RAI Volume 2, Chapter 2.1.1.3, Second Set, Number 4: Explain why the fire ignition frequency of a facility over the preclosure period (3.1 events during the preclosure period), given in Table F5.5-1 of BSC (2008b), is not same as the overall facility ignition frequency (3.7 events during the preclosure period), given in Table F5.2-1 of BSC (2008b).

The overall facility frequency was calculated using Equation F-1 of BSC (2008b). The calculation method is provided in "CRCF Fire Frequency – No Suppression jwm.xls" included in Attachment H of BSC (2008b), and in Table F5.5-1 of BSC (2008b). In addition, the overall frequency is distributed by ignition category and by room, as described in Sections F4.3.2.1 through F4.3.2.3 of BSC (2008b).

1. RESPONSE

The fire ignition frequency of a facility (3.1 events during the preclosure period) is not the same as the overall facility fire ignition frequency (3.7 events during the preclosure period) because some ignition source categories do not apply to an operating facility.

The overall facility fire ignition frequency for an industrial facility the size of the Canister Receipt and Closure Facility (CRCF), which is based on the total surface area of the facility (19,611 m^2), is 3.7 events over a 50-year period. This information is provided in Table F5.2-1 of *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008). The facility was then partitioned into ignition source categories (BSC 2008, Appendix F.II) with associated fractions, as shown in Table F5.3-1 of the CRCF analysis (BSC 2008) and Table 1. If the facility has equipment represented in all the ignition source categories, then the total fire ignition frequency, which is the sum of all category frequencies, would equal the overall facility fire ignition frequency of 3.7 events over a 50-year period. This is the case in Table 1, which shows the sum of the category fraction as unity.

However, if a facility does not contain a particular category of ignition sources, then the fraction of that category in Table 1 would be zero. This is the case in the CRCF, which has no equipment in the "Heat Generating Equipment" category, as shown in Table F5.5-1 of the CRCF analysis (BSC 2008). This category represents 15.5% of the overall facility fire ignition frequency (see Table 1) or 3.7 events × 0.155 = 0.57. Therefore, the total CRCF fire ignition frequency is 3.7 – 0.57 ≅ 3.1 events over a 50-year period.

In summary, the adjustment from 3.7 events for the overall facility fire ignition frequency to 3.1 events for the fire ignition frequency of the CRCF is attributable to the absence of equipment in a specific ignition source category in the CRCF.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

BSC (Bechtel SAIC Company) 2008. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis*. 060-PSA-CR00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080311.0031.

Table 1. Example - Ignition Frequency by Source Category for a Facility Containing All Ignition Source Categories

Ignition Source Category	Category Fraction		Overall Facility Fire Ignition Frequency (50 years)		Category Frequency (50 years)
Electrical	0.086	×	3.70	=	3.17×10^{-1}
HVAC	0.080	×	3.70	=	2.97×10^{-1}
Mechanical Equipment	0.139	×	3.70	=	5.15×10^{-1}
Heat Generating Equipment	0.155	×	3.70	=	5.74×10^{-1}
Torches, welders, burners	0.219	×	3.70	=	8.10×10^{-1}
Internal combustion engines	0.021	×	3.70	=	7.77×10^{-2}
Office/kitchen equipment	0.064	×	3.70	=	2.37×10^{-1}
Portable Equipment	0.102	×	3.70	=	3.77×10^{-1}
No equipment involved	0.134	×	3.70	=	4.96×10^{-1}
Sum	1.000				3.70

NOTE: Category Fraction values are from Table F5.3-1 of the CRCF analysis (BSC 2008).

RAI Volume 2, Chapter 2.1.1.3, Second Set, Number 8: Explain why the methodology used to estimate the margin of error for fire ignition sources, described on page F-102 of BSC (2008b), could be applied to data sets containing only a few events. Although the reference is to the Canister Receipt and Closure Facilities, the same need applies to analyses of fire-related initiating event frequencies for other facilities.

The confidence interval associated with the ignition source category (Tables FII-5 and FII-6 of BSC, 2008b) and extent of flame damage (Tables FII-7 through FII-10 of BSC, 2008b) for fire related event scenarios is calculated based upon the margin of error. Estimation of the margin of error assumes that the frequency associated with each event follows a binomial distribution and the sample size is large enough to use a normal distribution approximation to the binomial distribution in obtaining the interval limits. The normal approximation is appropriate when the sample size is large. This often is interpreted to mean that there are at least 10 occurrences of the event in question and at least 10 occurrences of other outcomes. However, Table F.II-1 of BSC (2008b) lists four events involving the internal combustion ignition source, a number not large enough to be used for normal distribution approximation. Similarly, both Tables F.II-2 and F.II-3 of BSC (2008b) list several categories of fire damage with only five or less events.

1. RESPONSE

The normal distribution approximation to the binomial distribution for estimation of margin of error (i.e., confidence intervals) for fire ignition sources and fire extent is demonstrated, by graphical comparisons of the normal approximation to the binomial distribution, to be reasonable and appropriate for the data sets containing only a few events.

