suggest the surface design HVAC to the following heat loads:

| | |
|---|---|
| TAD | 25 kW each |
| DOE canisters | 1.5 kW each |
| Naval canisters | 11.8 kW each |
| Waste Packages | 18 kW to 25 kW each |

Total heat load per room will depend on number of items per room.

---

TAD 25 kW based on the range in the TAD draft specification , also Thermal Management Study Section 3.4. (DIRS 172739). There really is no limit, it is whatever the vendors design, but 30 kW should be bounding, 22 kW is more likely.

WP 18.0 kW based on pending TMRB decision (TMRB 2007-084), but better use 25 kW to meet potential changes in drift thermal requirements.

DOE canister 1500 watts REF: [DIRS 176668] "Request for Updated U.S. Department of Energy (DOE) Canister Thermal Output Limits in Support of Repository Design (EM-FMDP-06-006)." Memorandum from M.R. Arenaz (DOE) to W.J. Arthur, III (DOE/ORD), February 6, 2006, 0210065322, with enclosures. ACC: MOL.20060315.0141.

Naval canister 11.8 kW REF: Section 11 of [DIRS 165219] Naval Nuclear Propulsion Program Technical Baseline Compliance Document, Revision 1, October 2002. Letter from J.M. McKenzie (DOE) to J. Williams (DOE/OCRWM)

# ATTACHMENT 2: E-MAIL REGARDING RF ELECTRICAL EQUIPMENT HEAT GAIN INFORMATION

(5 pages)

This e-mail is from Arsenio Mendiola of the BSC Electrical Group to Tracy Johnson of the BSC Mechanical HVAC Group, and then forwarded to Greg Gould of the BSC Mechanical HVAC Group. It confirms the electrical heat load in the RF Electrical Room (Normal Power).

There are seven files attached to the e-mail. Three pertain to different facilities and the one that pertains to the RF ITS Electrical Room is not applicable to this calculation. Only the file that contains information on the RF Electrical Room 1018 (Normal Power) and Room 2012 are shown and deemed pertinent to this calculation.

Greg Gould
11/14/2007 11:38 AM

To: Monico Pingul/YM/RWDOE@CRWMS, Elpidio Castroverde/YM/RWDOE@CRWMS, Gin Cababa/YM/RWDOE@CRWMS, Fred Favis/YM/RWDOE@CRWMS, Orlando Santiago/YM/RWDOE@CRWMS, Jerry Herszman/YM/RWDOE@CRWMS, Hang Yang/YM/RWDOE@CRWMS, Oscar Rosales/YM/RWDOE@CRWMS, Ricardo Abraham/YM/RWDOE@CRWMS, Orlando Asuncion/YM/RWDOE@CRWMS, Francis Banea/YM/RWDOE@CRWMS
cc:
Subject: Fw: Heat Loss update

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

FYI.

----------------- Forwarded by Greg Gould/YM/RWDOE on 11/14/2007 11:37 AM -----------------

Arsenio Mendiola
11/14/2007 11:33 AM

To: Tracy Johnson/YM/RWDOE@CRWMS
cc: Debra Nevergold/YM/RWDOE@CRWMS, David Tooker/YM/RWDOE@CRWMS, Roshellia Goines/YM/RWDOE@CRWMS, Hadi Jalali/YM/RWDOE@CRWMS, Greg Gould/YM/RWDOE@CRWMS, Robert Slovic/YM/RWDOE@CRWMS, Muhammad N Islam/YM/RWDOE@CRWMS
Subject: Heat Loss update

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Attached below are the estimated heat losses for nuclear facilities.

Regards,
Arsenio

----------------- Forwarded by Arsenio Mendiola/YM/RWDOE on 11/14/2007 10:58 AM -----------------

Muhammad N Islam
11/14/2007 10:08 AM

To: Arsenio Mendiola/YM/RWDOE@CRWMS
cc: Amando de la Cruz/YM/RWDOE@CRWMS
Subject: Heat Loads Updated

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Incorporated your comments.

CRCF Heat Loads.xls Heat loss for RF (normal).xls Heat loss for RF ITS Train B.xls Heat loss for RF ITS TrainA.xls

Heat loss for RF ROOM 2012.xls IHF Heat Loads.xls WHF Heat Loads 1.xls

Attachment 2 – Print of Attached File, Normal RF.xls

| RF HANDLING FACILITY (RF) | | |
|---|---|---|
| ELECTRICAL ROOM 1018(Normal) HEAT LOSS ESTIMATE (PRELIMINARY) | | |
| ELECTRICAL EQUIPMENT | HEAT LOSS IN kW | EQUIPMENT NUMBER |
| 480 V Load Center | 11.160 | 200-EEN0-LC-00001 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00001 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00002 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00003 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00004 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00005 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00006 |
| Lighting Panel | 0.500 | 200-EUL0-PL-00001 |
| Lighting Panel | 0.500 | 200-EUL0-PL-00002 |
| 75 kVA XFMR | 2.695 | 200-EEN0-XFMR-00004 |
| Distribution Panel | 0.500 | 200-EEN0-PL-00004 |
| 75 kVA XFMR | 2.695 | 200-EEN0-XFMR-00003 |
| Distribution Panel | 0.500 | 200-EEN0-PL-00003 |
| DCMIS Panel | 0.400 | |
| DCMIS Panel | 0.400 | |
| PLC Panels | 0.340 | |
| PLC Panels | 0.340 | |
| UPS 05A | 6.556 | 200-EEP0-UJX-00001 |
| Maintenance Bypass XFMR (40 kVA) | 0.500 | 200-EEP0-XFMR-00001 |
| Cable Tray 36", 350' | 3.780 | |
| **Total in kW** | **34.652** | |

Attachment 2 – Print of Attached File, Normal RF.xls

| RF HANDLING FACILITY (RF) | | |
|---|---|---|
| ELECTRICAL ROOM 2012(Normal) HEAT LOSS ESTIMATE (PRELIMINARY) | | |
| ELECTRICAL EQUIPMENT | HEAT LOSS IN kW | EQUIPMENT NUMBER |
| 480 V Load Center | 7.1 | 200-EEN0-LC-00002 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00007 |
| 480 V MCC | 0.631 | 200-EEN0-MCC-00008 |
| Lighting Panel | 0.5 | 200-EUL0-PL-00007 |
| 75 kVA XFMR | 2.695 | 200-EEN0-XFMR-00005 |
| Distribution Panel | 0.5 | 200-EEN0-PL-00005 |
| Cable Tray 36", 350' | 3.78 | |
| **Total In kW** | **15.837** | |

# ATTACHMENT 3: E-MAIL REGARDING ENVIRONMENTAL, SAFETY & HEALTH EQUIPMENT HEAT GAIN INFORMATION

(12 pages)

This e-mail is from Thomas Bastian of the BSC Environmental, Safety And Health Group, dated 6/20/07, to Ricardo Abraham of the BSC Mechanical HVAC Group. It confirms the heat loads of various pieces of equipment located throughout the RF.

Ricardo Abraham
07/09/2007 07:58 AM

To: Clayton De Losier/YM/RWDOE@CRWMS
cc:
Subject: Fw: HVAC Heat Gain Information for RF Facility

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

FYI

---------------------- Forwarded by Ricardo Abraham/YM/RWDOE on 07/09/2007 08:02 AM ---------------------------

Thomas Bastian 06/20/2007 02:43 PM

To: Ricardo Abraham/YM/RWDOE@CRWMS
cc: Gregory Eadie/YM/RWDOE@CRWMS, Stacy Junio/YM/RWDOE@CRWMS
Subject: Re: HVAC Heat Gain Information for RF Facility

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Ricardo,

I have attached the file containing an estimate of the heat producing radiation protection equipment in the RF.

I will be out of the office until 6/25. I can answer any questions when I return.

