Nine Mile Point Unit 2
Alternative Source Term

Calculation H21C-094

"Calculation of Atmospheric Dispersion Parameter for MSLB Release to Unit 2 Control Room"

ORIGINAL

Nuclear Engineering	CALCULATION COVER SHEET	Page 1 (Next 2) Total 57 Last B-30

Project: NINE MILE POINT NUCLEAR STATION Unit (1, 2 or 0=Both) : 2 Discipline : ANALYSIS

Title	Calculation No.			
Calculation of Atmospheric Dispersion Parameter For MSLB Release to Unit 2 Control Room	H21C-094			
	(Sub)system(s): N/A	Building: N/A	Floor Elev.: N/A	Index No.: N/A

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Rev	Description	Eval. or Change No.	Prepared By	Date	Chk	Date	App	Date
0	Original Issue (See Remarks)	N/A	MDE	3/16/04	AGK	3/16/04	WJJ	3/16/04

Computer Output/Microfilm separately filed? (Yes/No/NA): N/A Safety Class (SR/NSR/Qxx) : SR

Superseded Document(s) : N/A

Document Cross Reference(s) - For additional references see page(s) : 21

Ref No.	Document No.	Type	Index	Sheet	Rev	Ref No.	Document No.	Type	Index	Sheet	Rev
8.5	Calc. NMPAST-02-001	Input	N/A	N/A	2						
8.6	Calc. 12177-ES-109-1	Input	N/A	4	1						
8.7	Calc. 12177-PR-C-25-B	Input	N/A	N/A	1						
8.8	Calc. HVC-080	Input	N/A	N/A	00						
8.9	Calc. PR-C-25-B, Disp. 01C	Input	N/A	N/A	1						

General Reference(s) :
Crane 410, "Flow of Fluids", NRC Reg. Guide 1.194, Slade, et. al, "Meteorology and Atomic Energy"

Remarks :
The reviewer's signature indicates compliance with S&L Procedure SOP-0402 and the verification of, as a minimum, the following items: correctness of math for manually prepared calculations, appropriateness of input data, appropriateness of assumptions, and appropriateness of the calculational method.

Confirmation Required (Yes / No) : No See Page(s) : 3/18/04	Final Issue Status APP 3/18/04	Turnover Required (Yes / NA) : N/A

10CFR50.59 Evaluation Number(s): N/A
Copy of Applicability Review Attached? ~~Yes~~ 3/18/04

Component ID(s) (As shown in MEL) :
N/A

Key Words : AST, X/Q, MSLB, CR, Dose, Puff

NEP-DES-08
Rev 05

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1. Purpose

The purpose and scope of this calculation are to determine the atmospheric dispersion parameter (χ/Q) to the Nine Mile Point Unit 2 control room intake for the Main Steam Line Break (MSLB) accident. The approach used to determine the χ/Q value will be consistent with the instantaneous puff release model described in NRC Regulatory Guide 1.194.

2. Acceptance Criteria

None.

3. Assumptions

3.1. Meteorological Conditions

Assumed site meteorological conditions are prescribed by NRC Regulatory Guide 1.194 (Reference 8.1) for the instantaneous puff release model as follows:

- Wind Speed: 1 meter/second toward the receptor; and
- Stability Class F.

3.2. Control Room Unfiltered Inleakage Location

It is assumed that the Unit 2 control room air intake locations can be used to conservatively characterize the location of any unfiltered inleakage entering the control room envelope (CRE). CRE leakage testing will definitively identify the location and amount of any unfiltered inleakage. It will be conservatively assumed that all CRE unfiltered inleakage will be located at the bounding (closest) control room air intake location.

3.3. Main Steam Line Break Signal for Control Room Emergency Ventilation Actuation

Current plant licensing basis credits the control room (CR) noble gas monitor response for actuation of the CR emergency ventilation system for the MSLB radiological analysis (Reference 8.9 and Reference 8.2, Table 15.6-6). A change to the plant licensing basis is being considered to credit a main steam line break signal for actuation of the CR emergency ventilation system. If the MSLB signal is used, it is assumed that the signal delay to the control room emergency ventilation system is equivalent to the 0.5 seconds for MSIV closure per Calculation 12177-ES-

109-1 (Reference 8.6, page 4). This signal delay is consistent with the current revision to USAR Table 15.6-6 (Reference 8.2).