Ignition source and fire propagation probabilities are estimated using fire counts as given in Table F.II-5, Table F.II-7, and Table F.II-9 of *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008). Specifically, marginal distributions, $F(p)$, for each category probability, p, used a mixed normal probability distribution such that,

$$F(p) = \begin{cases} 0 & , p < 0 \\ \Phi\left(\dfrac{p-\mu}{\sigma}\right) & , 0 \le p < 1 \\ 1 & , p \ge 1 \end{cases}$$

$$\mu = \frac{k}{n}, \quad \text{and} \quad \sigma = \left(\frac{t}{z}\right)\sqrt{\frac{\mu(1-\mu)}{n}}$$

where μ is the location parameter, σ is the scale parameter, and the category count is k out of a total number of n samples. The function $\Phi(x)$ is the area under the standard normal curve from $-\infty$ to x. The value of t, the Student's-t variant for the 0.975 quantile, depends on the number of

samples ($t = 1.98$ for Table F.II-5 and $t = 2.00$ for Tables F.II-7 and F.II-9). The value of z, the standard normal variant for the 97.5 percentile, is equal to 1.96.

This distribution is based on the normal approximation to the marginal binomial distribution for count numbers. To compare the mixed normal distribution above to the discrete binomial count distribution, the probabilities are transformed to counts for the corresponding sample size with the usual continuity correction[1]. This allows the comparison of the marginal binomial probability masses with the comparable (for the sample size) probability masses from the mixed normal approximation. Non-integer binomial distributions, due to the one-third estimator for the zero count cases (see the response to RAI 2.2.1.1.3-2-005), were calculated using the exact beta interpolator for the binomial.

Categories with counts of ten or less are shown in Table 1. All six cases in Table 1 are graphed in Figures 1 through 6, so the approximations can be visually compared. As can be seen in the graphs, the probability masses at the binomial means (k) agree well. Generally, count values for the normal approximation above the mean are conservatively assigning more mass than given by the binomial, while count values below the mean are conservatively assigning less mass than given by the binomial. For cases 3 and 6, the zero count cases, results are approximately Bernoulli distributed; therefore, the probability mass at one is equivalent to the mean for these cases. The normal approximation means are conservatively larger than the binomial.

Based on this comparison, the normal approximations used are appropriate estimates for these small sample size cases in the fire ignition frequency calculations. The methodology used to estimate the margin of error for fire ignition sources is independent of facility and is generically applicable to all of the surface facilities.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

BSC (Bechtel SAIC Company) 2008. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis*. 060-PSA-CR00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080311.0031.

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[1] A continuity correction is applied when a discrete distribution supported on the integers is approximated with a continuous cumulative distribution function, $F(x) = \Pr(X \le x)$. The discrete probability, $\Pr(X = x)$, is approximated by $F(x + ½) - F(x - ½)$ for x, an integer.

Table 1. Cases with Counts of Ten or Less

Case	Count, *k*	Total, *n*	Source
1	4	187	Table F.II-5, Ignition Source Category • Internal Combustion
2	5	86.99	Table F.II-7, Extent of Flame Damage (without suppression) • Fire-rated Compartment
3	0.33	86.99	Table F.II-7, Extent of Flame Damage (without suppression) • Room • Floor • Beyond structure
4	5	72.66	Table F.II-9, Extent of Flame Damage (with suppression) • Floor
5	2	72.66	Table F.II-9, Extent of Flame Damage (with suppression) • Room • Structure
6	0.33	72.66	Table F.II-9, Extent of Flame Damage (with suppression) • Fire-rated Compartment • Beyond structure

