containing waste and fires that start in other rooms and propagate to where the waste is located. The steps of this process are as follows:

F4.2.1 Identify Fire-Rated Barriers and Designate Fire Zones

The facility is broken into fire zones based on the location of fire-rated barriers. The rating of the barriers is not significant to the methodology, so all rated barriers are considered. In order for a fire zone to exist, the penetrations, doorways, and ducts must also be limited to the perimeter of the zone. Note that a floor is always considered to be a fire barrier as long as it is solid. Zones are identified by a number, determined by the analyst, and will consist of one or more rooms.

F4.2.2 Identify the Rooms Where Waste can be Present

Each room where waste can be present, even if only for a brief time, is listed. The first set of fire initiating events to be considered in the PCSA is fires that affect each of these rooms, but do not affect other rooms that could contain waste.

F4.2.3 Define Local Initiating Events

Fire ignition occurrences are identified for each room within a fire zone. The total occurrences of a fire within a room containing a waste form is composed of the occurrences of ignitions in that room plus the occurrences of ignitions in surrounding rooms, within the fire zone, which propagate across room boundaries to the room containing the waste form. The locations of fire initiating events were identified in the master logic diagrams.

F4.2.4 Define Large Fire Initiating Events

Traditional fire risk studies for nuclear power plants have tended to ignore large fires, arguing that the fire barriers in place will prevent such occurrences. However, actual observed historical data shows that large fires in buildings occur. Large fires are defined for this study as those that spread to encompass the entire building. This is recognized in the latest fire risk guidance from Nuclear Regulatory Commission and Electrical Power Research Institute.[1] There, potential large fire initiating events are identified. The general approach is as follows:

In the YMP facilities, waste forms, except during the short time they are being lifted by a canister transfer machine, are on the ground floor. Continuing with the focus on rooms that contain waste forms, large fires may be divided two ways. One is associated with fires that start on the ground floor and spread to the entire building. The other is a fire that starts anywhere else in the building and spreads to the entire building.

As a practical analysis technique, any fire that spreads out of a fire area is considered a large fire.

[1] See, for example, NUREG/CR-6850 (Ref. F2.63) and (Ref. F2.64, Volume 2, Section 11.5.4).

F4.3 QUANTIFICATION OF FIRE IGNITION FREQUENCY

The quantification of initiating event frequency involves three steps. First, the overall frequency of fire ignition for the facility is determined, then that frequency is allocated to the individual room in the facility based on the number and types of ignition sources in the rooms. Types of ignition sources are characterized in general terms such as mechanical, electrical, combustible liquid. Finally, propagation probabilities are applied to determine the overall frequency that a fire reaches the area of the waste. Quantification uses data from the following sources for equipment ignition frequencies and conditional probabilities of propagation:

Summary & Overview. Volume 1 of *EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities.* (Ref. F2.64)

Detailed Methodology. Volume 2 of *EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities.* (Ref. F2.63)

Fires in or at Industrial Chemical, Hazardous Chemical, and Plastic Manufacturing Facilities: 1988 - 1997 Unallocated Annual Averages and Narratives. (Ref. F2.1)

Structure Fires in Radioactive Material Working Facilities and Nuclear Energy Plants of Non-Combustible Construction (Ref. F2.65)

Chemical Agent Disposal Facility Fire Hazard Assessment Methodology. (Ref. F2.66)

Utilisation of Statistics to Assess Fire Risks in Buildings. (Ref. F2.67).

F4.3.1 Determine the Overall Facility Fire Frequency

There is insufficient data available regarding the total frequency of fires in facilities comparable to YMP. NUREG/CR-6850 ((Ref. F2.64) and (Ref. F2.63)) provides an overall frequency for a typical nuclear power plant, but these are much larger and complex than the YMP facilities. Therefore, it has been decided to use a more generic fire ignition frequency approach that relates building size to total fire frequency for various broad categories of facilities (Ref. F2.67). This approach applies the following equation to overall fire ignition frequency.

Determine the Fire Frequency per Unit Area – The frequency per unit area is expressed by the following equation:

$$f_m(A) = c_1 A^r + c_2 A^s \quad \text{(Eq. F-1)}$$

where:

f_m is the fire ignition frequency per m^2 / yr

A is the floor area (in m^2)

c_1, c_2, r, and s are coefficients that were determined from historical data observations for different types of facilities.

For industrial buildings, the parameter values are as follows:

$$c_1 = 3 \times 10^{-4};\ c_2 = 5 \times 10^{-6};\ r = -0.61;\ \text{and}\ s = -0.05$$

Equation F-1 relates the frequency per unit area to the total area of the facility. This correlation was determined from the historical data, which showed that total fire frequency was not linearly related to the size of the facility. Rather, the frequency per unit area was affected by the size of the facility, and the larger the facility the lower the frequency per unit area.

Determine the Total Fire Frequency for the Facility – The total frequency of fire ignition for the building is thus represented by the following equation:

$$f_{\text{fire}} = f_{\text{m}}(A) \times A \qquad \text{(Eq. F-2)}$$

F4.3.2 Determine the Fire Ignition Frequency in Each Room

The approach to allocating the fire ignition frequency is based on the two approaches used in *Wet Handling Facility UPS 050-EEP0-UJX-00001 Single Line Diagram* (Ref. F2.62), *Detailed Methodology*. Volume 2 of *EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities*. EPRI TR-1011989 and NUREG/CR-6850 (Ref. F2.63), and *Chemical Agent Disposal Facility Fire Hazard Assessment Methodology* (Ref. F2.66). Both of these approaches determine the fraction of the total facility ignition frequency associated with various categories of equipment (i.e., ignition source category), then determine a facility-specific ignition frequency for each piece of equipment in each category, and then determine the total ignition frequency in the room based on the ignition source population in the room.

F4.3.2.1 Fraction of Fire Ignition Frequency Associated with Each Ignition Source Category

Wet Handling Facility UPS 050-EEP0-UJX-00001 Single Line Diagram (Ref. F2.62) and *Detailed Methodology*. Volume 2 of *EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities*. EPRI TR-1011989 and NUREG/CR-6850 (Ref. F2.63) have data for these fractions for nuclear power plants, and *Chemical Agent Disposal Facility Fire Hazard Assessment Methodology* (Ref. F2.66) has data for these frequencies for chemical process plants. Neither of these data sets is the best for the facilities at YMP. Therefore, the National Fire Protection Association (NFPA) was requested to provide an analysis (Ref. F2.65) of the data in their proprietary database on the distribution of fires by equipment type in all nuclear facilities of non-combustible construction. NFPA distinguishes between a large number of equipment types that can cause ignition of a fire. There is an insufficient amount of data to justify retaining this number of equipment types, so the equipment types were consolidated into a set of ignition source categories. These categories are defined in Appendix F.I.

Using the data by category, an analysis is performed to determine the fraction of fires that are caused by each category. That analysis is documented in Appendix F.II.

The total fire ignition frequency from Section F4.3.1 is multiplied by each of these factors to determine the total fire ignition frequency due to each equipment type. For example, the total ignition frequency due to electrical equipment for a given facility is:

$$f_{\text{elec-all}} = f_{\text{fire}} * 0.086 \quad \text{(Eq. F-3)}$$

F4.3.2.2 Individual Ignition Source Fire Ignition Frequency

The next step is to determine the fire ignition frequency from each piece of equipment in each category. As is done in *Wet Handling Facility UPS 050-EEP0-UJX-00001 Single Line Diagram* (Ref. F2.62), *Detailed Methodology*. Volume 2 of *EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities*. EPRI TR-1011989 and NUREG/CR-6850 (Ref. F2.63), and *Chemical Agent Disposal Facility Fire Hazard Assessment Methodology* (Ref. F2.66), divide the frequency contribution for each equipment type by the total number of pieces of equipment in the facility. For example, take the case following from the above example for the frequency of fire ignition from electrical equipment. If there are 50 pieces of electrical equipment in the facility, the ignition frequency for each piece of equipment is:

$$f_{\text{elec-each}} = f_{\text{elec-all}} / 50 \quad \text{(Eq. F-4)}$$

For the case of the category "no equipment involved" the ignition frequency is per unit area, so the total for this category is divided by the total floor area of the facility (which was already determined in Section F4.3.1).

F4.3.2.3 Allocation of Fire Ignition Frequency to Each Room

The final step is to use the per equipment values to allocate fire frequency to each room. This is done by counting the number of ignition sources of each type contained in each room, multiplying by the ignition frequency for each ignition source type, and summing across all types. For example, if Room 1 has six pieces of electrical equipment, then the ignition frequency in that room due to electrical equipment is:

$$f_{\text{elec-1}} = f_{\text{elec-each}} \times 6 \quad \text{(Eq. F-5)}$$

Doing this for each ignition source type (including multiplying the "no equipment involved" per unit area by the floor area of the room) and summing them together yields the total fire ignition frequency for the room.

$$f_1 = f_{\text{elec-1}} + f_{\text{hvac-1}} + f_{\ldots\text{-1}} \quad \text{(Eq. F-6)}$$

F4.4 DETERMINE INITIATING EVENT FREQUENCY

The definition of each initiating event includes the implicit condition that the fire actually threatens a target that contains radioactive material. Therefore, for each initiating event, the initiating event frequency considers two aspects; the fraction of time there is a waste container in the room, and the probability a fire propagates to that waste container.