Since the actuation time may change, a range of actuation times is investigated to determine the effect of change of the actuation time on the control room χ/Q.

3.4. Ground Level Release

The MSLB is assumed to be a ground level release and therefore the height of the release is taken to be the same as the elevation of the control room air intakes. This has a conservative effect on the integrated atmospheric dispersion parameter (χ/Q) by reducing dispersion.

4. Design Inputs

4.1. Main Steam Mass Release

The safety analysis for the Main Steam Line Break (MSLB) is reported in USAR Section 15.6 and Tables 15.6-5 and 15.6-6 (Reference 8.2). The MSIV detection and closure time is 5.5 seconds (Reference 8.7). This closure time results in a total integrated mass leaving the Reactor Pressure Vessel (RPV) through the steam line break of 4.85E+07 grams. Mass release data is reported below (Reference 8.7, pages 14 and 16):

Table 1. Mass of Steam Released Following the MSLB

Parameter	Value
Total mass released	4.85E+07 gm
Mass of steam released	7.1E+06 gm
Mass of coolant released	4.1E+07 gm
Mass of coolant released in liquid form	2.56E+07 gm
Mass of coolant that flashes and is released as steam	1.58E+07 gm

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4.2. Plant Dimensions

The elevation of the Unit 2 Main Steam Tunnel (break location) is 45.08 ft (or 13.7 m) above grade (Table 5.3.1 of Reference 8.5).

The elevations of Unit 2 Control Room Intakes (Table 5.3.1 of Reference 8.5) are as follows (above grade):

- Upper West: 36 ft, 11 m
- Lower West: 15.5 ft, 4.7 m
- Upper East: 52.75 ft, 16.1 m
- Lower East: 19 ft, 5.8 m

The horizontal distances from the Unit 2 Main Steam Tunnel to the Unit 2 Control Room Intakes are as follows (Table 7.1.2 of Reference 8.5):

- Upper West: 73.37 m
- Lower West: 63.67 m
- Upper East: 63.96 m
- Lower East: 63.96 m.

4.3. Unit 2 Control Room Flow Rates (Current Licensing Basis)

Unit 2 Control Room flow rates after the MSLB are taken from pages 3 and 4 of Reference 8.9 and page 6 of Reference 8.8 and are reproduced in the table below. Normal (unfiltered) ventilation is in operation during the first 30 seconds after the accident (Data/Assumption 3 of Reference 8.9). At 30 seconds, emergency filtration for both intake and recirculation is credited in the control room. At 20 minutes, the operator secures 1 fan, reducing flow to 1650 cfm.

Table 2. Unit 2 Control Room Parameters

Time After Accident	Intake Flow Rate
0 – 30 sec.	1650 cfm
30 sec. – 20 min.	2750 cfm
20 min. – 720 hrs.	1650 cfm

The timing of the control room flow rates in Table 2 is based on credit for emergency HVAC actuation from the CR noble gas monitor (Reference 8.9). In Reference 8.9, it is shown that

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sufficient airborne activity is present in the HVAC intakes after the MSLB to trip the radiation monitor. This is based on an instantaneous release, uniform concentration, and instantaneous transport to the CR intakes.

The 30 second actuation time is based on the following. It takes 12.5 seconds (rounded up to 14 seconds) for the airborne activity to travel from the intake to the sample chamber and fill the sample chamber (Reference 8.9). It takes another 16 seconds for fan startup and damper closure (References 8.8 and 8.9) before the CR emergency ventilation system is considered operating.

The intake flow rates given are upper bound conservative values for the purpose of calculating control room doses (+10% tolerance limit). They will be used in this calculation as given. It is expected that this calculation will not be sensitive to the +/-10% tolerance band on intake flow rates.

4.4. Steam Conditions

Saturated steam at atmospheric pressure (14.696 psia) has a temperature of 212°F and a density of 1 / 26.799 ft^3/lbs = 0.0373 lbs/ft^3 per page A-12 of Reference 8.4.