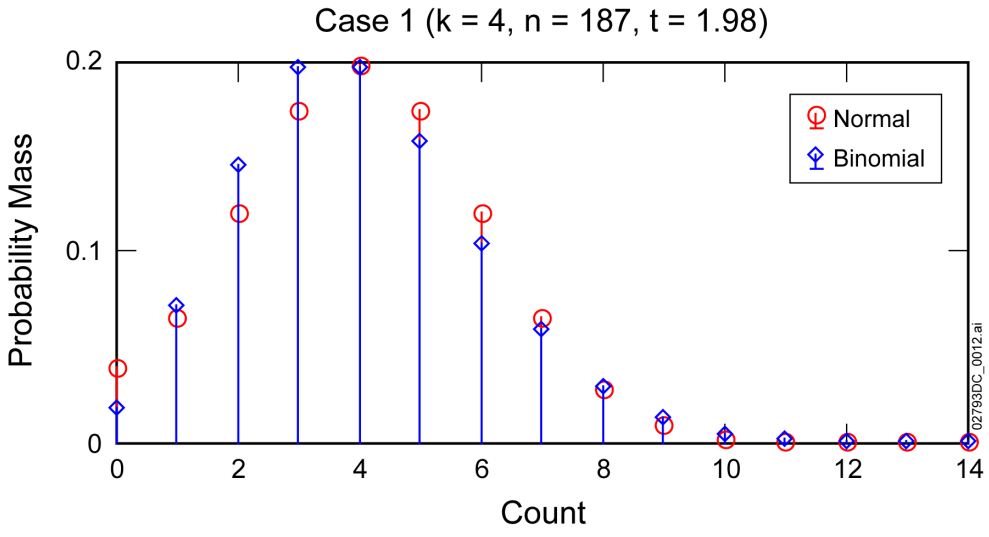

Figure 1. Case 1 Comparison

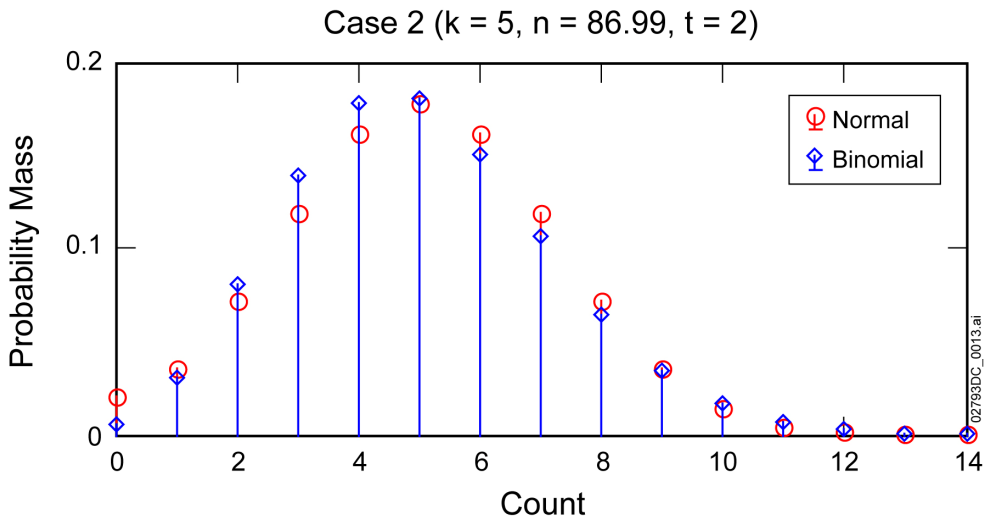

Figure 2. Case 2 Comparison

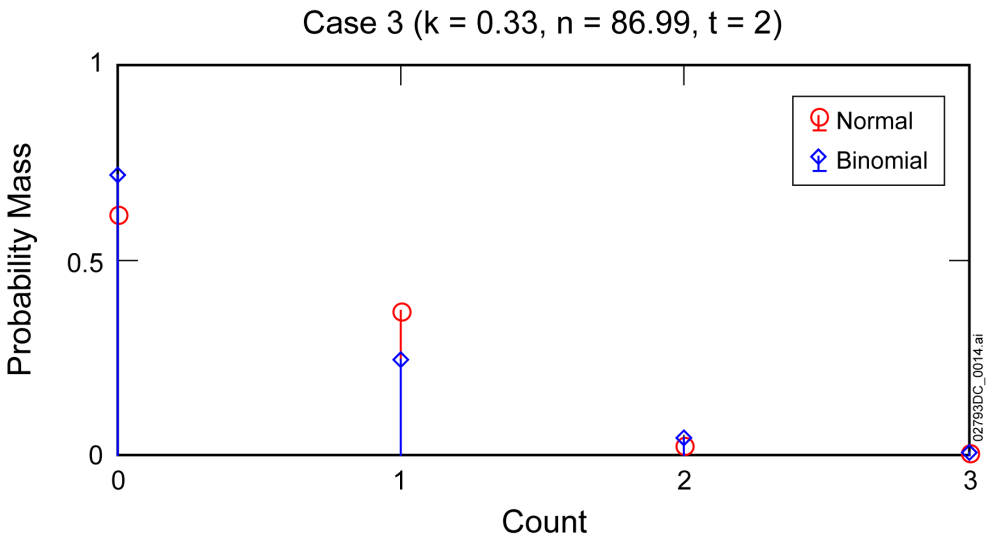

Figure 3. Case 3 Comparison

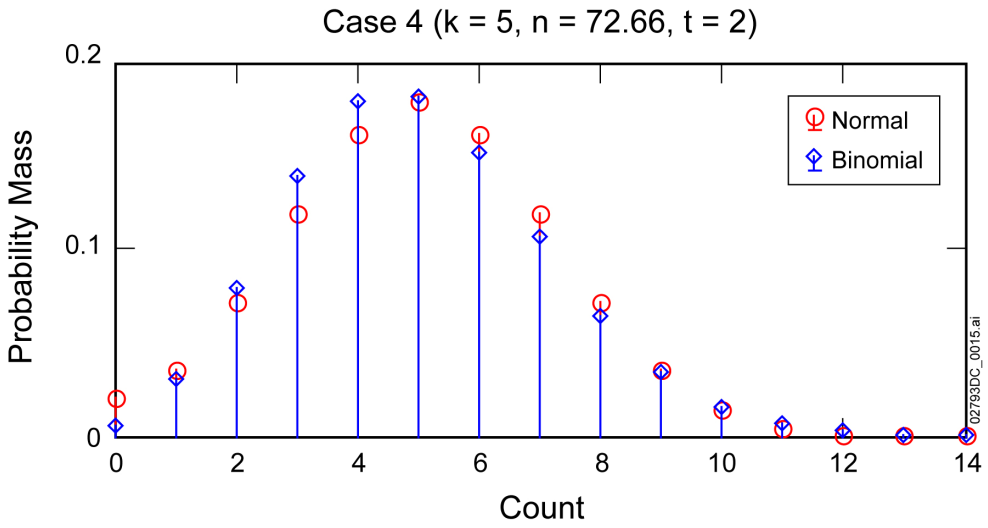

Figure 4. Case 4 Comparison

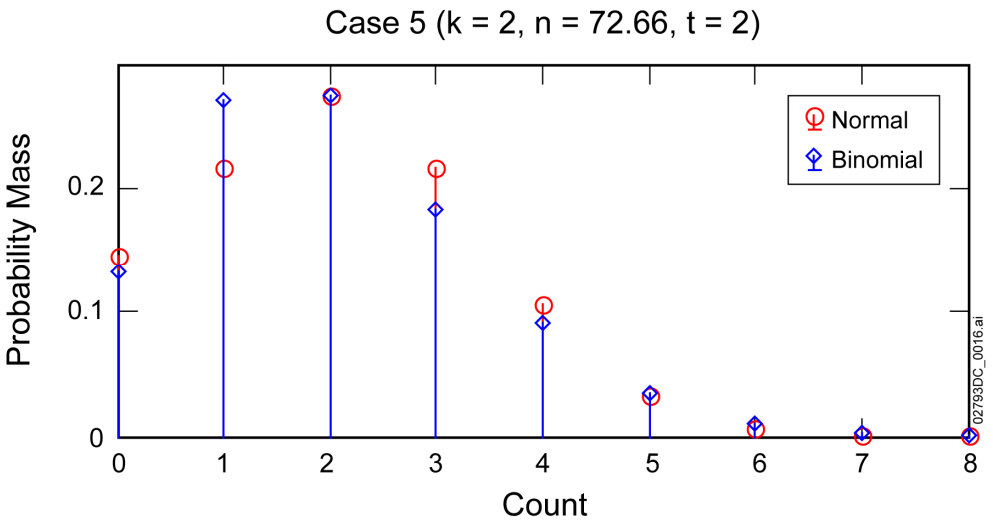

Figure 5. Case 5 Comparison

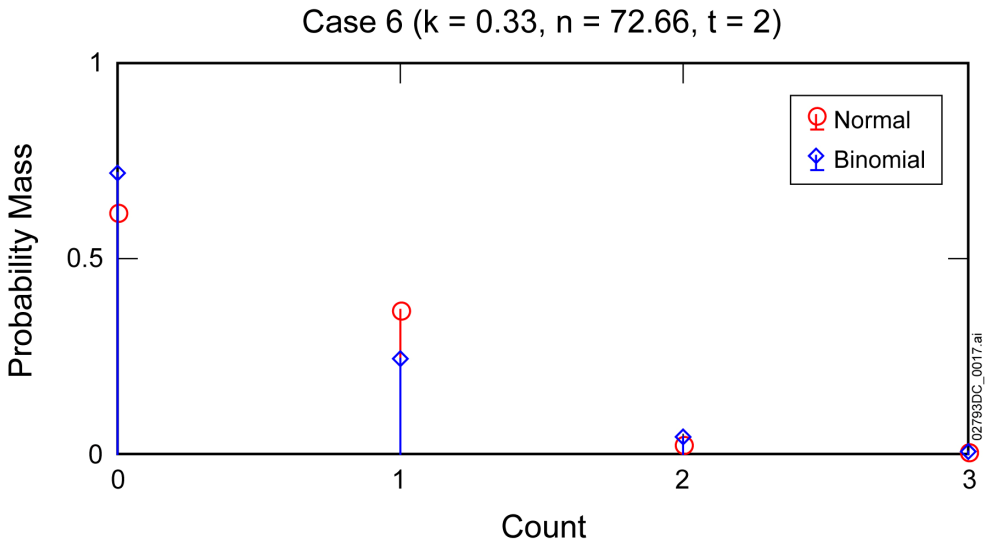

Figure 6. Case 6 Comparison

RAI Volume 2, Chapter 2.1.1.3, Second Set, Number 9: (a) Explain how the confidence limits for the fire ignition frequency, shown on Figure FIII-5 of BSC (2008b), capture the 95% confidence interval for ignition frequency.

(b) Provide the calculations to estimate the confidence intervals and the correct Figures F.III-3 and F.III-4, as they are currently blank figures in BSC (2008b). Although the reference is to the Canister Receipt and Closure Facility, the same equation was used for the other facilities of the repository.

The confidence limits were developed from eight data values read from Figure F-III.1 of BSC (2008b). The development of the confidence interval, described on pages F-112 and F-113 of BSC (2008b), involves a regression analysis. No information in terms of the value of the coefficient of determination has been provided to show how well the eight data points fit a linear relationship in the log of the ignition frequency and the log of the floor area space. Additionally, it is not clear how the confidence intervals have been calculated using Equations FIII-2 through F.III-4.

1. RESPONSE

The ignition frequency confidence limits determined in Appendix F.III of *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008a) capture the 95% confidence interval. Also, the provided coefficient of determination demonstrates the need to characterize the confidence intervals. Further, the five facility reliability and event sequence categorization analyses, each of which contains an appendix with the missing figures, are included with this response.

1.1 CONFIDENCE LIMITS IN FIGURE FIII-5 CAPTURE THE 95% CONFIDENCE INTERVAL FOR IGNITION FREQUENCY

In the following, A is a facility floor area in meters squared and $f(A)$ is the annual fire ignition frequency per meter squared. References to tables and equations identified as F.III are from *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008a, Appendix F.III).