F4.4.1 Probability of Presence of a Target

The probability of the presence of a target waste form is the fraction of time that the waste form(s) is in the area affected by the fire (e.g., for a room fire it is the fraction of time a waste form is in the room). For use in initiating event frequency equations, the probability is represented as follows:

P_{wri} = probability that a particular waste form is in room i during the preclosure period

P_{wz} = probability that a particular waste form is in zone i during the preclosure period

P_{wfi} = probability that a particular waste form is on floor i during the preclosure period

P_{wb} = probability that a particular waste form is in the building during the preclosure period.

The specific phrasing should be noted. This probability pertains to each individual waste form (i.e., one of the approximately 11,000 waste forms that will be handled at YMP). For example, if each waste form that passes through the WHF spends 60 minutes in the Cask Preparation Area, the probability that it is present when a fire occurs is 60 min/(50 yrs × 8760 hrs/yr × 60 min/hr). This is used to correct the final initiating event frequency for fires (normally expressed as per year) to be per operation over the preclosure period so that it is equivalent to the other internal initiating events (e.g., drops) and can be multiplied by the number of operations in same manner.

F4.4.2 Probability of Propagation to a Target

Of key interest for assessing the fire risk, is the extent to which fires that start in a “benign” area can spread to sensitive areas (i.e., areas where nuclear waste is present). The likelihood of fire propagation within the building is strongly dependent on the building construction and the presence of automatic fire suppression systems.

Both probabilities of exceedance and conditional probabilities were determined. The probabilities of exceedance are the probabilities that a fire propagates up to a specified limit or beyond. The conditional probabilities are probabilities that a fire spreads to a specified limit.

Probabilities of exceedance are not independent, but rather represent the total probability that a fire spreads up to the specified limit or beyond. These values are provided because, for many fire sequences, there is only be one case of interest, (i.e., there is only one target of concern, and once the fire reaches that target, the fact that the fire may propagate even further does not change the outcome of the sequence in terms of release). For example, this value could be applied to a case where a fire that spreads throughout a room affects the waste form in that room, and there are no additional waste forms in adjacent rooms or fire zones.

Conditional probabilities are independent, as they represent the probability that a fire spreads to precisely the specified limit. These values are provided to address those cases where the extent of propagation will define the number of targets involved in the fire. For example, these values would be applied when a fire that spreads throughout a room affects a waste form in that room; if it spreads to adjacent rooms, however, additional forms would be involved.

There are two types of propagation that are considered: propagation within a room and propagation between rooms.

F4.4.2.1 Fire Propagation within Rooms

An important consideration in the fire risk assessment is propagation within a given room. This scenario is referred to as “in-room propagation.” Propagation within the room is important for fires initiated in a room where waste is present. In this case, the question is whether the fire, which can ignite wherever there is an ignition source in the room, reaches the area within the room in which the waste is located.

This section provides a table with the in-room propagation values for the cases with and without automatic fire suppression systems functioning. To use this table to determine whether the fire spreads sufficiently to threaten waste forms, it is necessary to consider where the fire occurs in the room of interest. The steps in this process are as follows:

- Determine the distribution of the ignition sources (identified under Section F4.3.2.3) within the room by counting the total number of potential ignition sources that are “at,” “near,” or “far from” the target waste form.[2]

- Calculate the fraction of ignition sources “at,” “near,” and “far from” the target waste form by dividing the number at each location by the total in the room.

- Calculate the frequency of the fire reaching the waste form using the following equation:

$$\text{fier-i} = \text{Pwri} \; [\text{fi} \; (\text{FRa} + (\text{FRn} \times (\text{Ppc} + \text{Prc})) + (\text{FRf} \times \text{Prc}))] \qquad \text{(Eq.F-7)}$$

where:

f_i = frequency of ignition, *i*-th room

FR_a = fraction of ignition sources at the waste form

FR_n = fraction of ignition sources near the waste form

P_{pc} = conditional probability for fire confined to part of room of origin

FR_f = fraction of ignition sources far from the waste form

P_{rc} = conditional probability for confined to room of origin.

The values for P in the previous equation were developed from the analysis performed by NFPA (Ref. F2.65). The derivation of the values is provided in Appendix F.II for two cases (i.e., automatic fire suppression available and automatic fire suppression unavailable). The frequency f_i is the sum of frequencies of ignition of all ignition sources in the room. The fraction of ignition sources at, near, and far from the waste form was developed from equipment layout drawings such as the following:

[2] In the context of this method, an ignition source within a few feet of the waste source would be “at” the source, whereas an ignition source beyond this distance, but within a few yards of the waste source would be “near” the source. Ignition sources more that a few yards distant would be “far from” the waste source. This definition coordinates with the fire response model given in Attachment D.

Wet Handling Facility Normal Electrical and Utility Room Equipment Layout. (Ref. F2.55)

Wet Handling Facility General Arrangement Ground Floor Plan. (Ref. F2.38)

F4.4.2.2 Fire Propagation Beyond Rooms

This section provides propagation probabilities for fires spreading beyond the room in which they start. This type of propagation will be referred to as "ex-room propagation."

This section provides a table with the ex-room propagation values for the cases with and without automatic fire suppression systems functioning. To use this table to determine whether the fire spreads sufficiently to threaten waste forms, it is necessary to consider the various rooms where the fire could start and spread to the extent defined by the initiating event. The steps in this process are as follows:

- For each initiating event, identify all of the rooms within the area defined by the initiating event. For example, for a fire involving a specific fire zone, list all the rooms in that zone. For a fire involving the entire floor, list all the rooms on the floor. For a fire involving the entire building, list all the rooms in the building.

- For each room, calculate the probability that a fire that starts within the room is not confined to the next smaller fire initiating event but is confined to less than the definition of the next largest initiating event by multiplying the ignition frequency for the room by the conditional probability (or sum of conditional probabilities) that the fire spreads at least as far as defined, but no further. For example, for a fire involving a floor where there is also an initiating event for a fire involving a zone on the floor and an initiating event involving the entire building (multiple floors or beyond), the equation is:

$$f_{ief\text{-}fj\text{-}ri} = f_i \times P_{fc} \quad \text{(Eq. F-8)}$$

where:

$f_{ief\text{-}fj\text{-}ri}$	=	frequency of fire in zone j starting in room *i*
f_i	=	frequency of ignition, *i-th* room
P_{fc}	=	conditional probability for fire confined to the floor of origin.

Similarly, for a fire involving a floor where there is an initiating event for a fire in a zone on the floor and no specific initiating event for a fire involving the entire building the equation is:

$$f_{ief+\text{-}ri} = f_i \times (P_{fc} + P_{bc} + P_{b+c}) \quad \text{(Eq. F-9)}$$

where:

$f_{ief+\text{-}ri}$	=	frequency of fire involving an entire floor or greater starting in room i
f_i	=	frequency of ignition, *i-th* room

P_{fc} = conditional probability for fire confined to floor of origin

P_{bc} = conditional probability for fire confined to building of origin

P_{b+c} = conditional probability for fire extending beyond building of origin[3].

The total fire frequency of the defined severity is the sum across all rooms relevant to the initiating event, as discussed above.

F4.4.3 Initiating Event Frequency

The final initiating event frequency is determined by multiplying the frequency of the fire reaching the waste form (in occurrences per year) times the probability that a waste form is present (fraction of time per waste form) times 50 (years in the preclosure period). This multiplication yields the initiating event frequency for a fire of a specific severity affecting a waste form, per waste form handled, over the preclosure period.

F5 ANALYSIS

F5.1 INTRODUCTION

Fire initiating event frequencies have been calculated for each initiating event identified for the WHF. This section details the analysis performed to determine these frequencies, using the methodology documented in Section F4. The discussion of the analysis below presupposes that the reader has developed a thorough understanding of the details of that methodology, as those details are not repeated in this section. Note that the tables presented in this section, unless otherwise noted, are images of the actual spreadsheets used to perform the calculations. Therefore, there are no typographical errors in the translation of the results of the calculations into this report. The spreadsheet cells are color-coded to aid the analyst. Green numbers indicate values that are input by the analyst specific to the facility. Black numbers result from "off-line" calculations performed for this study. That is, they are facility-specific parameters whose values were determined as part of this analysis, but are not directly linked to the cell (i.e., they needed to be entered by the analyst). The source for these values is indicated in the text description of the spreadsheet. Orange numbers are values based on the analysis of operational experience (e.g., NFPA data), and should generally not be changed unless the analysis of operational experience changes or is updated. Red numbers are calculated values and should never be changed by the analyst. Green shaded cells are parameters that are assigned distributions that are used for the Crystal Ball Monte Carlo simulation runs discussed in Section F5.8. The aqua shaded cells are the final initiating event frequencies. The values shown in the cells are the baseline, point estimate values. The Monte Carlo simulation runs convert these values into distributions for use in the event sequence quantification.

[3] Note that the definition of a fire extending beyond the building of origin does not imply that the fire crosses some distance to affect other buildings or objects, but rather that the fire (i.e., flame damage) affects the outside surfaces of the building and items attached thereto.

F5.2 INITIATING EVENT FREQUENCIES

Fire ignition frequencies are based upon the total floor area of the building. Thus, the assessment of the area of each room of the WHF is the first step in obtaining initiating event frequencies. Table F5.2-1 shows the calculations that were performed to identify individual room areas, total ignition frequency, and uncertainty distributions.