Tom

RP Equipment Load List RF (06-25-07).xls

Ricardo Abraham

Ricardo Abraham
06/15/2007 03:18 PM

To: Thomas Bastian/YM/RWDOE@CRWMS
cc: Oscar Rosales/YM/RWDOE@CRWMS, Tracy Johnson/YM/RWDOE@CRWMS
Subject: HVAC Heat Gain Information for RF Facility

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Tom,
I'm doing the HVAC cooling load calculation for the RF facility (C2) areas. Please provide the ES&Hequipment list, location, and load that will be release to the rooms for all the equipment that you are using for the RF facility
Attached is our standard form that you might want to use for listing the equipment.

Thanks,

Ricardo

EqupHtGainListForm.xls

Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Use Factor Note 3 | Load Factor Note 4 | Heat Load Note 5 | Units Note 6 | Motor Location Type Note 7 | Equip Load Btu/hr Note 8 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittant) Note 11 | Equipment Load by Process Btu/h Note 12 | Process Note 13 | Equip Load USED, per RM Btu/h Note 14 | Originating Group/ Discipline | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1001 | SITE TRANSPORTER VESTIBULE | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1002 | LID BOLTING ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1002 | SITE TRANSPORTER VESTIBULE | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1002 | LID BOLTING ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1004 | HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1004 | HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1011 | LLW VESIBULE | AREA RADIATION MONITOR | 4 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1011 | LLW VESIBULE | CONTINUOUS AIR MONITOR | 4 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1012 | LLW STAGING ROOM | AREA RADIATION MONITOR | 10 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |

1 of 10

Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1012 | LLW STAGING ROOM | CONTINUOUS AIR MONITOR | 10 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1012 | LLW STAGING ROOM ENTRANCE | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1013 | LOADING ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1013 | LOADING ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1015 | CASK UNLOADING ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1015 | CASK UNLOADING ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1016 | CTM MAINTENANCE ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1016 | CTM MAINTENANCE ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1017 | CASK PREPARATION ROOM | AREA RADIATION MONITOR | 12 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1017 | CASK PREPARATION ROOM | CONTINUOUS AIR MONITOR | 12 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |

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Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1019 | HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1021 | TRANSPORTATION CASK VESIBULE ANNEX | AREA RADIATION MONITOR | 4 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1021 | TRANSPORTATION CASK VESIBULE ANNEX | CONTINUOUS AIR MONITOR | 4 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1029 | ELEVATOR LOBBY | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1203 | RA CONTROL POINT | BAR CODE SCANNER | 1 | 1.00 | 1.00 | 0 | | | 0 | X | | | | | [redacted] | ES&H | ASSUME NO HEAT LOAD |
| 1203 | RA CONTROL POINT | PC | 2 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1203 | RA CONTROL POINT | RADIATION AREA ACCESS CONTROL STATION | 4 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1207 | OPERATIONS ROOM | DISPLAY BOARD | 10 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME 1 PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 (BASED ON NO. OF WORKSTATION ON PLAN) |
| 1209 | RP STAFF WORK ROOM | DISPLAY BOARD | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME 1 PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 (BASED ON NO. OF WORKSTATION ON PLAN) |

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Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1209 | RP STAFF WORK ROOM | PC | 4 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1212 | RP GEAR SUPPLY ROOM | PC | 4 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1215 | RP EQUIPMENT ROOM | PC | 4 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1216 | RESPIRATOR ROOM | PC | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1216 | RESPIRATOR ROOM | RESPIRATOR DRYING EQUIPMENT | 1 | 1.00 | 1.00 | 2760 | WATTS | | 9,420 | | X | | | | [redacted] | ES&H | BASED ON AMERICAN AIRWORKS GS1500 RESPIRATOR DRYER |
| 1216 | RESPIRATOR ROOM | RESPIRATOR WASHING EQUIPMENT | 1 | 1.00 | 1.00 | 2760 | WATTS | | 9,420 | | X | | | | [redacted] | ES&H | BASED ON AMERICAN AIRWORKS GS4800 RESPIRATOR WASHER |
| 1217 | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 5 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, |
| 1218 | RP LAB/COUNT ROOM | ALPHA SPECTOMETER | 1 | 1.00 | 1.00 | 3 | WATTS | | 10 | X | | | | | [redacted] | ES&H | ASSUME POWER REQUIREMENTS OF 3 WATTS FOR CANBERRA MODEL 7401 ALPHA SPECTOMETER |
| 1218 | RP LAB/COUNT ROOM | FRISKER STATION | 2 | 1.00 | 1.00 | 0 | | | 0 | X | | | | | [redacted] | ES&H | ASSUME NO HEAT LOAD |

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Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1218 | RP LAB/COUNT ROOM | GAMMA SPECTOMETER | 2 | 1.00 | 1.00 | 1200 | WATTS | | 4,096 | X | | | | | [redacted] | ES&H | ASSUME POWER REQUIREMENTS OF 1200 WATTS FOR CANBERRA, GAM-AN1 GAMMA SPECTOMETER |
| 1218 | RP LAB/COUNT ROOM | LIQUID SCINTILATION COUNTER | 1 | 1.00 | 1.00 | 1230 | WATTS | | 4,198 | X | | | | | [redacted] | ES&H | ASSUME POWER REQUIREMENTS OF 1230 WATTS FOR BECKMAN COULTER, MODEL 6500 SCINTILATION COUNTING SYSTEM |
| 1218 | RP LAB/COUNT ROOM | PROPORTIONAL COUNTER | 1 | 1.00 | 1.00 | 575 | WATTS | | 1,962 | X | | | | | [redacted] | ES&H | ASSUME POWER REQUIREMENTS OF 575 WATTS FOR TENNELEC LB4100, MULTI-DETECTOR COUNTING SYSTEM |
| 1218 | RP LAB/COUNT ROOM | SWIPE COUNTER | 2 | 1.00 | 1.00 | 575 | WATTS | | 1,962 | X | | | | | [redacted] | ES&H | ASSUME POWER REQUIREMENTS OF 575 WATTS FOR TENNELE LB4100, MULTI-DETECTOR COUNTING SYSTEM |
| 1219 | RP LAB/SAMPLE PREPARATION ROOM | FRISKER STATION | 1 | 1.00 | 1.00 | 0 | | | 0 | X | | | | | [redacted] | ES&H | ASSUME NO HEAT LOAD |
| 1219 | RP LAB/SAMPLE PREPARATION ROOM | SAMPLE PREPARATION HOOD | 1 | 1.00 | 1.00 | 0 | | | 0 | X | | | | | [redacted] | ES&H | ASSUME EXHAUST FAN MOTOR IS EXTERNAL TO BUILDING |
| 1220 | DECON ROOM | FRISKER STATION | 2 | 1.00 | 1.00 | 0 | | | 0 | X | | | | | [redacted] | ES&H | ASSUME NO HEAT LOAD |
| 1221 | RA EXIT/ PCM ROOM | COMPUTER TERMINAL WALL DISPLAY | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME 1 PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1221 | RA EXIT/ PCM ROOM | FRISKER | 1 | 1.00 | 1.00 | 0 | | | 0 | X | | | | | [redacted] | ES&H | ASSUME NO HEAT LOAD |
| 1221 | RA EXIT/ PCM ROOM | RADIATION AREA ACCESS CONTROL STATION | 4 | | | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |

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Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1221 | RA EXIT/ PCM ROOM | SMALL EQUIPMENT MONITOR | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | | ES&H | ASSUME 1 PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1221 | RA EXIT/ PCM ROOM | PERSONNEL PORTAL MONITOR | 4 | 1.00 | 1.00 | 250 | WATTS | | 853 | X | | | | | | ES&H | BASED ON THERMO EBERLINE PCM-2 WHOLE BODY CONTAMINATION MONITOR |
| 1223 | GAS SAMPLING ROOM | FRISKER STATION | 2 | 1.00 | 1.00 | 0 | | | 0 | X | | | | | | ES&H | ASSUME NO HEAT LOAD |
| 1224 | HP INSTRUMENT ROOM | ELECTRONIC DOSIMETER CALIBRATOR | 1 | 1.00 | 1.00 | 1 | WATTS | | 3 | X | | | | | | ES&H | ASSUME 0.9 WATTS POWER CONSUMPTION FOR GDS MODEL LDM220 |
| 1224 | HP INSTRUMENT ROOM | PC | 2 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 2003 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 2004 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 6 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 2004 | HVAC ROOM NORTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 6 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 2006 | HVAC ROOM (HEPA EXHAUST FOR SUPPORT, DECON AND LLW AREAS) | AREA RADIATION MONITOR | 10 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 2006 | HVAC ROOM (HEPA EXHAUST FOR SUPPORT, DECON AND LLW AREAS) | CONTINUOUS AIR MONITOR | 10 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |

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Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | CANISTER TRANSFER ROOM | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 2007 | CANISTER TRANSFER ROOM | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 2010 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 2011 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 2011 | HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 2023 | STAIR #2 | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2027 | STAIR #5 | RADIATION AREA ACCESS CONTROL STATION | 5 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2029 | ELEVATOR LOBBY | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1003A | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 3 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |

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Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1003B | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 2 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1003E | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1003F | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 2 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1003G | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 3 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 1004A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN A) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1004A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN A) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 150 | WATTS | | 512 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND 3/4 HP VACUUM PUMP MOTOR |
| 1017A | CASK PREPARATION ROOM ANNEX | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |
| 1017A | CASK PREPARATION ROOM ANNEX | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 1019A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN B) | AREA RADIATION MONITOR | 8 | 1.00 | 1.00 | 16 | WATTS | | 55 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA ADM606M MULTI-PURPOSE RADIATION MONITOR |

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Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1019A | HVAC ROOM (ITS HEPA EXHAUST BATTERY ROOM FOR TRAIN B) | CONTINUOUS AIR MONITOR | 8 | 1.00 | 1.00 | 43 | WATTS | | 147 | X | | | | | [redacted] | ES&H | BASED ON CANBERRA iCAM ALPHA/BETA AIR MONITOR AND USE OF FACILITY VACUUM SYSTEM |
| 2002A | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2002B | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 3 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2002C | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2002E | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 5 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2002F | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |
| 2002G | CORRIDOR | RADIATION AREA ACCESS CONTROL STATION | 1 | 1.00 | 1.00 | 30 | WATTS | | 102 | X | | | | | [redacted] | ES&H | ASSUME AS PC IN ENERGY SAVE MODE AT 30 WATTS EACH, MONITOR AT 0 WATTS PER ASHRAE (2005) CH. 30, TABLE 8 |

Attachment 3 – Print of Attached File, RF Equipment Load List RF (06-25-07).xls (Continued)

Notes:

1. Description of equipment giving heat to the room.
2. Quantity of equipment in the room.
3. "Use Factor" means the approximate usage of equipment based on a 24 hour period.
4. "Load Factor" applies to equipment driven by electric motor such as Cranes, Trolleys and Site Transporter. The electric motor horsepower selection is based on the maximum capacity that the equipment can handle. In reality, these pieces of equipment are not lifting or pulling the maximum load all the time during a 24 hour period, therefore 85% load factor is a very conservative assumption.
5. Heat load that each equipment gives up into a room. Refer to next column for units (Watts, kW or HP)
6. The conversion factor used to convert Watts to Btu/h is 3.413 and kW to Btu/h is 3413. For HP conversion, refer to Note 7.
7. Refer to Table 4.12 of ASHRAE Cooling and Heating Load Calculation Manual (Reference 2.2.4) for location of motor and driven equipment with respect to conditioned space or airstream (A - motor in, driven equipment in; B - motor out, driven equipment in, C - motor in, driven equipment out) and equivalent Btu/h rating for listed motor HP.
8. Equipment heat load in Btu/hr.
9. "Continuous Operation" means equipment is operating all the time 24 hour a day, heat load is constant.
10. "Intermittent Operation" means equipment is operating ON and OFF during a 24 hour period. The time of operation is not simultaneous with other equipment in a room which is also operating intermittently.
11. "Simultaneous Operation" means the equipment is also operating ON and OFF, but it operates at the same time with other equipment which is also operating intermittently.
12. Heat load by an individual piece of equipment based on the type of operation (continuous, intermittent or simultaneous).
13. Most of the equipment listed in this table operates intermittently. There are certain types of work when an appropriate piece of equipment is used to handle that particular job. The process that utilizes the most equipment working simultaneously represents the highest heat load. That figure is used as the room equipment heat load. When numbers are shown (1,2,3 etc.) they represents the number of scenarios where equipment works simultaneously with the other equipment. The type of work that utilizes the most equipment represents the highest heat load and it is the figure used as the room equipment heat load.
14. The total equipment heat load per room obtained by adding all the equipment heat load in a room under the column "Equipment Load by Process".

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# ATTACHMENT 4: E-MAIL REGARDING INSTRUMENTATION AND CONTROLS EQUIPMENT HEAT GAIN INFORMATION

(4 pages)

This attachment contains an e-mail from Lino Salgado of the BSC Instrumentation and Controls Group, dated 6/20/2007, to Ricardo Abraham of the BSC Mechanical HVAC Group. It confirms the locations and heat gains of various instrumentation and controls equipment located throughout the RF.

Ricardo Abraham
07/09/2007 07:56 AM

To: Clayton De Losier/YM/RWDOE@CRWMS
cc:
Subject: Fw: HVAC Heat Gain Information for RF Facility

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

FYI

-------------------- Forwarded by Ricardo Abraham/YM/RWDOE on 07/09/2007 07:59 AM --------------------

Lino Salgado
06/20/2007 10:17 AM

To: Ricardo Abraham/YM/RWDOE@CRWMS
cc: Steve Schmude/YM/RWDOE@CRWMS, Oscar Rosales/YM/RWDOE@CRWMS, Tracy Johnson/YM/RWDOE@CRWMS
Subject: Re: HVAC Heat Gain Information for RF Facility

LSN: Not Relevant
User Filed as: Not a Record

Heat gain information for Rf Facility per your request:

RF Heat Load List(C&I).xls

Lino
1-8635

Attachment 4 – Print of File, RF Heat Load List (C&I).xls

## RF Heat Load List

| Room No. | Conf. Zoning C or NC | Area | Room Name | Heat Source | Qty. | Heat Load/Equipment (Watts) | Motor Location Type | Total Equip Load (Btu/hr ) | Continuous Operation | Intermittent Operation | Simultaneous Operation | Indoor Design Temp | Reference Document | Originating Group/ Discipline | Contact Person | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1001 | | | Site Transport Vestibule | Remote I/O (RIO) | 1 | 100 | | 341 | | | | | Delta V product data sheet (typical for all RIOs) | | | |
| 1002 | | | Lid Bolting Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1004 | | | HVAC Room (ITS HEPA Exhaust Train A) | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1005 | | | Electrical Room (ITS Train A) | DCMIS I/O Cabinet | 1 | 1000 | | 3413 | | | | | | | | |
| | | | | PLC | 1 | 350 | | 1195 | | | | | Triconex Corporation Topical Reports 7286-545 "Qualification Summary Report" | | | Assumed 2 power supplies per PLC |
| 1006 | | | Gas Sampling Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1008 | | | Operations Room | DCMIS Workstations | 2 | 920 | | 6280 | | | | | | I&C | Lino Salgado | 1 control console consists of 1 computer and 4 screens. Power supply for computer is 200 w (Dell Model DHP) and 180 w (Dell model 1905 FP) for 1 screen. Total power supply is 920 watts. |
| | | | | CCTV Power supplies | 2 | 960 | | 6553 | | | | | Source: SuperON Technology Co website (http://www.globalsources.com/gsol/I/CCTV-control/p/sm/1000532009.htm) | | | |
| | | | | DCMIS Network Cabinet | 1 | 500 | | 1707 | | | | | | | | Assumed 500 watts each. |
| 1009 | | | Communication Room | Comm Cabinets | 5 | 750 | | 12799 | | | | | | | | Assumed 750 watts each |
| | | | | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1011 | | | LLW Vestibule | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1012 | | | LLW Staging Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1013 | | | Loading Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1015 | | | Cask Unloading Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1016 | | | CTM Maintenance Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1017 | | | Cask Preparation Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1018 | | | Electrical Room (normal Power) | DCMIS I/O Cabinet | 1 | 1000 | | 3413 | | | | | | | | |
| | | | | PLC | 2 | 350 | | 2389 | | | | | | | | |
| 1019 | | | HVAC Room (ITS HEPA Exhaust Train B) | RIO | 1 | 100 | | 341 | | | | | | | | |
| 1020 | | | Electrical Room (ITS Train B) | DCMIS I/O Cabinet | 1 | 1000 | | 3413 | | | | | | | | |
| | | | | PLC | 1 | 350 | | 1195 | | | | | | | | |
| 1021A | | | Transportation Cask Vestibule | RIO | 1 | 100 | | 341 | | | | | | | | |
| 2001 | | | Operations/Maintenance Storage Room | RIO | 1 | 100 | | 341 | | | | | | | | Room 2001 is not identified in Reference 2 |
| 2003 | | | HVAC Room North (Process Area Supply) | RIO | 1 | 100 | | 341 | | | | | | | | |
| 2004 | | | HVAC Room North (Process Area Supply) | RIO | 1 | 100 | | 341 | | | | | | | | |
| 2005 | | | Instrument & Electrical Storage | RIO | 1 | 100 | | 341 | | | | | | | | Room 2005 is not identified in Reference 2 |
| 2007 | | | Canister Transfer Room | RIO | 1 | 100 | | 341 | | | | | | | | |
| 2009 | | | HVAC Room South | RIO | 1 | 100 | | 341 | | | | | | | | Labeled as "HVAC Room South (Process Area Supply)" in Reference 2. |
| 2010 | | | HVAC Room South (Process Area Supply) | RIO | 1 | 100 | | 341 | | | | | | | | |

~0056364.xls,7/9/2007 1 of 2

Attachment 4 – Print of File, RF Heat Load List (C&I).xls (Continued)

**RF Heat Load List**

| Room No. | Conf. Zoning C or NC | Area | Room Name | Heat Source | Qty. | Heat Load/Equipment (Watts) | Motor Location Type | Total Equip Load (Btu/hr ) | Continuous Operation | Intermittent Operation | Simultaneous Operation | Indoor Design Temp | Reference Document | Originating Group/ Discipline | Contact Person | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | | | HVAC Room South (Process Area Supply) | RIO | 1 | 100 | | 341 | | | | | | | | Room 2011 is not identified in Reference 2. |

NOTE: VALUES IN THIS TABLE ARE PRELIMINARY AND WILL BE VERIFIED AS THE DESIGN PROGRESSES.

REFERENCES:
1) 200-P0K-RF00-10101-000, REV 00A - RECEIPT FACILITY PRELIMINARY LAYOUT GROUND FLOOR PLAN
2) 200-P0K-RF00-10102-000, REV 00A - RECEIPT FACILITY PRELIMINARY LAYOUT SECOND FLOOR PLAN
3) 200-30R-RF00-00200-000 I&C 6-18-07.DOC (INTEGRATED SYSTEM OPERATION REPORT: RECEIPT FACILITY) (FILE LOCATION: O:\D&E\CONTROL SYSTEMS\ISORS\RECEIPT FACILITY)

~0056364.xls,7/9/2007 2 of 2

# ATTACHMENT 5: HVAC AND MECHANICAL PROCESS EQUIPMENT LIST

(5 pages)

This list contains HVAC and Mechanical Process equipment and their motor drive using drawings with their document number listed in the Remarks/Additional Info column as reference.

Attachment 5 – Enclosure 5

## RF HVAC EQUIPMENT

| COMPONENT ID | COMPONENT DESCRIPTION | LOCATION | COMPONENT RATING | | | SAFETY CLASS (Note 1) | | LOAD TYPE (Note 2) | PACKAGED EQPT. | | LOAD STATUS (Note 3) | OTHER REQUIREMENTS (Note 4) | OPERATIONAL REQUIREMENTS (Note 5) | REMARKS/ADDITIONAL INFO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HP/KVA/KW | VOLTAGE | PHASE | ITS | NON-ITS | | YES | NO | | | | |
| 200-VCT0-AHU-00001 | AIR HANDLING UNIT | 2003 HVAC ROOM NORTH (PROCESS AREA SUPPLY) | 125 HP | Note 6 | Note 6 | | X | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00206-000 |
| 200-VCT0-AHU-00002 | AIR HANDLING UNIT | 2003 HVAC ROOM NORTH (PROCESS AREA SUPPLY) | 125 HP | Note 6 | Note 6 | | X | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00206-000 |
| 200-VCT0-AHU-00003 | AIR HANDLING UNIT | 2004 HVAC ROOM NORTH (PROCESS AREA SUPPLY) | 125 HP | Note 6 | Note 6 | | X | S | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00206-000 |
| 200-VCT0-AHU-00004 | AIR HANDLING UNIT | 2009 HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | 100 HP | Note 6 | Note 6 | | X | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00201-000 |
| 200-VCT0-AHU-00005 | AIR HANDLING UNIT | 2010 HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | 100 HP | Note 6 | Note 6 | | X | S | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00201-000 |
| 200-VCT0-AHU-00006 | AIR HANDLING UNIT | 2010 HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | 75 HP | Note 6 | Note 6 | | X | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00103-000 |
| 200-VCT0-AHU-00007 | AIR HANDLING UNIT | 2011 HVAC ROOM SOUTH (PROCESS AREA SUPPLY) | 75 HP | Note 6 | Note 6 | | X | S | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00103-000 |
| 200-VCT0-EXH-00001 | EXHAUST FAN | 2006 HVAC ROOM (HEPA EXHAUST FOR SUPORT, DECON AND LLW AREAS) | 75 HP | Note 6 | Note 6 | | X | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00205-000 |
| 200-VCT0-EXH-00002 | EXHAUST FAN | 2006 HVAC ROOM (HEPA EXHAUST FOR SUPORT, DECON AND LLW AREAS) | 75 HP | Note 6 | Note 6 | | X | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00205-000 |
| 200-VCT0-EXH-00005 | EXHAUST FAN (TRAIN A) | 1004 HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | 200 HP | Note 6 | Note 6 | X | | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00101-000 |
| 200-VCT0-EXH-00006 | EXHAUST FAN (TRAIN B) | 1019 HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | 200 HP | Note 6 | Note 6 | X | | S | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00102-000 |
| 200-VCT0-EXH-00009 | EXHAUST FAN (TRAIN A) | 1004A HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN A) | 7.5 HP | Note 6 | Note 6 | X | | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00302-000 |
| 200-VCT0-EXH-00010 | EXHAUST FAN (TRAIN A) | 1004A HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN A) | 7.5 HP | Note 6 | Note 6 | X | | S | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00302-000 |
| 200-VCT0-EXH-000011 | EXHAUST FAN (TRAIN B) | 1019A HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN B) | 15 HP | Note 6 | Note 6 | X | | C | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00304-000 |
| 200-VCT0-EXH-00012 | EXHAUST FAN (TRAIN B) | 1019A HVAC ROOM (ITS HEPA EXHAUST FOR BATTERY ROOM TRAIN B) | 15 HP | Note 6 | Note 6 | X | | S | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00304-000 |
| 200-VCT0-EXH-00013 | EXHAUST FAN | 2006 HVAC ROOM (HEPA EXHAUST FOR SUPORT, DECON AND LLW AREAS) | 75 HP | Note 6 | Note 6 | | X | S | | X | Calc | ASD | | V&ID: 200-M80-VCT0-00205-000 |