The confidence limits that were developed appear in Table F.III-2 and are shown in Figure F.III-5 of *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008a), along with the eight data points that served as the basis for the confidence limits. The eight data points correspond to the eight largest floor areas (840 to 230,000 m^2) appearing in Table F.III-1 (see Table 1). The uncertainty in $\log_{10}(f(A))$ is approximated using the prediction interval from the linear regression to these eight points of $\log_{10}(f(A))$ given $\log_{10}(A)$.

Equations F.III-1 to F.III-4 in Appendix F.III show that the uncertainty of $\log_{10}(f(A))$ values (for a specific floor area, A) is considered to be normally distributed with mean (μ) and variance

(V). The mean and variance are functions of the area, with the mean equal to $\log_{10}(f_m(A))$ (where $f_m(A)$ is given by Equation F.III-1), and the variance is given by the relations in Equations F.III-2, F.III-3, and F.III-4. To summarize mathematically,

$$\log_{10}(f(A)) \sim N\left(\mu = \log_{10}(f_m(A)), \quad V = \left(\frac{a \cdot \sigma(\log_{10}(A))}{z_2}\right)^2\right)$$

where N represents a normal distribution characterized by a mean (μ) and variance (V). The $f(A)$ values are lognormally distributed with median (M) and error factor (EF) given as:

$$f(A) \sim LN\left(M = f_m(A), EF = \text{antilog}_{10}\left(\frac{z_1}{z_2}(a \cdot \sigma(\log_{10}(A)))\right)\right)$$

$$\text{where} \quad z_1 = \Phi^{-1}(0.950) = 1.645, \quad z_2 = \Phi^{-1}(0.975) = 1.960$$

Here, the function $\Phi(x)$ is the area under the Standard Normal curve from $-\infty$ to x. The value of a equals 2.447, the Student's-t variant with six degrees of freedom (i.e., eight data points minus the two regression parameters determined from the data) associated with the 0.975 quantile. The prediction error standard deviation, $\sigma(x_o)$, is given by the relations in Equations F.III-2′, F.III-3, and F.III-4′. Specifically, where X-values are log base 10 areas and Y-values are log base 10 annual frequencies per area (for the eight data points, see Table 1) and n is the number of points:

$$m_x = \frac{1}{n}\sum_{i=1}^{n} X_i \qquad m_y = \frac{1}{n}\sum_{i=1}^{n} Y_i$$

$$s_x^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - m_x)^2 \qquad s_y^2 = \frac{1}{n}\sum_{i=1}^{n}(Y_i - m_y)^2$$

$$r_{xy} = \frac{\sum_{i=1}^{n}(X_i - m_x)(Y_i - m_y)}{n s_x s_y} \qquad \text{(Eq. F.III-4′)}$$

$$s_{xy} = \sqrt{s_y^2(1 - r_{xy}^2)} \qquad \text{(Eq. F.III-3)}$$

$$\sigma(x_o) = \frac{s_{xy}}{\sqrt{n-2}}\sqrt{n + 1 + \frac{(x_o - m_x)^2}{s_x^2}} \qquad \text{(Eq. F.III-2′)}$$

Therefore, the 95% confidence interval for a given area has an upper bound equal to $f_m(A) \times 10^{a \cdot \sigma(\log_{10}(A))}$ and a lower bound equal to $f_m(A) \big/ 10^{a \cdot \sigma(\log_{10}(A))}$.

It should be noted that, for results in Appendix F.III, values for the (biased) population standard deviation, s_x^2 and s_y^2, were calculated using the (unbiased) sample standard deviation formulation, represented as:

$$s_x^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(X_i - m_x\right)^2 \quad s_y^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(Y_i - m_y\right)^2$$

The use of the unbiased sample standard deviation formulation caused prediction intervals to be conservatively large. For example, where error factors were calculated to be equal to 2.1 using the (unbiased) sample standard deviation, they would be recalculated to be 1.9 if the biased population formula was used. Therefore, the results of the analysis predict conservatively larger confidence intervals.

1.2 COEFFICIENT OF DETERMINATION

The coefficient of determination (R^2) for the linear regression fit to the eight points is 0.44. This value is calculated using the relationship for the coefficient of determination, where *b* is the slope value to the linear fit (Draper and Smith 1981, Chapter 1). The relationships are:

$$b = \frac{\sum_{i=1}^{n}\left(X_i - m_x\right)\left(Y_i - m_y\right)}{\sum_{i=1}^{n}\left(X_i - m_x\right)^2}, \qquad \hat{Y}_i = m_y + b\cdot\left(X_i - m_x\right)$$

$$\mathrm{R}^2 = 1 - \frac{\sum_{i=1}^{n}\left(Y_i - \hat{Y}_i\right)^2}{\sum_{i=1}^{n}\left(Y_i - m_y\right)^2}$$

This low value for R^2 reflects the scatter in the data about the fit and points out the need to characterize this uncertainty. Characterization of the uncertainty, which is developed in Appendix F.III, is further explained in this response.