F5.2.1 Room Area

Dimensions for room area calculations were obtained from the following WHF general layout drawings:

Wet Handling Facility General Arrangement Ground Floor Plan. (Ref. F2.38)

Wet Handling Facility General Arrangement Plan Below +40'-0". (Ref. F2.39)

Wet Handling Facility General Arrangement Plan Below E: +93'-0". (Ref. F2.40)

Wet Handling Facility General Arrangement Second Floor Plan. (Ref. F2.41)

Wet Handling Facility Pool Plan and Sections D, H, J. (Ref. F2.56).

In some cases, the dimension intervals shown on the general arrangement drawings matched the boundaries of the rooms. Where this was the case, these values were used to define the dimensions of the rooms. In cases where the dimension intervals did not accurately represent a room, the drawing scale and a straightedge was utilized to determine the dimensions. The length and width figures obtained were entered into the L1 (ft) and L2 (ft) columns of Table F5.2-1 and multiplied to produce the area in square feet. Rooms 1001, 1016, 1028, 1036, 2004, and 2025 occupy two floors of building space. The area obtained for these rooms was doubled to account for this. Rooms 1001, 10032, 1218A, 2005A, 2034, and 2203 are not of a standard rectangular shape whose area can be calculated by a single length and width. Thus, these rooms were divided into two to three rectangles, each with a determined length and width. Addition of the area of these rectangles provides the total room area. Rooms 1002, 1009, 1013, 1018, 1019, and 2012 contain smaller room(s) within themselves. To account for this, the red text indicates a reference to the cells that contain the dimensions of the smaller room(s), the area of which is subtracted from the area of the room containing it. All areas calculated in square feet were multiplied by 0.093 to obtain the area in square meters, because Equation F-1 is based in square meters.

F5.2.2 Building Ignition Frequency

Ignition frequency calculations are presented at the bottom of Table F5.2-1, and begin with the total area calculation. This is obtained by summing the areas (in square meters) of all rooms in the building. The ignition frequency per square meter per year line implements Equation F-1. The ignition frequency per year line implements Equation F-2. The ignition frequency over the 50-year period is obtained by multiplying the latter value by 50. As can be seen from the table, the expected number of ignition events over the preclosure period is approximately four.

The values shown are the baseline mean values for ignition frequency. An uncertainty analysis was performed on the results of Equation F-1 for the use of Crystal Ball software to run Monte

Carlo simulations to obtain fire initiating event frequency distributions. The geometric mean and 97.5% values of the resulting distribution for Equation F-1 are shown on the table. Refer to Appendix F.III for the calculations performed to develop the uncertainty distribution.

F5.3 IGNITION SOURCE FREQUENCY

As discussed in Section F4.3.2.1, an industrial building fire can begin as the result of numerous types of ignition sources, which have been grouped into nine categories:

- Electrical
- HVAC
- Mechanical equipment
- Heat generating equipment
- Torches, welders, and burners
- Internal combustion engines
- Office/kitchen equipment
- Portable equipment
- No equipment involved.

Each category has a fraction representing the probability that, given an ignition, that category is the source of the ignition. The mean values of these fractions are shown in the column labeled "category fraction" in Table F5.3-1. The derivation of these values is discussed in Appendix F.II. The column labeled "category frequency" implements the generic form of Equation F-3 to determine the mean ignition frequency associated with each ignition source. The next column, category population, contains the total number of ignition sources in each category in the facility. This is either the actual count of sources, a weighted point score of sources, or (for the case of "no equipment involved") the total floor area of the facility. The source of the count or score is presented in the next section. The floor area is taken from Table F5.2-1, fourth row from the bottom. The fifth column uses the previous two columns to implement Equation F-4 to determine the frequency per ignition source unit (i.e., per ignition source, per ignition source weighted point, or per square meter of floor area). These values are used in the next section to allocate fire ignition frequency to each room in the facility.

As stated previously, these values are mean values. The right hand group of columns is used by Crystal Ball to apply an uncertainty distribution to each of the category fraction values for the purpose of developing uncertainty distributions on initiating event frequency. The mean fraction, 97.5% value, and 97.5th percentile add columns show the parameters of these distributions. The development of all of the values is detailed in Appendix F.II. When Crystal Ball is run, it creates a sampled value for each fraction in the sampled value column. The spreadsheet then determines a normalized value by first assuring that each sampled value is not negative (minimum value of zero) and then normalizing the values so that the sum is always equal to one. The normalized value for each trial then replaces the category fraction value in the calculation. These probabilities must always add to one, as the groupings include all possible sources of ignition.

F5.4 IGNITION SOURCE DISTRIBUTION (EQUIPMENT LIST)

Compiling an initiating event frequency for the WHF is dependant on identifying many characteristics of the building, to include ignition sources. Ignition sources are defined as items that exist in the rooms of the building that have the potential to contribute to the initiation and/or propagation of a fire. These sources are grouped into the following categories:

- Electrical equipment
- HVAC equipment
- Mechanical process equipment
- Heat-generating process equipment
- Torches, welders, and burners
- Internal combustion engines
- Office and kitchen equipment
- Portable and special equipment.

Once the grouping for a source is determined, it is assigned a count (points)–a number which specifies the significance of the source by its contribution to fire ignition. Counts are integral to the calculations, as the total count for each category and room are multiplied by the ignition source frequency and summed to obtain the room ignition frequency. Table F5.4-1 shows the results of the ignition source distribution assessment for the WHF. The red numbers on this table highlight the actual count used, so as to make identification of the equipment count values easy to pick out from the other equipment identification information provided. Pieces of equipment that are in the room in question, but they do not count as ignition sources per the counting rules are shown in grey text. The following sections describe how the equipment was identified, categorized, and counted for the building.

F5.4.1 Electrical Equipment

Information regarding electrical equipment was gathered solely from the following single line diagrams and electrical room layout drawings:

Wet Handling Facility 480V Load Center 050-EEN0-LC-00001 Single Line Diagram. (Ref. F2.7)

Wet Handling Facility 480V Load Center 050-EEN0-LC-00002 Single Line Diagram. (Ref. F2.8)

Wet Handling Facility 480V Load Center 050-EEN0-LC-00003 Single Line Diagram. (Ref. F2.9)

Wet Handling Facility 480V ITS Load Center 050-EEE0-LC-00001 Train A Single Line Diagram. (Ref. F2.10)

Wet Handling Facility 480V Load Center 050-EEN0-LC-00002 Train B Single Line Diagram. (Ref. F2.11)

Wet Handling Facility 480V ITS MCC 050-EEE0-MCC-00001 Train A Single Line Diagram. (Ref. F2.12)

Wet Handling Facility 480V ITS MCC 050-EEE0-MCC-00002 Train B Single Line Diagram. (Ref. F2.13)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00001 Single Line Diagram. (Ref. F2.14)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00002 Single Line Diagram. (Ref. F2.15)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00003 Single Line Diagram. (Ref. F2.16)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00004 Single Line Diagram. (Ref. F2.17)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00005 Single Line Diagram. (Ref. F2.18)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00006 Single Line Diagram. (Ref. F2.19)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00007 Single Line Diagram. (Ref. F2.20)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00008 Single Line Diagram. (Ref. F2.21)

Wet Handling Facility 480V MCC 050-EEN0-MCC-00009 Single Line Diagram. (Ref. F2.22)

Wet Handling Facility-Electrical Equipment Space Requirement Calculation. (Ref. F2.36)

Wet Handling Facility ITS Train A Electrical and Battery Rooms Equipment Layout. (Ref. F2.45)

Wet Handling Facility ITS Train B Electrical and Battery Rooms Equipment Layout. (Ref. F2.46)

Wet Handling Facility ITS UPS 050-EEU0-UJX-00001 Train A Single Line Diagram. (Ref. F2.47)

Wet Handling Facility ITS UPS 050-EEU0-UJX-00002 Train B Single Line Diagram. (Ref. F2.48)

Wet Handling Facility Normal Electrical and Utility Room Equipment Layout. (Ref. F2.55)

Wet Handling Facility UPS 050-EEP0-UJX-00001 Single Line Diagram. (Ref. F2.62)

Wet Handling Facility Normal Electrical and Battery Rooms Equipment Layout (Ref. F2.69).

The electrical equipment category consists of computers, equipment racks, load centers, motor control centers (MCCs), uninterruptable power supply, transformers, lighting panels, digital control and management information system, programmable logic controller panels, batteries, and electrical panels. In general, each piece of electrical equipment constitutes a single ignition source and, therefore, has a count of one. However, MCCs, load centers, and equipment racks are assigned a count based on the total number of active vertical cabinets making up the overall unit. Every vertical cabinet in an equipment rack is treated as active. In the case of MCCs and load centers, a cabinet is considered active if the single line diagram shows that a load is attached (i.e., unused circuit breakers are not counted).