| RF HVAC EQUIPMENT | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COMPONENT ID | COMPONENT DESCRIPTION | LOCATION | COMPONENT RATING | | | SAFETY CLASS (Note 1) | | LOAD TYPE (Note 2) | PACKAGED EQPT. | | LOAD STATUS (Note 3) | OTHER REQUIREMENTS (Note 4) | OPERATIONAL REQUIREMENTS (Note 5) | REMARKS/ADDITIONAL INFO. |
| | | | HP/KVA/KW | VOLTAGE | PHASE | ITS | NON-ITS | | YES | NO | | | | |
| 200-VCT0-FLT-00001 | HEPA FILTER PLENUM | 2006 HVAC ROOM (HEPA EXHAUST FOR SUPORT, DECON AND LLW AREAS) | N/A | N/A | N/A | | X | C | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00205-000 |
| 200-VCT0-FLT-00002 | HEPA FILTER PLENUM | 2006 HVAC ROOM (HEPA EXHAUST FOR SUPORT, DECON AND LLW AREAS) | N/A | N/A | N/A | | X | C | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00205-000 |
| 200-VCT0-FLT-00005 | EXHAUST HEPA FILTER PLENUM (TRAIN A) | 1004 HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | N/A | N/A | N/A | X | | C | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00101-000 |
| 200-VCT0-FLT-00006 | EXHAUST HEPA FILTER PLENUM (TRAIN A) | 1004 HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | N/A | N/A | N/A | X | | C | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00101-000 |
| 200-VCT0-FLT-00007 | EXHAUST HEPA FILTER PLENUM (TRAIN A) | 1004 HVAC ROOM (ITS HEPA EXHAUST TRAIN A) | N/A | N/A | N/A | X | | C | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00101-000 |
| 200-VCT0-FLT-00008 | EXHAUST HEPA FILTER PLENUM (TRAIN B) | 1019 HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | N/A | N/A | N/A | X | | S | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00102-000 |
| 200-VCT0-FLT-00009 | EXHAUST HEPA FILTER PLENUM (TRAIN B) | 1019 HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | N/A | N/A | N/A | X | | S | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00102-000 |
| 200-VCT0-FLT-00010 | EXHAUST HEPA FILTER PLENUM (TRAIN B) | 1019 HVAC ROOM (ITS HEPA EXHAUST TRAIN B) | N/A | N/A | N/A | X | | S | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00102-000 |
| 200-VCT0-FLT-00013 | HEPA FILTER PLENUM | 2006 HVAC ROOM (HEPA EXHAUST FOR SUPORT, DECON AND LLW AREAS) | N/A | N/A | N/A | | X | S | | X | Calc | N/A | | V&ID: 200-M80-VCT0-00205-000 |

Note 1: Safety class applies to electrical requirements only.
Note 2: Load Type: C = Continuous, I = Intermittent, S = Standby
Note 3: Load Status: Prel = Preliminary, Calc = Calculated, or Conf = Confirmed
Note 4: Other Requirements: ASD (Adjustable Speed Drive), 2-Speed Drive, 1-Speed Drive, etc.
Note 5: Operational Requirements: All HVAC equipment must be running for this building to be operational for production.
Note 6: Electrical discipline will specify the component voltage and phase based on provided HP

Attachment 5 – Enclosure 5 (Continued)

## RF MECHANICAL SYSTEMS/PROCESS EQUIPMENT (Last updated on 11/12/07)

| COMPONENT ID | COMPONENT DESCRIPTION | LOCATION | COMPONENT RATING | | | SAFETY CLASS (Note 1) | | LOAD TYPE (Note 2) | PACKAGED EQPT. | | LOAD STATUS (Note 3) | OTHER REQUIREMENTS (Note 4) | OPERATIONAL REQUIREMENTS (Note 5) | REMARKS/ADDITIONAL INFO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HP/kVA/kW | VOLTAGE | PHASE | ITS | NON-ITS | | YES | NO | | | | |
| 200-PSG0-VSL-00001 | GPA RECEIVER | ROOM 2012, 2ND FLOOR | N/A | N/A | N/A | | X | N/A | | X | PREL | | | |
| 200-PSA0-VSL-00001 | IA RECEIVER | ROOM 2012, 2ND FLOOR | N/A | N/A | N/A | | X | N/A | | X | PREL | | | |
| 200-PSG0-SKD-00001 | GP DRYER PACKAGE | ROOM 2012, 2ND FLOOR | 13.5 kW | Note 6 | Note 6 | | X | I | X | | PREL | | Yes | Calculation in Check and P&ID in drafting. NOTE 9 |
| 200-PSA0-SKD-00001 | IA DRYER PACKAGE | ROOM 2012, 2ND FLOOR | 3 kW | Note 6 | Note 6 | | X | I | X | | PREL | | Yes | Calculation in Check and P&ID in drafting. NOTE 9 |
| 200-PSG0-CMP0-00001-A | AIR COMPRESSOR | OUTSIDE | 200 HP | Note 6 | Note 6 | | X | I | X | | PREL | | Yes | Calculation in Check and P&ID in drafting. NOTE 9 |
| 200-PSG0-CMP0-00001-B | AIR COMPRESSOR | OUTSIDE | 200 HP | Note 6 | Note 6 | | X | I | X | | PREL | | Yes | Calculation in Check and P&ID in drafting. NOTE 9 |
| 200-PSG0-CMP0-00001-C | AIR COMPRESSOR | OUTSIDE | 200 HP | Note 6 | Note 6 | | X | S | X | | PREL | | Yes | Calculation in Check and P&ID in drafting. STANDBY |
| 200-PSE0-VSL-00001 | ME SERVICE GAS STORAGE VESSEL (He) | OUTSIDE THE NORTH SUPPORT AREA | N/A | N/A | N/A | | X | N/A | X | | PREL | | | |
| 200-PSC0-P-00001-A | ME CHILLED WATER PUMP | MAINTENANCE ROOM # 1014 | This equipment is in inspection and can be found on the issued P&ID: 200-M60-PSC0-00101-000 to 200-M60-PSC0-00103-000. | | | | | | | | | | | |
| 200-PSC0-P-00001-B | ME CHILLED WATER PUMP | MAINTENANCE ROOM # 1014 | | | | | | | | | | | | |
| 200-PSH0-P-00001-A | HOT WATER PUMP | MAINTENANCE ROOM # 1014 | This equipment is in inspection and can be found on the issued P&ID: 200-M60-PSH0-00101-000 to 200-M60-PSH0-00103-000. | | | | | | | | | | | |
| 200-PSH0-P-00001-B | HOT WATER PUMP | MAINTENANCE ROOM # 1014 | | | | | | | | | | | | |
| 200-MRE0-DET-00001 | MP CASK CAV GAS SAMPLING UNIT (VENDOR PACKAGE) | GROUND FLOOR, ROOM 1006 | 1kW (Note 7) | Note 6 | Note 6 | | X | I | X | | PREL | N/A | Yes | |
| 200-MRE0-VACP-00001 | MP CASK CAV GAS SAMPLING VAC PUMP | GROUND FLOOR, ROOM 1006 | This equipment is in inspection and can be found on the issued P&ID: 200-M60-MRE0-00101-000-00A. | | | | | | | | | | | See Note 7. |
| 200-MWL0-P-00002 | MP LIQUID LLW SUMP PUMP | SUMP PIT, ROOM P001 | This equipment is in inspection and can be found on the issued P&ID: 200-M60-MWL0-00107-000-00A. | | | | | | | | | | | |
| 200-MWL0-P-00001 | MP LIQUID LLW SAMPLING PUMP | SUMP PIT, ROOM P001 | This equipment is in inspection and can be found on the issued P&ID: 200-M60-MWL0-00107-000-00A. | | | | | | | | | | | |
| 200-MWL0-TK-00001 | MP LIQUID LLW SAMPLING TANK | SUMP PIT, ROOM P001 | N/A | N/A | N/A | | X | | | X | PREL | | | |
| 200-MWL0-SUMP-00001 | MP LIQUID LLW SUMP | SUMP PIT, ROOM P001 | N/A | N/A | N/A | | X | | | X | PREL | | | |
| 200-MWL0-TK-00002 | MP LIQUID LLW COLLECTION TANK | SUMP PIT, ROOM P001 | N/A | N/A | N/A | | X | | | X | PREL | | | |
| 200-MWL0-SUMP-00002 | MP LIQUID LLW SUMP | SUMP PIT, ROOM P001 | N/A | N/A | N/A | | X | | | X | PREL | | | |