1.3 ANALYSES AND RELATED FIGURES

The following analyses are provided with this response to replace the corresponding analyses provided on June 3, 2008, with the submittal of the license application. The blank figures are identical in each of the five analyses. These figures are now clearly shown in these replacement analyses. The five analyses and the related figures are:

1. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis*, Figures F.III-3 and F.III-4 (BSC 2008a).

2. *Wet Handling Facility Reliability and Event Sequence Categorization Analysis*, Figures F.III-3 and F.III-4 (BSC 2008b).

3. *Receipt Facility Reliability and Event Sequence Categorization Analysis*, Figures F.III-3 and F.III-4 (BSC 2008c).

4. *Initial Handling Facility Reliability and Event Sequence Categorization Analysis*, Figures F.III-3 and F.III-4 (BSC 2008d).

5. *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis*, Figures F.I-3 and F.I-4 (BSC 2008e).

In summary, this response provides the methodology and calculations used for determining the confidence intervals of the fire ignition frequencies that appear in Table F.III-2 and are shown in Figure F.III-5 in Appendix F.III. In so doing, capture of the 95% confidence interval is shown and a coefficient of determination (R^2) provided. Also, the five analyses are provided.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

BSC (Bechtel SAIC Company) 2008a. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis*. 060-PSA-CR00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080311.0031.

BSC 2008b. *Wet Handling Facility Reliability and Event Sequence Categorization Analysis.* 050-PSA-WH00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0033.

BSC 2008c. *Receipt Facility Reliability and Event Sequence Categorization Analysis.* 200-PSA-RF00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0030.

BSC 2008d. *Initial Handling Facility Reliability and Event Sequence Categorization Analysis.* 51A-PSA-IH00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0031.

BSC 2008e. *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis.* 000-PSA-MGR0-00900-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0032.

Draper, N.R. and Smith, H. 1981. *Applied Regression Analysis.* 2nd Edition. New York, New York: John Wiley & Sons. TIC: 231231.

Table 1. Ignition Frequency Data[a]

X-values Log_{10}(Area)	**Y-values Log_{10}(Annual Frequency per Area)**
2.92500	–5.2500
3.14375	–5.0500
3.40000	$-5.155\overline{5}$
3.61250	$-5.333\overline{3}$
3.85625	$-5.316\overline{6}$
4.15625	$-5.538\overline{8}$
4.51875	$-5.294\overline{4}$
5.36250	$-5.444\overline{4}$

NOTE: [a]Data values estimated as described in Appendix F.III and illustrated in Figure F.III-2. These values correspond to the antilog values displayed to two significant digits in Table F.III-1 for the eight largest floor areas.

RAI Volume 2, Chapter 2.1.1.3, Second Set, Number 11: Justify the methodology used to determine the statistical distribution of the fire-related initiating event frequencies.

Appendix F.IV of BSC (2008b) Attachment F discusses how statistical distribution of the fire-related initiating event frequencies has been determined. No technical basis, such as goodness-of-fit tests, has been provided to justify why the resulting distribution of fire-related initiating event frequencies would be lognormal. Although the reference is to the Canister Receipt and Closure Facilities, the same need applies to analyses of fire-related initiating event frequencies for other facilities.

1. RESPONSE

The selection of a lognormal distribution results in a good fit to the distributions that constitute the fire-related initiating event frequencies based on a graphical comparison of the percentiles, a quantile–quantile plot, and a Chi-Square test.

The description of how fire-related initiating event distributions have been determined is found in Section F5.8 of *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008). Similar comparisons exist for the Initial Handling Facility, the Receipt Facility, and the Wet Handling Facility. The fire initiating event frequencies are typically a product of a lognormal variable with one or more normal distributions. The normal distributions are constrained to values between zero and one. Figure F5.7-1 in Section F5.8 of *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008) displays the Crystal Ball results for the initiating event frequency of a localized fire threatening a transportation, aging, and disposal canister in the canister transfer machine in the transfer room. Crystal Ball (Version 7.3.1) is an Oracle program used as a Microsoft Excel add-on package for Monte Carlo simulations. A lognormal distribution was chosen to summarize the result by using the sample mean and median to fit lognormal distribution parameters. Appendix F.IV of *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008) presents a tabular comparison of the Crystal Ball distribution with a lognormal distribution and shows a good match.

A qualitative measure of how well the simulation results compare to the fitted distribution is made by graphing the fitted lognormal cumulative distribution function along with the percentile values from Crystal Ball (see Figure 1). A quantile–quantile plot is another way to show the initiating event percentiles in comparison with the fitted lognormal distribution (Figure 2). The plot illustrates that, to a good approximation, the quantiles lie on a line with a slope of one, indicating that a lognormal distribution is a good fit to the Crystal Ball output distribution. A quantitative measure of the fit is the coefficient of determination or R^2 of the points in the plot, which was calculated to be 0.97, suggesting that 97% of the variation is accounted for by the fitted distribution.