F5.4.2 HVAC Equipment

HVAC equipment locations and horsepower were obtained from the following facility general layout drawings and HVAC equipment lists:

Wet Handling Facility Composite Vent Flow Diagram HVAC Electrical & Battery Rooms. (Ref. F2.24)

Wet Handling Facility Composite Vent Flow Diagram HVAC Supply & ITS Exhaust. (Ref. F2.25)

Wet Handling Facility Composite Vent Flow Diagram Non-Confinement HVAC Trans Vest & Support Areas. (Ref. F2.26)

Wet Handling Facility Composite Vent Flow Diagram Non- ITS HVAC Electrical, Transportation Cask & Maintenance. (Ref. F2.27)

Wet Handling Facility Composite Vent Flow Diagram Tertiary Confinement Non- ITS HVAC Supply & Exhaust System. (Ref. F2.28)

Wet Handling Facility Confinement ITS Battery Room Exhaust System – Train A Ventilation & Instrumentation Diagram. (Ref. F2.29)

Wet Handling Facility Confinement ITS Battery Room Exhaust System – Train B Ventilation & Instrumentation Diagram. (Ref. F2.30)

Wet Handling Facility Confinement ITS Electrical Room HVAC System – Train A Ventilation & Instrumentation Diagram. (Ref. F2.31)

Wet Handling Facility Confinement ITS Electrical Room HVAC System – Train B Ventilation & Instrumentation Diagram. (Ref. F2.32)

Wet Handling Facility Confinement Maintenance Room HVAC System Ventilation & Instrumentation Diagram. (Ref. F2.33)

Wet Handling Facility Confinement Non-ITS Battery Room Exhaust System Ventilation & Instrumentation Diagram. (Ref. F2.34)

Wet Handling Facility Confinement Transportation Cask Vestibule HVAC System Ventilation & Instrumentation Diagram. (Ref. F2.35)

Wet Handling Facility ITS Confinement Areas HEPA Exhaust System – Train A Ventilation & Instrumentation Diagram. (Ref. F2.43)

Wet Handling Facility ITS Confinement Areas HEPA Exhaust System – Train B Ventilation & Instrumentation Diagram. (Ref. F2.44)

Wet Handling Facility Non-Confinement 2nd Floor Air Distribution System Ventilation & Instrumentation Diagram. (Ref. F2.49)

Wet Handling Facility Non-Confinement HVAC Supply System Ventilation & Instrumentation Diagram. (Ref. F2.50)

Wet Handling Facility Non-Confinement Site Transp. Vestibule HVAC System Ventilation & Instrumentation Diagram. (Ref. F2.51)

Wet Handling Facility Non-ITS Confinement Areas HEPA Exhaust System Ventilation & Instrumentation Diagram. (Ref. F2.52)

Wet Handling Facility Non-ITS Confinement Areas HVAC Supply System Ventilation & Instrumentation Diagram. (Ref. F2.53)

Wet Handling Facility Non-ITS Confinement Areas HVAC Supply System Ventilation & Instrumentation Diagram. (Ref. F2.54).

HVAC equipment consists of HEPA filters, exhaust fans, air handling units, fan coil units, and sump pumps. Because any motor with a horse power rating of five or more is considered to be an initiator, the number of motors and the horsepower of each motor is determined for all applicable HVAC equipment identified. A piece of equipment containing motors is assigned a count based on the number of motors with a horsepower of five or more. Because HEPA filter units are not applicable to this process, a count of one is assigned for each.

F5.4.3 Mechanical Process Equipment

Information regarding mechanical process equipment locations and horsepower were obtained from the following facility general layout drawings, mechanical equipment lists, and equipment piping and instrument diagram drawings:

CRCF, RF, WHF, and IHF Cask Transfer Trolley Process and Instrumentation Diagram. (Ref. F2.4)

Equipment Motor Horsepower and Electrical Requirements Analysis. (Ref. F2.5)

Wet Handling Facility Chilled Water System Piping & Instrument. Diagram. (Ref. F2.23)

Wet Handling Facility Electrical Load Summary Calculation. (Ref. F2.37)

Wet Handling Facility General Arrangement Ground Floor Plan. (Ref. F2.38)

Wet Handling Facility General Arrangement Plan Below +40'-0". (Ref. F2.39)

Wet Handling Facility General Arrangement Plan Below E: +93'-0". (Ref. F2.40)

Wet Handling Facility General Arrangement Second Floor Plan. (Ref. F2.41)

Wet Handling Facility Hot Water System – Piping & Instrument Diagram. (Ref. F2.42)

Wet Handling Facility Pool Water Treatment and Cooling System Piping & Instrument. Diagram. (Ref. F2.57)

Wet Handling Facility Pool Water Treatment System Train A Piping & Instrument. Diagram. (Ref. F2.58)

Wet Handling Facility Pool Water Treatment System Train B Piping & Instrument. Diagram. (Ref. F2.59)

Wet Handling Facility Pool Water Treatment System Train C Piping & Instrument. Diagram. (Ref. F2.60)

Wet Handling Facility Transportation Cask/DPC/STC Cavity Gas Sampling System Piping & Instrument Diagram. (Ref. F2.61).

Mechanical process equipment includes most of the motorized equipment that includes cranes, trolleys, doors, and platforms. These pieces of equipment are counted in the method described in Section F5.4.2 (i.e., each motor of 5 horsepower or more contributes a count of one). Because some of the equipment in this category is mobile, and counts are done for each room individually, it was necessary to consider the counts for equipment which can occupy more than one room. To accomplish this task, the amount of time a piece of equipment spends in each room was identified using the process throughput Gantt charts (Ref. F2.6). The cask transfer trolley (CTT) was identified as the only piece of mobile equipment that occupies more than one room.

The total time the CTT spends in the Cask Unloading Room (1008) is calculated from the following procedures (in parentheses) identified in the process throughput:

- Move transportation, aging, and disposal (TAD) canister shielded transportation cask (STC) into Cask Unloading Room – 20 minutes (1.5.9)
- Move TAD canister to aging overpack – 138 minutes (5.1)
- Export TAD canister in aging overpack – 299 minutes (1.6)
- Install TAD canister STC lid – 20 minutes (1.7.1)
- Open move TAD canister STC to preparation station #1 – 20 minutes (1.7.2).

The total time the CTT spends in the Cask Preparation Area (1016) is calculated by subtracting the total amount of time the CTT will be in Room 1008 from the total time of the procedure (18,195 minutes).

The time a mobile equipment item spends in each room is utilized to determine the percentage of time the equipment occupies a room, which directly corresponds to the percentage of the total count assigned to that room. This is represented on the equipment list as the residence weighting factor (RWF).

F5.4.4 Heat Generating Process Equipment

This equipment refers to such things as furnaces, dryers, and other such equipment except for those associated with the HVAC, which are counted separately as discussed above. There is no equipment for any of the facilities that falls under this category.

F5.4.5 Torches, Welders, and Burners

Welding operations are the only contributors to this category. The assignment of residency in this case is based on the estimated number of hours per year that welding operations are expected to occur in the area. This determination provides a suitable relative weight for apportioning fire ignition caused by welding operations. Portable welding receptacles are provided in various areas of the facility for the purpose of occasional welding of stationary equipment that may show signs of cracking. These receptacles are provided for convenience, and are not expected to see significant use. Each station is estimated to see on the order of five hours of use per year, and so is assigned a score of five points each. The primary maintenance area also contains a welding receptacle (the "primary welding station"), intended to perform all of the maintenance related welding for repair and fabrication that does not require direct work on a stationary piece of equipment (including on components of stationary pieces of equipment that are easily removed). The primary welding station is estimated to be used about 8 hours per week, and so it is assigned a score of 400 points. The WHF also has the TAD canister welding machine, which has weld end effectors. The number of hours of operation per year for the weld end effectors on the TAD canister welding machine is estimated based on the throughput time-and-motion study and the number of TAD canisters expected to be handled, as follows: (1) the period for preclosure operation of the WHF is 50 years; (2) the welding machine actually operates for 15 hours per TAD canister; (3) the WHF will process 1,165 TAD canisters. $1165 \times 15/50$ is 350 hours per year (a score of 350).

The locations of portable welding receptacles were determined as an engineering judgment on the part of the design team based on preliminary electrical and general layout drawings. The resultant fire initiating event frequencies are insensitive to the precise distribution of the portable welding receptacles, so a more rigorous analysis of the distribution is not required.

F5.4.6 Internal Combustion Engines

There are two transporters that utilize internal combustion engines in the WHF, which provide the entire contribution of fire ignition to the internal combustion engines category. The site transporter and site prime mover are assigned a total of 100 points each. The points are allocated to the rooms where these vehicles could be located by use of a RWF, as discussed in section F5.4.3.

The site transporter occupies Rooms 1007 (Loading Room) and 1023 (Site Transporter Vestibule). The times necessary to determine the percentage of time the site transporter spends in each room are given in Sections 1.5, 5.1, and 1.6 of the WHF process throughput diagram (Ref. F2.6). A total of 28 minutes is assigned to both rooms because the doors between them are open. Resultant times are 392 minutes in the Site Transporter Vestibule (1023) and 605 minutes in the Loading Room (1007).

The site prime mover occupies Rooms 1016 (Cask Preparation Area) and 1001 (Transportation Cask Vestibule). The times necessary to determine the percentage of time the prime mover spends in each room are given in section 1.1 of the WHF process throughput diagram. There are 12 total minutes that are assigned to both rooms because the doors between them are open. Resultant times are 24 minutes in the Transportation Cask Vestibule (1001) and 85 minutes in the Cask Preparation Area (1016).

The times internal combustion engines spend in each room is utilized to determine the percentage of time the engine occupies a room, which directly corresponds to the percentage of the total count assigned to that room. This is represented on the equipment list as the RWF.