Note 1: Safety class applies to electrical requirements only.
Note 2: Load Type: C = Continuous, I = Intermittent, S = Standby.
Note 3: Load Status: PREL = Preliminary, Calc = Calculated, or Conf = Confirmed.
Note 4: Other Requirements: VFD (Variable Frequency Drive), 2-Speed Drive, 1-Speed Drive, etc.
Note 5: Operational Requirements: All equipment must be running for this building to be operational for production.
Note 6: Electrical discipline will specify the component voltage and phase based on provided HP.

Note 7: Based on engineering estimate. Calculation for the gas sampling will be revised to reflect the power requirements and bases. Typical unit is single phase, 120 VAC.
Note 9: Estimated hours of operation of compressors and dryers are 6 hours per use and a total of 12 hours per day. This requires further confirmation.

# ATTACHMENT 6: E-MAIL REGARDING MECHANICAL HANDLING GROUP EQUIPMENT HEAT GAIN INFORMATION

(3 pages)

This e-mail is from Bryan Elliot of the BSC Mechanical Handling Group, dated 11/14/07, to Greg Gould of the BSC Mechanical HVAC Group, and then forwarded to Elpidio S. Castroverde of the BSC Mechanical HVAC Group. It confirms the heat load and use factor of various pieces of equipment used throughout the RF.

Greg Gould
11/15/2007 07:58 AM

To: Monico Pingul/YM/RWDOE@CRWMS, Elpidio Castroverde/YM/RWDOE@CRWMS, Gin Cababa/YM/RWDOE@CRWMS, Fred Favis/YM/RWDOE@CRWMS, Oscar Rosales/YM/RWDOE@CRWMS, Ricardo Abraham/YM/RWDOE@CRWMS, Orlando Santiago/YM/RWDOE@CRWMS, Jerry Herszman/YM/RWDOE@CRWMS, Hang Yang/YM/RWDOE@CRWMS, Orlando Asuncion/YM/RWDOE@CRWMS
cc: Tracy Johnson/YM/RWDOE
Subject: Fw: Mechanical Handling Equipment Loads

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Gentlemen,

Bryan has taken a final look at the mechanical equipment loads and use factors. He has also addressed the incidental loads (See below). Please use the attached spreadsheet for your calculation. Please look at the information and elevate any problems you find.

Greg

----------------- Forwarded by Greg Gould/YM/RWDOE on 11/15/2007 07:55 AM -----------------

Bryan Elliott
11/14/2007 05:04 PM

To: Greg Gould/YM/RWDOE@CRWMS
cc: Daryl Lopez/YM/RWDOE@CRWMS, Maurice LaFountain/YM/RWDOE@CRWMS
Subject: Mechanical Handling Equipment Loads

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Greg,

Attached is an Excel file providing the loads for the mechanical handling equipment.

The loads are based on the motor sizes shown on issued mechanical equipment envelope drawings. This table also provides the updated usage factors, based on the throughput studies.

After some investigation, incidental loads (power for controls) are insignificant, and are thus not included within the table.

Please let me know if you need anything further.

Bryan Elliott

MH Equipment Load List.xls

| Equipment Number | Room Number | Room Name | Description | Use Factor | Load Factor | Equipment Motors | Continuous operation | Intermittent operation | Simultaneous operation | Reference Drawing | Remark 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200-HM00-CRN-00001 | 1017 | Cask Preparation Room | CASK HANDLING CRANE | 0.45 | 1.00 | H 90HP,A 45HP, T 7.5HP & B 30HP | | X | | 200-MJ0-HM00-00101-000 | Only one motor operates at a time |
| 200-HMC0-CRN-00001 | 1002 | Lid Bolting Room | LID BOLTING ROOM CRANE | 0.35 | 1.00 | H 25HP,T 1.5HP & B 3HP | | X | | 200-MJ0-HMC0-00101-000 | Only one motor operates at a time |
| 200-HMC0-PLAT-00001 | 1017 | Cask Preparation Room | MOBILE ACCESS PLATFORM | 0.45 | 1.00 | (4) 1HP, (4) 5HP, (2) 10HP | | X | X | 000-MJ0-HMC0-00301-000 | Use (2) 10 HP motors for load. Equipment can operate at the same time as the Cask Handling Crane |
| 200-HTC0-CRN-00001 | 2007 | Canister Transfer Room | CTM MAINTENANCE CRANE | 0.10 | 0.85 | H 35HP,T 2HP & B 7.5HP | | X | | 200-MJ0-HTC0-00101-000 | Only one motor operates at a time |
| 200-HTC0-FHM-00001 | 2007 | Canister Transfer Room | CANISTER TRANSFER MACHINE | 0.20 | 1.00 | 45HP, 3HP,(2) 7.5HP,60HP, 5 HP | | X | | 000-MJ0-HTC0-00201-000 | Only one motor operates at a time |
| 200-HTC0-HTCH-00001 | 2007 | Canister Transfer Room | CASK PORT SLIDE GATE | 0.10 | 1.00 | (2) .5 HP | | X | | 000-MJ0-H000-00301-000 | Both motors operate at the same time |
| 200-HTC0-HTCH-00002 | 2007 | Canister Transfer Room | AO PORT SLIDE GATE | 0.10 | 1.00 | (2) .5 HP | | X | | 000-MJ0-H000-00301-000 | Both motors operate at the same time |
| 200-RF00-DR-00001 | 1017 | Cask Preparation Room | CASK UNLOADING ROOM SHIELD DOOR (TYPE 5) | 0.10 | 1.00 | 7.5 HP, 7.5 HP | | X | | 000-MJ0-H000-01101-000 | Both motors operate at the same time |
| 200-RF00-DR-00002 | 1002 | Lid Bolting Room | LOADING ROOM SHIELD DOOR (TYPE 2) | 0.10 | 1.00 | 7.5 HP, 7.5 HP | | X | | 000-MJ0-H000-00801-000 | Both motors operate at the same time |
| 200-RF00-DR-00003 | 1017A | Cask Preparation Annex | CASK PREPARATION ROOM EQUIPMENT CONFINEMENT DOOR SOUTH | 0.10 | 1.00 | (2) 3HP | | X | | 200-MJ0-HMH0-00301-000 | Both motors operate at the same time |

## ATTACHMENT 7: E-MAIL REGARDING THE NUMBER OF OCCUPANTS IN THE RF BUILDING.

(3 pages)

This attachment contains e-mails from Clarence Smith to Ricardo Abraham and Clayton De Losier, dated 06/12/2007 and 07/09/2007, confirming the number and distribution of occupants in the RF building.