A formal goodness-of-fit test that may be performed is the Chi-Square test based on the ten intervals formed by the percentiles indicated in Figure 1. A Chi-Square test is used to determine

if a sample of data came from a population with a specific distribution. If the p-value (i.e., the probability of the test statistic being that large or larger under the null hypothesis) is too small, the null hypothesis is rejected. In this case, the null hypothesis is that the data are from the fitted lognormal distribution. A characteristic of a formal goodness-of-fit test is that unless the distribution is an exact match, there will always be a large enough sample size under which the null hypothesis will be rejected. For this situation, the relevant criterion is the size of the sample that would lead to rejection the hypothesized lognormal distribution. As shown in Figure 3, it would take a sample size of well over 4,000 before small p-values are observed. This is an extremely large population sample and is a strong indicator that the lognormal distribution represents the data very well.

Three methods: graphical comparison of the percentiles, quantile–quantile plot, and Chi-Square test have indicated that the fire-related initiating event frequencies derived from Crystal Ball simulations are well approximated by lognormal distributions.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

BSC (Bechtel SAIC Company) 2008. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis*. 060-PSA-CR00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080311.0031.

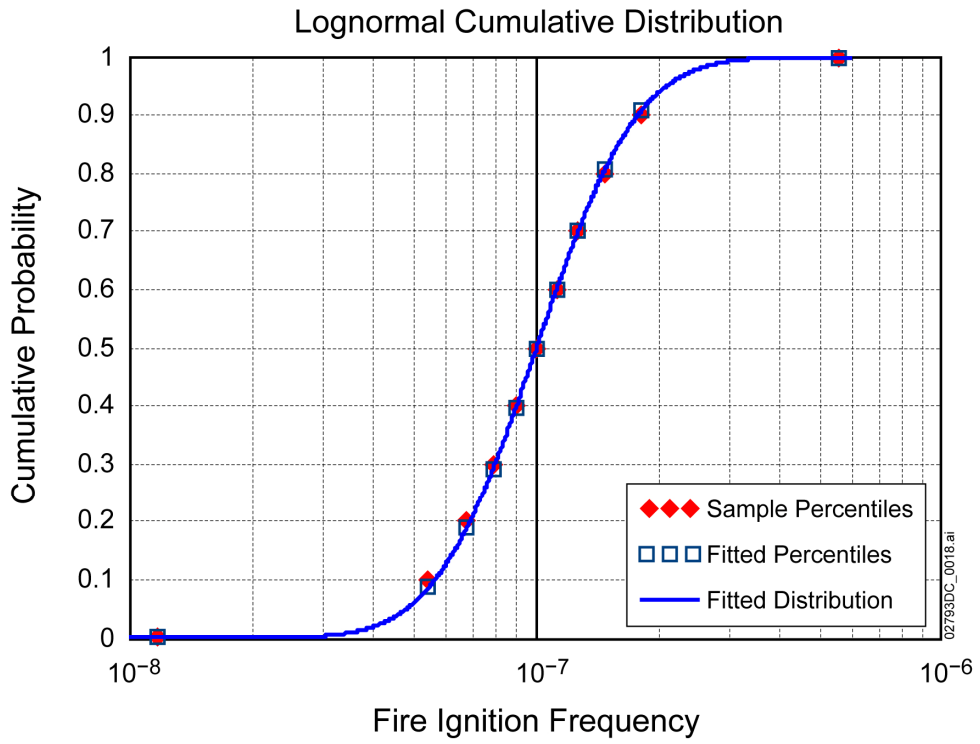

Figure 1. Comparison of Percentile Values

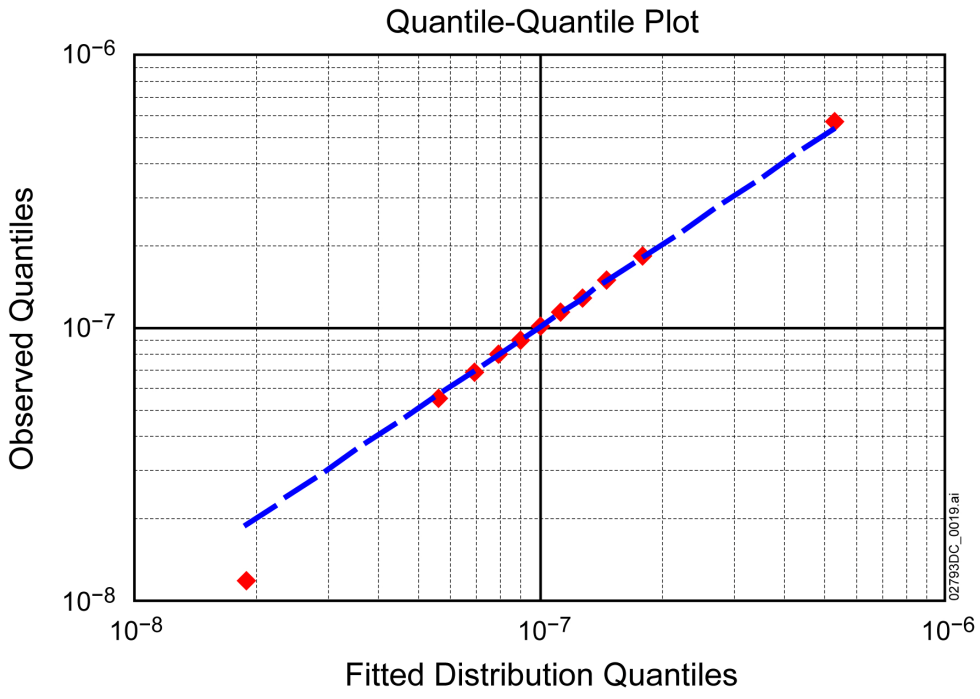

Figure 2. Quantile–Quantile plot

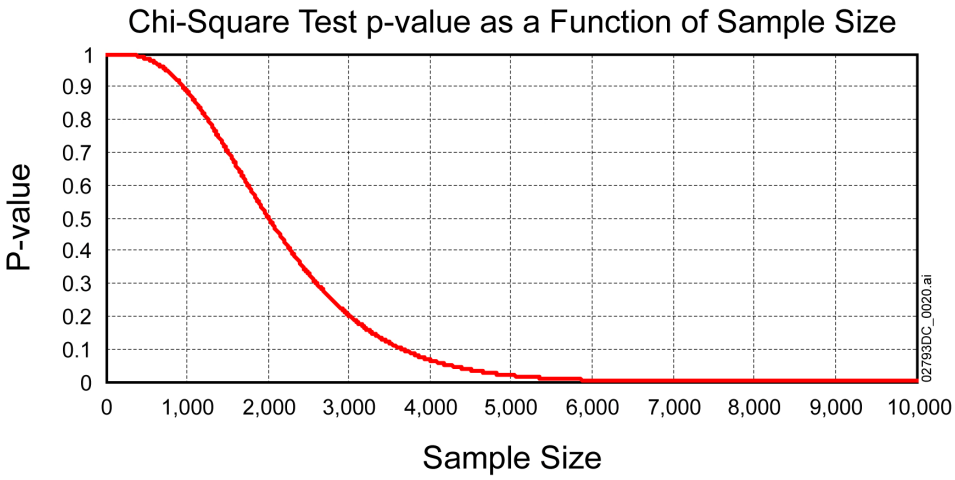

Figure 3. Goodness-of-Fit Test Dependence on Sample Size

RAI Volume 2, Chapter 2.1.13, Second Set, Number 17: Provide the technical basis for the large fire propagation probability estimate for the Low Level Waste Facility, as provided in BSC (2008j).

The large fire propagation probability for the Low Level Waste Facility was changed from 0.105 to 0.165 in the 000-PSA-MGR0-00900-000a09-Mar-11-2008.xls spreadsheet under the 'oldL Plumb LLWF Fire' tab, accounting for a failed fire suppression system. However, no explanation has given what factors have been considered to make such changes and how the new value has been established.

1. RESPONSE

The large fire propagation probability estimate used in the intrasite/balance of plant fire analysis for the Low-Level Waste Facility (LLWF) in *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis* (BSC 2008a) is 0.165, as shown on page F-22. This probability estimate was derived from information developed from the National Fire Protection Association (NFPA) database in which either an automatic fire suppression system was not present or it failed to operate. This 0.165 value is the