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5. Methodology/Calculations

5.1 Methodology

Overview

The MSLB represents a double-ended break in the Unit 2 steam tunnel. The subsequent release of steam will occur over a very short period of time before the Main Steam Isolation Valves (MSIV's) close in 5.5 seconds. Since the release duration is so short (less than one minute), it qualifies as an instantaneous puff release per Regulatory Guide 1.194.

The released steam exits through the steam tunnel blowout panels and constitutes an unfiltered release directly to the environment. The puff is modeled as a gaussian distribution after it expands to atmospheric conditions. The puff is centered at the Unit 2 main steam tunnel location. The Turbine Building is conservatively not considered in the model, therefore there is no holdup nor building wake effects from this structure.

Figure 1 below shows schematically, the puff in relation to the closest Unit 2 control room air intake location. Calculation of puff dimensions is given in Section 5.2. As shown in the figure below, the puff is assumed to have a gaussian form. 95% of the puff activity is contained within 2 standard deviations (2σ) from the puff centerline as shown in the figure.

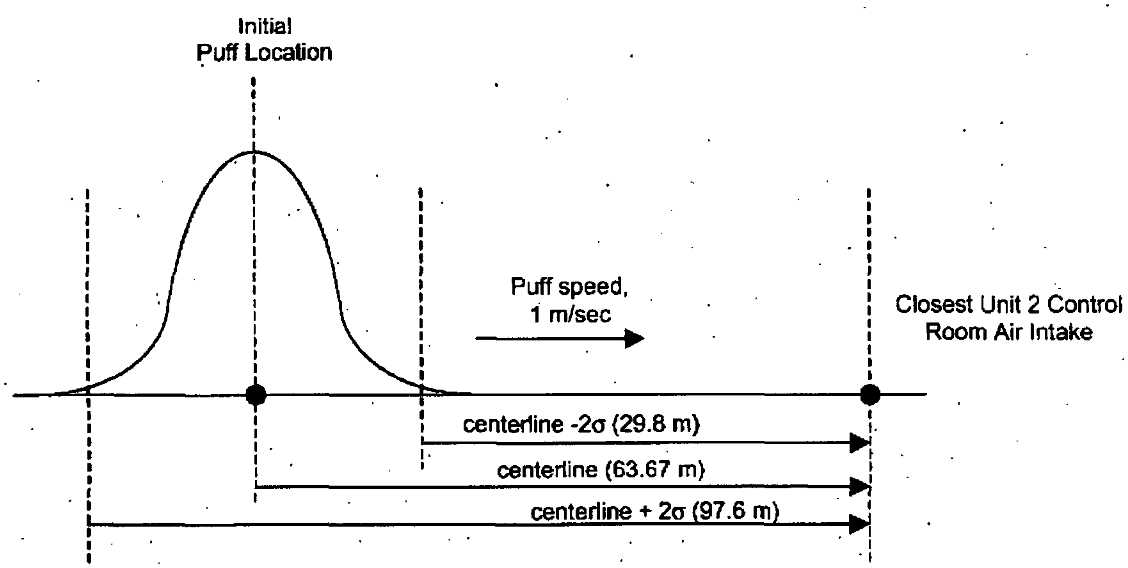

Figure 1 – MSLB Puff Model

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This calculation will determine a conservative χ/Q at the Unit 2 control room air intake for the MSLB accident. The calculation will consider the following inputs:

- Regulatory Guide 1.194 methodology
- Increased unfiltered inleakage to the Unit 2 control room
- Main Steam Line Break signal credited to actuate control room emergency filtration system

The reason control room HVAC parameters are important is because the puff release model is time-dependent which means airborne radionuclide concentration varies within the puff release volume and thus the airborne radionuclide concentration at the receptor location (Unit 2 control room air intakes) changes with time. When an average χ/Q is reported, it is assumed that the air intake flow rate is constant over the time the puff passes over the intakes. If the flow rates change (or increase) when the puff concentration is at its highest, then the average χ/Q reported may not be conservative. Hence, Regulatory Guide 1.194 methodology is used for applying adjustment factors to the χ/Q to account for this phenomenon.