Ricardo Abraham
07/03/2007 04:19 PM

To: Clayton De Losier/YM/RWDOE@CRWMS
cc:
Subject: Fw: Number of Personnel in the RF Facility

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

---------------------- Forwarded by Ricardo Abraham/YM/RWDOE on 07/03/2007 04:19 PM ---------------------------

Keep America Safe

**Clarence Smith**
06/12/2007 07:23 AM

To: Ricardo Abraham/YM/RWDOE@CRWMS
cc: Clarence Smith/YM/RWDOE@CRWMS
Subject: Re: Number of Personnel in the RF Facility

LSN: Not Relevant - **Privileged**
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Ricardo the staffing for the RF will be approximately 20 people per shift for a 24/7 operation this will include Rad protection, QC, Operation, maintenance and supervisors.
If you have any questions please give me a call
Thanks
Clarence

Ricardo Abraham

Ricardo Abraham
06/11/2007 04:32 PM

To: Clarence Smith/YM/RWDOE@CRWMS
cc: Tracy Johnson/YM/RWDOE@CRWMS, Oscar Rosales/YM/RWDOE@CRWMS
Subject: Number of Personnel in the RF Facility

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Clarence,
I'm doing the HVAC cooling load calculation for the RF facility. I need the number of personnel that will be working in this Facility to be included in my cooling and heating load calculation. Please provide the number of Personnel on each area in the the RF facility.

Thanks,
Ricardo

Keep America Safe

Clarence Smith
07/09/2007 11:32 AM

To: Clayton De Losier/YM/RWDOE@CRWMS
cc: Clarence Smith/YM/RWDOE@CRWMS
Subject: Re: RF Personnel

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

I concur the data listed below is per our conversation as to the location of personnel within the RF facility.

Thanks
Clarence

Clayton De Losier

Clayton De Losier
07/09/2007 09:57 AM

To: Clarence Smith/YM/RWDOE@CRWMS
cc:
Subject: RF Personnel

LSN: Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Dear Clarence Smith,

I need to have documentation of our earlier conversation for my document; therefore, can you please reply to this e-mail and state that the following personnel distribution for the RF is correct, per our earlier discussion.

| Room No. | Room Name | No. of People |
|---|---|---|
| 1001 | Site Transporter Vestibule | 1 |
| 1002 | Lid Bolt Room | 4 |
| 1017 and 1017A | Cask Preparation Room and Annex | 8 |
| 1207 | Operations Room | 2 |
| 1209 | Staff Work Room | 2 |
| 1223 | Gas Sampling Room | 1 |
| 1224 | Instrument Room | 2 |

Thank You,

Clayton De Losier

# ATTACHMENT 8: SECOND E-MAIL REGARDING MECHANICAL HANDLING GROUP EQUIPMENT HEAT GAIN INFORMATION

(3 pages)

This e-mail is from Scott Drummond of the BSC Mechanical Handling Group, dated 7/13/07, to Clayton De Losier of the BSC Mechanical HVAC Group. It confirms the heat loads of pieces of equipment that were left off in the first e-mail.

**Scott Drummond** **07/13/2007 07:59 AM**

To: Clayton De Losier/YM/RWDOE@CRWMS
cc: Lisa Green/YM/RWDOE@CRWMS
Subject: Fw: RF Mechanical Handling Equipment

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Clayton
Per our conversation:
The information on the attache sheets is correct: the site transporter that enters the CRCF is the same that enters RF.
The platform motor size is correct. you could reference the MEE for both.
Scott

---------------------- Forwarded by Scott Drummond/YM/RWDOE on 07/13/2007 08:00 AM ---------------------------

Lisa Green
07/13/2007 07:06 AM

To: Scott Drummond/YM/RWDOE@CRWMS
cc: Clayton De Losier/YM/RWDOE@CRWMS
Subject: Fw: RF Mechanical Handling Equipment

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Scott,

Please verify and get back to Clayton.

Thanks :O)

Lisa

---------------------- Forwarded by Lisa Green/YM/RWDOE on 07/13/2007 07:08 AM ---------------------------

Clayton De Losier
07/12/2007 03:46 PM

To: Lisa Green/YM/RWDOE@CRWMS
cc:
Subject: RF Mechanical Handling Equipment

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Dear Lisa Green,

I am working on a calculation and I need to verify some information. Can you please review the attached file and let me know if this information is correct.

Thank You,

Clayton De Losier

RF Equipment.xls

Attachment 8 – Print of File, RF Equipment.xls

| Room No. | Room Name | Heat Source Note 1 | Qty. Note 2 | Heat Load, Each Note 5 | Units Note 6 | Continuous Operation Note 9 | Intermittent Operation Note 10 | Simultaneous Operation (Intermittent) Note 11 | Originating Group/ Discipline |
|---|---|---|---|---|---|---|---|---|---|
| 1002 | LID Bolting Room | SITE TRANSPORTER | 1 | 75.0 | HP | | | X | Mechanical Handling |
| 1002 | LID Bolting Room | CASK PREPARATION PLATFORM | 1 | 5.0 | HP | | X | | Mechanical Handling |
| 1013 | Loading Room | SITE TRANSPORTER | 1 | 75.0 | HP | | | X | Mechanical Handling |

# ATTACHMENT 9: E-MAIL REGARDING MECHANICAL HANDLING EQUIPMENT HEAT GAIN DIVERSITY FACTOR

(3 pages)

This e-mail is from Steve Ployhar of BSC Mechanical Handling Group, dated 11/17/07, to Greg Gould of BSC Mechanical HVAC Group and forwarded to Elpidio S. Castroverde of BSC Mechanical HVAC Group stating that a factor of 4 reduction in heat load from operation of Mechanical Handling equipment motors, from what is assumed based on the throughput use factors, is justified and still conservative.

Greg Gould
11/17/2007 08:36 AM

To: Fred Favis/YM/RWDOE@CRWMS, Monico Pingul/YM/RWDOE@CRWMS, Elpidio Castroverde/YM/RWDOE@CRWMS, Ricardo Abraham/YM/RWDOE@CRWMS, Orlando Santiago/YM/RWDOE@CRWMS
cc: Gin Cababa/YM/RWDOE@CRWMS, Oscar Rosales/YM/RWDOE@CRWMS, Jerry Herszman/YM/RWDOE@CRWMS, Orlando Asuncion/YM/RWDOE@CRWMS, Tracy Johnson/YM/RWDOE, Hadi Jalali/YM/RWDOE@CRWMS, Debra Nevergold/YM/RWDOE@CRWMS, David Tooker/YM/RWDOE@CRWMS
Subject: Fw: MH Equipment Heat Loads

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Please use where applicable in your calculations. Coordinate with Fred Favis as to a consistent approach.

Greg

----- Forwarded by Greg Gould/YM/RWDOE on 11/17/2007 08:32 AM -----

**Steve Ployhar**
11/17/2007 08:19 AM

To: Greg Gould/YM/RWDOE@CRWMS
cc: Bryan Elliott/YM/RWDOE@CRWMS, Tracy Johnson/YM/RWDOE@CRWMS
Subject: MH Equipment Heat Loads

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Greg,

I believe that a factor of 4 reduction in heat load from operation of MH equipment motors, from what is assumed based on throughput use factors, is justified and still conservative. See attachment.

Steve

MH Equipment Heat Loads for HVAC Load Calcs_17Nov07.doc

**Mechanical Handling Equipment Heat Loads for Use in HVAC Load Calculations**

HVAC engineers are assuming that mechanical handling equipment motors operate continuously based on the use factors defined in the YMP throughput analyses. This assumption is conservative. While the equipment may be "occupied," meaning it is dedicated to a task for those periods, it is not in continuous operation (producing heat) during all of that time. Two examples from WHF evaluated below.

**Canister Transfer Machine**

Use Factor (WHF) = 0.20

Time CTM in use each 24 hours: 288 minutes

On a busy day, the WHF CTM might handle the import of a DPC (from an AO to an STC) and the export of a loaded TAD (from an STC to an AO). This involves two canister lifts and 8 lid lifts (conservatively assume remove and replace at each end of the transfer). The total vertical travel of the CTM hoist for all these lifts (up and down) is on the order of 200 feet. At 5 feet per minute hoist speed, the hoist will be operating (producing heat) for 40 minutes.