Locations of the internal combustion engines were determined solely from the general layout drawings.

F5.4.7 Office/Kitchen Equipment

This category consists of miscellaneous office and kitchen equipment such as shredders, vending machines, microwaves, computers, radios, and printers. The location and quantity of such equipment was inferred by the description and layout of the rooms to come up with a reasonable distribution of such equipment in the facility. Work rooms, break rooms, briefing rooms, and offices were considered to possess such equipment. A judgment was made by the analysis team based on the function and size of the room as to how much of such equipment might reside in these rooms. Points were assigned to each room expected to contain office or kitchen equipment based on this judgment (one point per room). The resultant fire initiating event frequencies are quite insensitive to the precise distribution of this equipment, so a more rigorous analysis of the distribution is not required.

Locations of the office and kitchen equipment were determined solely from the general layout drawings.

F5.4.8 Portable and Special Equipment

This category consists of portable hand tools, monitoring devices, portable heaters, diagnostic equipment, and the like. Rooms where there were significant amounts of equipment that would expect to be maintained on a regular basis or where monitoring would take place were considered to possess such equipment. Determinations for the portable and special equipment category were inferred from the description and layout of the rooms, as described in Section F5.4.7. Each room containing such equipment was assigned four to eight points, depending on the quantity expected in that room. The resultant fire initiating event frequencies are quite insensitive to the precise distribution of this equipment, so a more rigorous analysis of the distribution is not required.

F5.5 ROOM IGNITION FREQUENCY

Ignition frequencies for each room are determined as a function of the number of units of ignition sources in the room, and the area of the room. The spreadsheet used to determine these frequencies is displayed as Table F5.5-1.

The major input to the spreadsheet is the number of units per category for each room (green text). These values are taken from the equipment list table (Table F5.4-1), which is formulated from equipment lists and equipment and general layout drawings (Section F5.4). The total number of units in each category is the result of a sum across all rooms, and can be found in the bottom total row. It is this value that is used in Table F5.3-1 in the column entitled “Category Population” for all categories except “no equipment involved,” as explained in Section F5.3.

The “no equipment involved” column of Table F5.5-1 is the area of the rooms, as a unit in this category is represented by a single square meter. These values are taken from Table F5.2-1, in the column entitled “A (sq-m).”

The final column on Table F5.5-1, entitled “Room Ignition Frequency”, implements the generic forms of Equations F-5 and F-6. It calculates the room ignition frequency, which uses the frequency per unit from Section F5.3. It takes the required per unit ignition frequencies directly from the spreadsheet represented by Table F5.3-1, the column entitled “Frequency per Unit.” Per Equation F-5, the number of units in each category (green text) is multiplied by the corresponding frequency per unit for that category. Per Equation F-6, summing these multiplications across a row provides the room ignition frequency for that room. The sum of all rooms is the building ignition frequency. This value is shown in the lower right hand column of the table. Note that this value does not match the value shown at the bottom of Table F5.2-1. That value, which is based only on building area, pre-supposes that the ignition sources in the building cover each of entire ignition source categories used in the analysis. However, the WHF does not have any equipment that fits the definition of heat generating equipment (welders have their own category), so this contribution does not apply to WHF.

F5.6 PROPAGATION PROBABILITIES

Propagation probabilities are used in this analysis to define the probability of a fire spreading to various defined points. The first two columns of Table F5.6-1 define the maximum extent of propagation, and the conditional probability column is the probability associated with that extent of propagation. The remaining columns in Table F5.6-1 are used in the uncertainty distribution for the conditional probability. The structure of this spreadsheet is analogous to Table F5.3-1. The right hand group of columns is used by Crystal Ball to apply an uncertainty distribution to each of the propagation probability values for the purpose of developing uncertainty distributions on initiating event frequency. The mean fraction, 97.5% value, and 97.5th percentile add columns show the parameters of these distributions. The development of all of the values is detailed in Appendix F.II. When Crystal Ball is run, it creates a sampled value for each fraction in the sampled value column. The spreadsheet then determines a normalized value by first ensuring that each sampled value is not negative (minimum value of zero) and then normalizing the values so that the sum is always equal to one. The normalized value for each trial then replaces the category fraction value in the calculation. These probabilities must always add to one, as the groupings include all possible propagation outcomes.

F5.7 INITIATING EVENT FREQUENCIES

Initiating event frequencies are the final results of the fire hazard analysis, and are a factor of all of the previously discussed data and residence fractions. The following sections shall describe the culmination of this data to conclude with initiating event frequencies.

F5.7.1 Residence Fractions

Residence fractions have been developed from process throughputs to determine the length of time a waste form will be vulnerable in a particular area of the building and in a particular configuration. The source for all of the times related to TAD canisters, dual-purpose canisters (DPCs), and spent nuclear fuel is the WHF throughput study (Ref. F2.6). Table F5.7-1 shows the vulnerabilities for all waste forms at the WHF, and the times that contribute to the overall time of vulnerability. The column labeled block flow diagram “BFD Task” refers to the task number from the process block flow diagram that was used in the throughput study. These numbers appear directly on the Gantt charts and provide a reference for the task that was considered. The total shows the total number of minutes that the waste form was in the specified configuration in the specified location. The fraction column implements the approach discussed in Section F4.4.1 to calculate the fraction of time that a specific waste form spends in the particular configuration and location over the 50-year period of preclosure operations in WHF.

F5.7.2 Localized Fires

Initiating event frequencies have been divided into two types of calculations: localized and large fires. Table F5.7-2 contains all of the calculations contributing to the localized fire initiating event frequencies.

F5.7.2.1 Room Groupings

The first column of Table F5.7-2 identifies the room(s) of origin. If the vulnerability is expected to occur in a single room with no gates or doors open and that is surrounded by qualified fire barriers (i.e., it is a single room fire area), this room is listed as the only room of origin. However, there are several cases in which the vulnerability takes place as the waste form moves between multiple rooms, or the room where the vulnerability occurs has open doors or gates with other rooms, or it shares a qualified fire area with other rooms. Table F5.7-3 lists all of the vulnerabilities that have more than one room of origin, and the justification for the multiple room listing. Whenever such a condition exists, the quantification of the localized fire considers not only fires that start in the room where the waste form resides, but also the contribution of other rooms that could directly communicate with that room through non-qualified or open fire barriers. Rooms within the same fire area of a room of origin are listed under each vulnerability in the column labeled "Propagation From Rooms in Fire Zone" heading.

For rooms of origin, the Frequency per Unit column is populated by the results in Section F5.3. This is discussed further in Section F5.7.2.2. Propagation rooms populate the Frequency per Unit column with the total ignition frequency for that room, as calculated and reviewed in Section F4.4 (Room Ignition Frequency).

F5.7.2.2 Ignition Source Distribution Within a Room

Per the methodology discussion in Section F4.4.2.1, the locations of the ignition sources within a room are identified relative to the target and assigned a location at the target, near the target, or away from the target. These locations are shown in their respective columns in Table F5.7-2, and must sum to the "Number In Room" column entry. These columns are designators of where the ignition sources are in relation to the vulnerable waste form.

For all categories except "no equipment involved," the distribution is determined by analysis of the room layout to determine whether the ignition source unit is at a distance within about three meters (at target), between about 3 and 7 meters (near target), or further (away from target) of the vulnerable waste form. For vulnerable waste forms in motion (e.g., in the railcar), ignition sources within the aforementioned distances of any portion of the path of motion are counted in the class representing its closest point to the waste form.

The ignition source units for the "no equipment involved" category are the area of the room (square meters). For vulnerabilities that are not waste forms in motion, the numbers for at target and near target are 30 and 120, respectively (i.e., a floor area of approximately 30 m^2 is considered at the target and the next 120 m^2 is considered near the target). The remaining area is entered as away from target. For vulnerable waste forms in motion, the "at target" value is the total area covered by the full range of motion plus a 3-m ring. Similarly, the number near target is figured to be a 7-m ring around the at target area. The remaining area is entered as away from target.

The distribution of ignition sources is used to determine how far a fire must spread before it reaches the vulnerable waste form. The propagation values are taken from Table F5.6-1 for the "no suppression" case, per the boundary conditions, in accordance with the guidance discussed in Section F4.4.2 (in particular, F4.4.2.1). The "frequency per (ignition source) unit" column is taken from Table F5.3-1, the column labeled Frequency per Unit. The target exposure time fraction, which is the probability that there is a waste form in the room, is taken from Table F5.7-1. The column labeled "Contribution to IE Frequency" implements Equation F-7 to provide the total initiating event frequency contribution from fire that start in the room where the waste form resides.

There is also a section of Table F5.7-2 that addresses the contribution from nearby rooms in the same fire area (i.e., that are separated from the room by walls or doors, but those barriers are not qualified fire barriers). In this case, the location of the ignition sources within these rooms is not important, only the probability that the fire spreads beyond the room within the same fire area matters as to whether the fire reaches the target. In this case, the Frequency per Unit column refers to the overall frequency of ignition in the room, which comes from the last column in Table F5.5-1. In this case, the appropriate propagation value for spread of a fire beyond the room is taken from Table F5.6-1, again for the no suppression case, as discussed in Section F4.4.2 (in particular, F4.4.2.2). For these rooms, the "Contribution to IE Frequency" column implements the generic form of Equation F-8, as applied to a fire throughout a fire area (zone) where the next largest fire is a floor fire.