value used in the 000-PSA-MGR0-00900-000a09-Mar-11-2008.xls spreadsheet in Attachment H of the event sequence categorization analysis (BSC 2008a). The value of 0.105 was not used because it is inconsistent with the fire initiating event and event sequence analysis which was carried out without consideration of fire suppression. (BSC 2008a). The value of 0.105 under the "oldL Plumb LLWF Fire" tab was an interim estimate of the large fire propagation probability for the LLWF and, as noted in the spreadsheet, was derived using NFPA figures for fires in which an automated fire suppression system was operational.

Table F.II-2 (Attachment F, Appendix II of the reliability and event sequence analyses for the waste handling facilities (e.g., *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis* (BSC 2008b)) summarizes the extent of damage propagation data taken from *Structure Fires in Radioactive Material Working Facilities and Nuclear Energy Plants of Non-Combustible Construction* (Ahrens 2007). Table F.II-2 (BSC 2008b) shows that of 86 fires, the flame damage from 14 fires was categorized as "confined to the structure of origin," and none of the fires were categorized as "extended beyond the structure of origin." Two additional categories of flame damage extent show no fire occurrences.

Table F.II-7 (BSC 2008b) fills in the three null categories (categories with no fire occurrences including the category "extended beyond the structure of origin") with a value of 0.33. As discussed in Section 1.2 of the response to RAI 2.2.1.1.3-2-005, the use of 0.33 for null categories is a standard practice for estimating the probability of events with zero occurrences. Table F.II-7 shows the total number of occurrences to be 86.99 (the 0.99 is the sum of the three null categories for which 0.33 was entered) and the estimated probability of each extent of flame damage category to be the number of occurrences divided by 86.99. Using the categories "confined to structure of origin" (14 fires) and "extended beyond structure of origin" (0.33 fires) to represent a large fire, the estimated large fire conditional probability is (14 + 0.33)/86.99 =

0.165. Thus, the large fire propagation probability for the LLWF is 0.165, as described in *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis* (BSC 2008a).

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

Ahrens, M. 2007. *Structure Fires in Radioactive Material Working Facilities and Nuclear Energy Plants of Non-Combustible Construction*. Quincy, Massachusetts: National Fire Protection Association. TIC: 259983.

BSC 2008a. *Intra-Site Operations and BOP Reliability and Event Sequence Categorization Analysis*. 000-PSA-MGR0-00900-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080312.0032.

BSC 2008b. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis*. 060-PSA-CR00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080311.0031.