Other, smaller CTM motors will be in use for horizontal travel from port to port and back and forth to the lid staging location. A total of 500 feet of travel is estimated. At 20 feet per minute this is another 25 minutes of motor operation.

Based on this conservative evaluation, the large CTM motors are producing heat only about 23% of the time that the CTM is occupied based on the use factor.

**Site Transporter Vestibule Shield Door**

Use Factor (WHF) = 0.10

Time Shield Door in use each 24 hours: 144 minutes

On a busy day it could be assumed that this shield door might be opened 4 times to allow a site transporter to enter or depart. This door has a travel of 20' – 6". Total travel distance is thus 164 feet. Assuming a slow travel speed of 5 fpm (actual speed not known) result in a motor operating time of 32.8 minutes.

Based on this conservative evaluation, the large shield door drive motor is producing heat only about 23% of the time that the shield door is occupied based on the use factor.

**Conclusion:**

These two examples produced a similar result by chance, but I believe these results are typical for cranes and other mechanical handling equipment. Where HVAC load calculations assume continuous motor heat generation based on the throughput study use factors, I believe these heat loads could be reduced by a factor of four and still be conservative.

Steve Ployhar/ November 17, 2007

MH Equipment Heat Loads for HVAC Load Calcs_17Nov07.doc Page 1 of 1

| BSC | **Calculation/Analysis Change Notice**<br>*Complete only applicable items.* | 1. QA: N/A<br>2. Page 1 of 1 |
|---|---|---|

| 3. Document Identifier: | 4. Rev.: | 5. CACN: |
|---|---|---|
| 200-M8C-VCT0-00400-000 | 00C | 001 |

6. Title:
RF Heating and Cooling Load Calculation (Tertiary Non ITS)

7. Reason for Change:
In Table 5 Space Airflow Rates, there is an administrative error in Room 2012 (period instead of comma) and a typing error in "Corridor Total" under "Use Airflow cfm" and "Adjusted Room Sensible Load Btu/h". Actual values will be added above Note 18 on Rooms 1003E, 1003F, 1003G, 2002E, 2002F, 2002G, 2003E, 2003F, & 2003G under "Return Air" and "Exhaust Air".
This is documented in CR 11593 BR 12/27/07
This change does not impact the results of this calculation.

| 8. Supersedes Change Notice: | ☐ Yes If, Yes, CACN No.: ______ | ☒ No |
|---|---|---|

9. Change Impact:

| | | | | | |
|---|---|---|---|---|---|
| Inputs Changed: | ☐ Yes | ☒ No | Results Impacted: | ☐ Yes | ☒ No |
| Assumptions Changed: | ☐ Yes | ☒ No | Design Impacted: | ☐ Yes | ☒ No |

10. Description of Change:
(1) On Page 36, Table 5 Space Airflow Rates, Room 2012 under "Use Airflow cfm" change "5.420" to "5,420".

(2) On Page 36, Table 5 Space Airflow Rates, Corridor Total under "Use Airflow cfm" change "5,000" to "5,080".

(3) On Page 36, Table 5 Space Airflow Rates, Corridor Total under "Adjusted Room Sensible Load" change "155,223" to "157,689".

(4) On Page 37, Table 5 Space Airflow Rates, Sub system Totals under "Adjusted Room Sensible Load Btu/h" change "1,094,970"to "1,086,936".

(5) On Page 36, Table 5 Space Airflow Rates, Rooms 1003E, 1003F, 1003G, 1003H, 2002E, 2002F, 2002G, 2003E, 2003F, and 2003G under "Exhaust Air" add "0" (zero) above Note 18 in each cell.

(6) On Page 36, Table 5 Space Airflow Rates, Rooms 1003E, 1003F, 1003G, 1003H, 2002E, 2002F, 2002G, 2003E, 2003F, and 2003G under "Exhaust Air" add actual values above "Note 18" in each cell as follows:
Rooms 1003E=280, 1003F=1020, 1003G=1410, 1003H=440, 2002E=1160, 2002F=1120, 2002G=140, and 2003E through 2003G=2860.

**11. REVIEWS AND APPROVAL**

| Printed Name | Signature | Date |
|---|---|---|
| 11a. Originator:<br>Elpidio S. Castroverde | [signature] | 12/20/07 |
| 11b. Checker:<br>Greg W. Gould | [signature] | 12/20/07 |
| 11c. EGS:<br>Tracy L. Johnson | [signature] | 12/20/07 |
| 11d. DEM:<br>Hadi Jalali /for O.T. Asuncion | [signature] | 12/20/07 |
| 11e. Design Authority:<br>Barbara Rusinko | [signature] | 12/27/07 |

| BSC | **Calculation/Analysis Change Notice**<br>*Complete only applicable items.* ENG.20080116.0001 | 1. QA: N/A<br>2. Page 1 of 1 |
|---|---|---|

| 3. Document Identifier: | 4. Rev.: | 5. CACN: |
|---|---|---|
| 200-M8C-VCT0-00400-000 | 00C | CACN002 |

6. Title:

RF Heating and Cooling Load Calculation (Tertiary Non ITS)

7. Reason for Change:

In Table 5 Space Airflow Rates, there is an administrative error in Room 2012 (period instead of comma) and a typing error in "Corridor Total" under "Use Airflow cfm" and "Adjusted Room Sensible Load Btu/h". Actual values will be added above Note 18 on Rooms 1003E, 1003F, 1003G, 2002E, 2002F, 2002G, 2003E, 2003F, & 2003G under "Return Air" and "Exhaust Air".
This is documented in CR11593.

This change does not impact the results of this calculation.

| 8. Supersedes Change Notice: | ☒ Yes | If, Yes, CACN No.: CACN001 | ☐ No |
|---|---|---|---|

9. Change Impact:

| | | | | | |
|---|---|---|---|---|---|
| Inputs Changed: | ☐ Yes | ☒ No | Results Impacted: | ☐ Yes | ☒ No |
| Assumptions Changed: | ☐ Yes | ☒ No | Design Impacted: | ☐ Yes | ☒ No |

10. Description of Change:

(1) On Page 36, Table 5 Space Airflow Rates, Room 2012 under "Use Airflow cfm" change "5.420" to "5,420".

(2) On Page 36, Table 5 Space Airflow Rates, Corridor Total under "Use Airflow cfm" change "5,000" to "5,080".

(3) On Page 36, Table 5 Space Airflow Rates, Corridor Total under "Adjusted Room Sensible Load" change "155,223" to "157,689".

(4) On Page 37, Table 5 Space Airflow Rates, Sub system Totals under "Adjusted Room Sensible Load Btu/h" change "1,094,970"to "1,086,936".

(5) On Page 36, Table 5 Space Airflow Rates, Rooms 1003E, 1003F, 1003G, 1003H, 2002E, 2002F, 2002G, 2003E, 2003F, and 2003G under "Return Air" add actual values above "Note 18" in each cell as follows:
Rooms 1003E=280, 1003F=1020, 1003G=1410, 1003H=440, 2002E=1160, 2002F=1120, 2002G=140, and 2003E through 2003G=2860.

(6) On Page 36, Table 5 Space Airflow Rates, Rooms 1003E, 1003F, 1003G, 1003H, 2002E, 2002F, 2002G, 2003E, 2003F, and 2003G under "Exhaust Air" add "0" (zero) above "Note 18" in each cell.

**11. REVIEWS AND APPROVAL**

| Printed Name | Signature | Date |
|---|---|---|
| 11a. Originator:<br>Elpidio S. Castroverde | [signature] | 1/9/08 |
| 11b. Checker:<br>Greg W. Gould | Greg W. Gould | 1/9/08 |
| 11c. EGS:<br>Tracy L. Johnson | T Johnson | 1/9/08 |
| 11d. DEM:<br>Hadi Jalali | [signature] | 01/09/08 |
| 11e. Design Authority:<br>Barbara Rusinko | B Rusinko | 1/15/08 |