The overall fire initiating event frequency, provided in a shaded cell for each defined initiating event shown in bold, is the sum of all the individual contributors.

F5.7.3 Large Fires

Calculation of the Initiating Event Frequencies is completed similarly to the localized fire contributions from other rooms. Table F5.7-4 provides the analysis. In this case, the fire can start in any room in the facility and become a large fire. Since the fire can start in any room, and the methodology applies the same probability of fire propagation to each room, the starting point is the total ignition frequency from all rooms, taken from Table F5.6-1. The propagation probability is applied as discussed in Section F4.4.2 (in particular, Section F4.4.2.2) to implement Equation F-9. The target exposure time (fraction) is once again taken from Table F5.7-1. Large fires always propagate beyond the fire area of the room of origin.

F5.7.4 Contribution to Initiating Event Frequency

The probability of a fire reaching the vulnerable waste form and the target exposure time (residence fractions; refer to section F5.7.1) contribute to the final calculation of the contribution to initiating event frequency (cells highlighted in blue on Tables F5.7-2 and F5.7-4). Section F4.4 details the calculations performed to arrive at the initiating event frequency.

F5.8 MONTE CARLO SIMULATION/UNCERTAINTY DISTRIBUTIONS.

F5.8.1 Uncertainty Distributions

Uncertainty distributions are used in the contribution to initiating event frequency calculations to account for the potential of variance in the data. For example, the ignition frequency presented in Table F5.2-1, Section F5.1 is the result of a calculation based on room area. The equation used to perform this calculation was derived from data collected on building fires. While the data collected and the equation developed to fit the data have a good R-squared (percentage of variability accounted for in the equation) value (90), an uncertainty distribution is necessary to account for the natural variability of the frequency of ignition.

The uncertainty distributions used for this analysis are primarily normal, with the exception of the ignition frequency distribution, which is lognormal (skewed bell curve shape, with the median value at the top of the curve). Lognormal distributions can be accurately represented by a median (50%) and a 97.5% value. The 97.5% value is a figure that represents a point at which only 2.5% of all possible outcomes will vary from the mean more significantly.

Three uncertainty distributions were developed for this analysis: ignition frequency, category fraction, and conditional probability. The distribution for ignition frequency is discussed in detail in Appendix F.III. The distributions for category fraction and conditional probability are discussed in Appendix F.II.

F5.8.2 Monte Carlo Simulation

Monte Carlo simulations are performed to determine the mean, standard deviation, variance, minimum, and maximum values of each of the initiating event frequencies based on the variance of the contributing data. To accomplish this task, the Microsoft Excel add-on package Crystal Ball was used. This software requires input of the necessary uncertainty distribution figures (in this case, median (50%) and 97.5% values) and the figures that the simulation will produce results for (initiating event frequencies). Crystal Ball software uses the mean and 97.5% values to calculate the equation that represents the distribution. The software then randomly selects a value from the possibilities defined by the distribution. The software is set to iterate 10,000 times to ensure accurate results.

F5.9 RESULTS

The results of the analysis are the fire initiating event frequencies and their associated distributions. The initiating event frequencies represent the probability, over the length of the preclosure period, that a fire will threaten the stated waste form during the stated vulnerability. Because data used to obtain these results are based on existing fire data, it was necessary to determine the uncertainty distribution for each initiating event. Figure F5.7-1 displays the Crystal Ball results for a localized fire threatening a TAD canister in an aging overpack in the Site Transporter Vestibule.

These results provide a statistical reference for the variance of each initiating event frequency. As seen in Section F5.7.2, Table F5.7-2, the baseline initiating event frequency for this case is 3.7×10^{-7}. The Crystal Ball results give insight into this, showing that given the variability of the inputs, the true result could lie anywhere between 4.8×10^{-8} and 1.7×10^{-6}, with a mean of 3.5×10^{-7}, a standard deviation of 1.8×10^{-7}, and a lognormal shape. Crystal Ball was run for all of the initiating events. A summary of the results, giving the distribution parameters of each distribution, is shown in Table F5.7-5. The 97.5 percentile values in Table F5.7-5 are not provided in the Crystal Ball full report. Instead, these values were obtained by using the "extract data" option, which allows the analyst to specify the percentile values necessary. Also not included in the Crystal Ball report are the error factors, which were calculated from the mean and median as discussed in Appendix F.V. It was determined via methods described in Appendix F.IV that all of the resultant distributions are lognormal. The complete output from Crystal Ball and the 97.5 percentile values are provided in Appendix F.VI. In addition to showing the initiating event frequency distribution, Appendix F.VI also shows the input distribution for the parameters that were varied, which match the distributions developed and documented in Appendices F.II and F.III.

Table F5.2-1. Room Areas and Total Ignition Frequency

See Note 1

Room	L1(ft)	L2(ft)	A(sq-ft)	A(sq-m)	L3(ft)	L4(ft)	L5(ft)	L6(ft)	L7(ft)	L8(ft)	
B001	41	18	738	69							
B002	39	18	702	65							
B003	23	18	414	38							
B004	23	32	736	68							
B005	19	20	380	35							
B006	6	5	30	3							
B007	6	12	72	7							
B008	39	17	663	62							
B009	41	17	697	65							
P001(incl in 1016)	0	0	0	0							
1001	53	50	17540	1630	60	102	*Area multiplied by two - Room extends two floors				
1002	54	43	1997	186	13	25					
1003	13	25	325	30							
1004	54	43	2322	216							
1005	11	9	99	9							
1006	40	43	1720	160							
1007	37	53	1961	182							
1008	27	53	1431	133							
1009	54	53	2457	228	15	27					
1010	15	27	405	38							
1011A	10	55	550	51							
1011B	148	10	1480	137							
1012A	10	53	530	49							
1012B	108	10	1080	100							
1013	50	68	3392	315	18	11	10	19			
1014	18	11	198	18							
1015	7	9	63	6							
1016	212	104	44096	4097	*Area multiplied by two - Room extends two floors						
1017	46	63	2898	269							
1018	33	104	222	21	46	63	13	12	13	12	
1018A	13	12	156	14							
1018B	13	12	156	14							
1019	54	43	1997	186	25	13					
1020	25	13	325	30							
1021	54	43	2322	216							

Table F5.2-1. Room Areas and Total Ignition Frequency (Continued)

Room	L1(ft)	L2(ft)	A(sq-ft)	A(sq-m)	L3(ft)	L4(ft)	L5(ft)	L6(ft)	L7(ft)
1022	7	9	63	6					
1023	64	73	4672	434					
1024	18	12	216	20					
1025	26	12	312	29					
1026	12	28	336	31					
1027	12	28	336	31					
1028	20	15	600	56	*Area multiplied by two - Room extends two floors				
1029	20	15	300	28					
1030	12	15	180	17					
1031	22	15	330	31					
1032	34	6	288	27	6	14			
1032A	20	12	240	22					
1033	29	12	348	32					
1034	26	12	312	29					
1035	12	15	180	17					
1036	7	13	182	17	*Area multiplied by two - Room extends two floors				
1037	6	13	78	7					
1038	5	14	70	7					
1039	5	14	70	7					
1042A	13	16	208	19					
1042B	13	16	208	19					
1042C	13	16	208	19					
1043A	13	25	325	30					
1043B	13	25	325	30					
1043C	13	25	325	30					
1044A	13	21	273	25					
1044B	13	21	273	25					
1044C	13	21	273	25					
1045A	40	9	360	33					
1045B	40	9	360	33					
1045C	54	20	1080	100					
1045D	13	82	1066	99					
1046	46	37	1702	158					
1201	10	9	90	8					

Table F5.2-1. Room Areas and Total Ignition Frequency (Continued)

Room	L1(ft)	L2(ft)	A(sq-ft)	A(sq-m)	L3(ft)	L4(ft)	L5(ft)	L6(ft)	L7(ft)
1202	14	16	224	21					
1203	23	16	368	34					
1204	27	16	432	40					
1205	17	28	476	44					
1206	16	8	128	12					
1207	16	34	544	51					
1208	12	8	96	9					
1209	12	35	420	39					
1210	17	14	238	22					
1211	16	8	128	12					
1212	16	14	224	21					
1213	16	10	160	15					
1214	16	10	160	15					
1215	30	25	750	70					
1216	15	18	270	25					
1217	15	18	270	25					
1218A	97	6	648	60	11	6			
1218B	6	53	318	30					
1218C	104	6	624	58					
M001	51	100	5100	474					
2001	54	28	1512	140					
2001A	50	10	500	46					
2002	54	43	2322	216					
2003	40	36	1440	134					
2004	114	48	10944	1017	*Area multiplied by two - Room extends two floors				
2005A	157	9	1533	142	10	12			
2005B	108	9	972	90					
2006	146	10	1460	136					
2007A	10	56	560	52			868.4576		
2007B	212	10	2120	197					
2008	54	104	5616	522					
2010	54	43	2322	216					
2011A	54	19	1026	95					
2011B	54	24	1296	120					

Table F5.2-1. Room Areas and Total Ignition Frequency (Continued)

Room	L1(ft)	L2(ft)	A(sq-ft)	A(sq-m)	L4(ft)	L5(ft)	L6(ft)	L7(ft)	L8(ft)
2012	64	43	2596	241	12	13			
2013	12	13	156	14					
2024	18	11	198	18					
					*Area multiplied by two - Room extends two floors				
2025	22	11	484	45					
2026	12	28	336	31					
2027	12	28	336	31					
2029	10	18	180	17					
2030	10	15	150	14					
2032	17	6	102	9					
2033	21	6	126	12					
2034	24	6	312	29	7	24			
2201	13	16	208	19					
2202	20	16	320	30					
2203	40	12	560	52	5	16			
2204	9	14	126	12					
2205	10	14	140	13					
2206	6	14	84	8					
Total Area (sq-m)				15046		50% Value		97.5% Value	
Ignition Frequency (per sq-m/yr)				3.94E-06	3.94E-06	3.94E-06		9.40E-06	
Ignition Frequency (per yr)				5.93E-02					
Ignition Frequency (50 years - preclosure period)				2.96E+00					

NOTE: The blank cells in this table are intentionally blank and have been verified. Information that would appear in the blank locations is not applicable for the room identified in the first column.

Source: Original

Table F5.3-1. Ignition Frequency by Ignition Source

Category	Category Fraction	Category Frequency (50 years)	Category Population	Frequency per Unit (50 years)			Sampled Value	Mean Fraction	97.5% Value	97.5th percentile add
Electrical	0.086	2.54E-01	185	1.37E-03		0.086	0.086	0.086	1.26E-01	4.05E-02
HVAC	0.080	2.38E-01	50	4.76E-03		0.080	0.080	0.080	1.20E-01	3.93E-02
Mechanical Equipment	0.139	4.13E-01	64	6.45E-03		0.139	0.139	0.139	1.89E-01	5.01E-02
Heat Generating Equipment	0.155	4.60E-01	0	0.00E+00		0.155	0.155	0.155	2.07E-01	5.24E-02
Torches, welders, burners	0.219	6.50E-01	810	8.03E-04		0.219	0.219	0.219	2.79E-01	5.99E-02
Internal combustion engines	0.021	6.23E-02	200	3.12E-04		0.021	0.021	0.021	4.23E-02	2.09E-02
Office/kitchen equipment	0.064	1.90E-01	20	9.50E-03		0.064	0.064	0.064	9.97E-02	3.55E-02
Portable Equipment	0.102	3.03E-01	52	5.82E-03		0.102	0.102	0.102	1.45E-01	4.37E-02
No equipment involved	0.134	3.98E-01	15087	2.64E-05		0.134	0.134	0.134	1.83E-01	4.93E-02
	1.000					1.000				

NOTE: HVAC = heating, ventilation, and air conditioning.

Source: Original

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Table F5.4-1. Ignition Source Population by Room

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
B001 (Access Stair/Leak Detection Sump Area)			Leak Detection Sump Pump 1 050-PW00-P-00003-A 0.5 hp					
B002 (Storage Tank Area)			**1 MP Liquid LLW Sampling Pump** 050-MWL0-P-00001 • **5 hp** **1 MP Liquid LLW Sump Pump** 050-MWL0-P-00002 • **5 hp**					
B003 (Unassigned)								
B004 (Unassigned)								
B005 (Decon Collection Tank Area)								
B006 (Elevator Lobby)								
B007 (Elevator)								
B008 (Storage Tank Area)								
B009 (Access Stair/Leak Detection Sump Area)			Leak Detection Sump Pump 2 050-PW00-P-00003-B • 0.5 hp					
P001 (Pool)			**4 Pool Treatment Filter Pumps** 050-PW00-SKD-00001-A 050-PW00-SKD-00001-B 050-PW00-SKD-00001-C 050-PW00-SKD-00001-D • **15 hp**					
1001 (Transport Cask Vestibule)		**4 Fan coil units** 050-VCT0-FCU-00009 050-VCT0-FCU-00010 050-VCT0-FCU-00011 050-VCT0-FCU-00012 • **20 hp (ea.)**	**Entrance Vest. Crane** 050-HMC0-CRN-00001 • **2+1 motors @ 45, 2, & 5 hp** **Overhead Door** • **1 motor @ 5 hp**		**2 Portable Welding Receptacles – WWF = 10 points**	**22% Shared w/ room 1016** **Site Prime Mover (Railcar)** • **22 units**		

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1002 (Electrical Room)	**480 V Load Center** 050-EEE0-LC-00001 • **2 cabs** **480 V MCC** 050-EEE0-MCC-00001 • **10 cabs** **1 45 kVA Dist. XFMR** 050-EEE0-XFMR-00003 **1 40 kVA Maint. Bypass XFMR** 050-EEU0-XFMR-00001 **1 UPS** 050-EEU0-UJX-00001 **1 208/120 V Dist. Panel** 050-EEE0-PL-00003 **1 120 V UPS Panel** 050-EEU0-PL-00001 **1 Lighting Panel** 050-EUL0-PL-00001-A **2 DCMIS** **2 PLC Panels**	**2 Fan coil units** 050-VCT0-FCU-00001 050-VCT0-FCU-00002 • **15 hp (ea.)**			**Portable Welding Receptacle – WWF = 5 points**			**Assume 7.7% of all such eq.** • **4 points**
1003 (Battery Room)	**1 125 V Battery** 050-EEE0-BTRY-00001	**2 Exhaust Fans** 050-VCT0-EXH-00004 050-VCT0-EXH-00005 • **5 hp (ea.)** **2 HEPA Filter Units** (hp n/a) 050-VCT0-FLT-00010 050-VCT0-FLT-00011						
1004 (HVAC Room)		**1 Exhaust Fan** 050-VCS0-EXH-00001 • **200 HP** **3 HEPA Filter Units** (hp n/a) 050-VCT0-FLT-00001 050-VCT0-FLT-00002 050-VCT0-FLT-00003			**Portable Welding Receptacle – WWF = 5 points**			**Assume 7.7% of all such eq.** • **4 points**
1005 (Vestibule)								
1006 (HVAC Room)		**3 Exhaust Fans** 050-VCT0-EXH-00001 050-VCT0-EXH-00002 050-VCT0-EXH-00003 • **50 hp (ea.)** **3 HEPA Filter Units** (hp n/a) 050-VCT0-FLT-00016 050-VCT0-FLT-00017 050-VCT0-FLT-00018						**Assume 7.7% of all such eq.** • **4 points**
1007 (Loading Room)						**61% Site Transporter 1023** • **61 units**		

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1008 (Cask Unloading Room)			**3% Cask Transfer Trolley** 050-HM00-TRLY-00001 **1016** • **1 power drive** • X 3% = **0.03**					**Assume 4% of all such eq.** • **2 points**
1009 (CTM Maint. Rm.)					**Portable Welding Receptacle – WWF = 5 points**			
1010 (Gas Sampling Room)			**Cask Cavity Gas Sample Sys.** 050-MRE0-VACP-00001 050-MRE0-DET-00001 • **1 motor** • **1 hp**					
1011A (Corridor)								
1011B (Corridor)								
1012A (Corridor)								
1012B (Corridor)								
1013 (LLW Staging Area)			**Overhead Door** • **1 motor @ 5 hp**		**Portable Welding Receptacle – WWF = 5 points**			
1014 (Chemical Lab)								
1015 (Elevator Machine Room)								

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1016 (Cask Preparation Area)			**Cask Handling Crane** 050-HM00-CRN-00001 • **4 motors @ 90, 45, 7.5, & 30 hp** **Auxiliary Pool Crane** 050-HMH0-CRN-00001 • **2+1 motors @ 25, 1.5, & 7.5 hp** **DPC Cutting Jib Crane** 050-HD00-CRN-00001 • **1+2 motors @ 15, 1.5, &1.5 hp** **Spent Fuel Transfer Machine** 050-HTF0-FHM-00001 • **2+1 motors @ 30, 5, & 1.5 hp** **DPC Cutting Machine** 050-HD00-TOOL-00001 • **1 motor @ 20 hp** **Cask Support Frame** 050-HD00-FRM-00001 ○ **2 motors @ 5 hp** **DPC Cutting Station** 050-HD00-PLAT-00001 • **2 motors @ 5 hp** **TAD Closure Station** 050-HC00-PLAT-00001 • **4 motors @ 5 hp each** **TAD Closure Jib Crane** 050-HC00-CRN-00001 • **1+2 motors @ 15, 1.5, &1.5 hp** **DPC Unloading Bay Gate** 050-WH00-DR-00002 • **1 motor @ 5 hp** **Mobile Access Platform** 050-HMC0-PLAT-00001 • **6+4 motors: 4@1 hp, 4@5 hp, & 2@10 hp** **Pool Equipment Crane** 050-PW00-CRN-00001 • **1+2 motors @ 20, 1, & 3 hp** **Preparation Stations #1 & 2** 000-HMH0-PLAT-00001 • **2 motors @ 5 hp each** 050-HMH0-PLAT-00002 • **2 motors @ 5 hp**		**TAD Canister Welding Machine** 050-HC00-TOOL-00001 • **350 points (15*1165/50)** **3 Portable Welding Receptacles – WWF = 15 points**	**78% Shared w/ room 1001** **Site Prime Mover (Railcar)** • **78 units**		**Assume 15% of all such eq.** • **8 points**

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1016 (cont.)			**Prep Station Jib Cranes** 050-HMH0-CRN-00002 • **1+2 motors @ 15, 1.5, &1.5 hp** 050-HMH0-CRN-00003 • **1+2 motors @ 15, 1.5, &1.5 hp** **97% Cask Transfer Trolley** 050-HM00-TRLY-00001 **1008** • **1 power drive** • X 97% = **0.97** **TAD Canister Welding Machine** 050-HC00-TOOL-00001 • **1 motor @ 5 hp** **Shield Door** 050-WH00-DR-00001 • **1 motor @ 5 hp** **Shield Door** 050-WH00-DR-00003 • **1 motor @ 5 hp**					
1017 (Air Compressor Room)	**480V Load Center** 050-EEN0-LC-00003 • **5 cabs**		**2 Chilled Water Pumps** 050-PSC0-P-00001A 050-PSC0-P-00001B • **1 motor (ea.)** • **75 hp (ea.)** **2 Hot Water Pumps** 050-PSH0-P-00001A 050-PSH0-P-00001B • **1 motor (ea.)** • **20 hp (ea.)**					
1018 (Maintenance Room)		**2 Fan coil units** 050-VCT0-FCU-00007 050-VCT0-FCU-00008 • **20 hp (ea.)**			**Primary Welding Station** • **400 points**			
1018A (Vestibule)								
1018B (Vestibule)								

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1019 (Electrical Room)	**480 V Load Center** 050-EEE0-LC-00002 • **2 cabs** **480 V MCC** 050-EEE0-MCC-00002 • **10 cabs** **1 40 kVA Maint. Bypass XFMR** 050-EEU0-XFMR-00002 **1 480 V XFMR** 050-EEE0-XFMR-00002 **1 45 kVA Distribution XFMR** 050-EEE0-XFMR-00004 **1 UPS** 050-EEU0-UJX-00002 **1 120 V UPS Panel** 050-EEU0-PL-00002 **1 208/120 V Distribution Panel** 050-EEE0-PL-00004 **1 277 V Lighting Panel** 050-EUL0-PL-00001-B **2 DCMIS** **2 PLC Panels**	**2 Fan coil units** 050-VCT0-FCU-00003 050-VCT0-FCU-00004 • **15 hp (ea.)**			**Portable Welding Receptacle – WWF = 5 points**			**Assume 7.7% of all such eq.** • **4 points**
1020 (Battery Room)	**1 125 V Battery** 050-EEE0-BTRY-00002	**2 Exhaust Fans** 050-VCT0-EXH-00006 050-VCT0-EXH-00007 • **5 hp (ea.)** **2 HEPA Filter Units** (hp n/a) 050-VCT0-FLT-00012 050-VCT0-FLT-00013						
1021 (HVAC Room)		**1 Exhaust Fan** 050-VCS0-EXH-00002 • **200 hp** **3 HEPA Filter Units** (hp n/a) 050-VCT0-FLT-00005 050-VCT0-FLT-00006 050-VCT0-FLT-00007						**Assume 7.7% of all such eq.** • **4 points**
1022 (Vestibule)								
1023 (Site Transport Vestibule)		**3 Fan coil units** 050-VNI0-FCU-00001 050-VNI0-FCU-00002 050-VNI0-FCU-00003 • **7.5 hp (ea.)**	**Aging Overpack Access Plat.** 050-HAC0-PLAT-00001 • **2 motors @ 5 hp each** **Shield Door** 050-WH00-DR-00004 • **1 motor @ 15 hp** **Overhead Door** • **1 motor**			**39% Site Transporter 1007** • **39 units**		
1024 (Stair #1)								

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1025 (Stair #2)								
1026 (Stair #3)								
1027 (Stair #4)								
1028 (Freight Elevator)			**Elevator** • **1 motor @ 50 hp**					
1029 (Elevator Lobby)								
1030 (Elevator Equipment Room)								
1031 (Corridor)								
1032 (Corridor)								
1032A (Storage Room)								
1033 (Corridor)								
1034 (Fire Water Riser Valve R1)								
1035 (Fire Water Riser Valve R2)								
1036 (Elevator)			**Elevator** • **1 motor @ 50 hp**					
1037 (Elevator Machine Room)								
1038 (Condenser Area N)								
1039 (Condenser Area S)								
1042A (Pool Pump Room A)			**1 Pool Treatment Pump A 050-PW00-P-00001-A** • **40 hp**					

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1042B (Pool Pump Room B)			**1 Pool Treatment Pump B 050-PW00-P-00001-B 40 hp**					
1042C (Pool Pump Room C)			**1 Pool Treatment Pump C 050-PW00-P-00001-C 40 hp**					
1043A (Pool Filter Room A)								
1043B (Pool Filter Room B)								
1043C (Pool Filter Room C)								
1044A (Pool Ion Exchanger Room)								
1044B (Pool Ion Exchanger Room)								
1044C (Pool Ion Exchanger Room)								
1045A (Corridor)								
1045B (Corridor)								
1045C (Corridor)			**Overhead Door** • **1 motor @ 5 hp**					
1045D (Corridor)								

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1046 (Electrical Room)	**480 V Load Center** 050-EEN0-LC-00002 • **4 cabs** **480 V MCC** 050-EEN0-MCC-00005 • **12 cabs** **480 V MCC** 050-EEN0-MCC-00006 • **14 cabs** **480 V MCC** 050-EEN0-MCC-00007 • **14 cabs** **480 V MCC** 050-EEN0-MCC-00008 • **11 cabs** **480 V MCC** 050-EEN0-MCC-00009 • **29 cabs** **1 480 V Distribution XFMR** 050-EEN0-XFMR-00006 **1 Distribution Panel** 050-EEN0-PL-00006 **2 277 V Lighting Panels** 050-EUL0-PL-00004 050-EUL0-PL-00005 **2 DCMIS** **2 PLC Panels**							
1201 (Entry/Exit Vestibule)								
1202 (Briefing Room)							**Assume 5% of all such equipment** • **1 point**	
1203 (Mens Room)								
1204 (Womens Room)								
1205 (RP Control Point)							**Assume 5% of all such equipment** • **1 point**	
1206 (Controlled Exit)								
1207 (Vestibule Out)								

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
1208 (Vestibule In)								
1209 (RP Gear Supply Room)							**Assume 5% of all such equipment** • **1 point**	
1210 (Decon)							**Assume 5% of all such equipment** • **1 point**	
1211 (Respirator Room)							**Assume 5% of all such equipment** • **1 point**	
1212 (RP Equipment Room)							**Assume 5% of all such equipment** • **1 point**	
1213 (Change Room 2)								
1214 (Change Room 1)								
1215 (RP Instrument Room)							**Assume 5% of all such equipment** • **1 point**	
1216 (RP Lab/Sample Prep. Room)							**Assume 5% of all such equipment** • **1 point**	
1217 (RP Lab/Count Room)							**Assume 5% of all such equipment** • **1 point**	
1218A (Corridor)								
1218B (Corridor)								
1218C (Corridor)								
M001 (HVAC/Pool Equipment Room)		**3 Air Handling Units** 050-VC00-AHU-00001 050-VC00-AHU-00002 050-VC00-AHU-00003 • **40 hp (ea.)**						**Assume 7.7% of all such eq.** • **4 points**

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Table F5.4-1. Ignition Source Population by Room (Continued)

Ignition Source / Room Number	Electrical Equipment	Mechanical/ Electrical HVAC Equipment	Mechanical Process Equipment	Heat Generating Process Equipment	Torches, Welders, Burners	Internal Combustion Engines	Office/Kitchen Equipment	Portable and Special Equipment
2001 (Electrical Room)	**480 V Load Center** 050-EEN0-LC-00001 • **4 cabs** **480 V MCC** 050-EEN0-MCC-00001 • **9 cabs** **480 V MCC** 050-EEN0-MCC-00002 • **14 cabs** **480 V MCC** 050-EEN0-MCC-00003 • **13 cabs** **480 V MCC** 050-EEN0-MCC-00004 • **11 cabs** **3 480 V Distribution XFMRS** 050-EEN0-XFMR-00003 050-EEN0-XFMR-00004 050-EEN0-XFMR-00005 **1 480 V Bypass XFMR** 050-EEP0-XFMR-00001 **3 480 V Distribution Panels** 050-EEN0-PL-00003 050-EEN0-PL-00004 050-EEN0-PL-00005 **1 208/120 V UPS Distribution Panel** 050-EEP0-PL-00001 **1 UPS** 050-EEP0-UJX-00001 **3 277 V Lighting Panels** 050-EUL0-PL-00001 050-EUL0-PL-00002 050-EUL0-PL-00003 **2 DCMIS** **1 PLC Panel**							**Assume 7.7% of all such eq.** • **4 points**
2001A (Battery Room)	**1 125 V Battery** 050-EEP0-BTRY-00001	**2 Exhaust Fans** 050-VCT0-EXH-00008 050-VCT0-EXH-00009 • **5 hp (ea.)** **2 HEPA Filter Units** (hp n/a) 050-VCT0-FLT-00014 050-VCT0-FLT-00015						
2002 (HVAC Room)		**2 Air Handling Units** 050-VCT0-AHU-00001 050-VCT0-AHU-00002 • **100 hp (ea.)**						**Assume 7.7% of all such eq.** • **4 points**
2003 (HVAC Room)		**1 Air Handling Unit** 050-VCT0-AHU-00003 • **100 hp (ea.)**						**Assume 7.7% of all such eq.** • **4 points**