<u>Instantaneous Puff Release Model</u>

The instantaneous puff release model for calculating an effective atmospheric dispersion parameter is given below per Regulatory Guide 1.194 (Reference 8.1). Note that Equation 1 is <u>based on</u> Equation 10 in Regulatory Guide 1.194, as some modification was necessary. Refer to Appendix A.

[Equation 1]

$$\frac{\chi}{Q}(x,u,h,k)=\frac{1}{F}\int_0^T\frac{2}{\sqrt{\left(\sigma_z^2(x,k)+\sigma_I^2\right)}(2\pi)^{3/2}\left(\sigma_{x,y}^2(x,k)+\sigma_I^2\right)}\cdot\exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{\left(\sigma_{x,y}^2(x,k)+\sigma_I^2\right)}+\frac{h}{\left(\sigma_z^2(x,k)+\sigma_I^2\right)}\right)\right]\cdot F(t)dt$$

Where:

$\chi/Q(x,u,h,k)$	=	Effective puff atmospheric dispersion parameter, sec/m^3
χ	=	Integrated concentration at control room intake, Ci·sec/m^3
Q	=	Release quantity, Ci
x	=	Release point to receptor distance, m
u	=	Wind speed, m/sec. Assume 1.0 m/sec (Assumption 3.1)

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k = Stability Class. Assume F (Assumption 3.1)

h = Difference in elevation between the physical release point and the control room intake, m. If the control room intake is at a higher elevation than the release point and the puff is buoyant, assume h = 0.

T = Time for trailing edge of puff to pass control room intake, sec.

$$= \frac{x + 3 \cdot \left[\sigma_{x,y}(x,k) + \sigma_I\right]}{u}$$

F(t) = Control room total intake flow rate, cfm. (If the control room intake flow rate is constant over the period 0 to T seconds, the F(t) term can be omitted from the puff model.)

$\bar{F}$ = Average of control room total intake flow rate, cfm, over the puff transit time, T. (If the control room intake flow rate is constant over the period 0 to T seconds, the $\bar{F}$ term can be omitted from the puff model.)

$$= \frac{\int_0^T F(t)dt}{\int_0^T dt}$$

$\sigma_{x,y}(x,k)$ = <u>Lateral atmospheric diffusion coefficient</u>
Standard deviation, m, of the puff in the horizontal along the wind direction and cross-wind directions at the receptor location. Use Figure 4 of Reg. Guide 1.194 with the distance x and stability class F to determine $\sigma_{x,y}$ at the receptor, e.g., $\sigma_{x,y} = \sigma_y$.

$\sigma_z(x,k)$ = <u>Vertical atmospheric diffusion coefficient</u>
Standard deviation, m, of the puff in the vertical cross-wind direction at the receptor location. Use Figure 5 of Reg. Guide 1.194 with the distance x and stability class F to determine σ_z at the receptor.

σ_I = Initial standard deviation of the puff, m

$$= \left[\frac{2 \cdot V}{(2\pi)^{3/2}}\right]^{1/3}$$

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V = Initial puff volume (expanded to standard atmospheric conditions), m^3 (The puff dimensions that would exist when the puff is at the control room intake are assumed to exist during the entire puff transit.)

The MSLB is assumed to be a ground level release and therefore the height of the release is taken to be the same as the elevation of the control room air intakes (Assumption 3.4). This results in setting h=0 in Equation 1 above. This has a conservative effect on the integrated atmospheric dispersion parameter (χ/Q) by reducing dispersion.

With this assumption, Equation 1 reduces to the following form:

[Equation 2]

$$\frac{\chi}{Q}(x,u,k)=\frac{1}{\overline{F}}\frac{2}{\sqrt{(\sigma_z^2(x,k)+\sigma_l^2)}(2\pi)^{3/2}(\sigma_{x,y}^2(x,k)+\sigma_l^2)}\int_0^T \exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{(\sigma_{x,y}^2(x,k)+\sigma_l^2)}\right)\right]F(t)dt$$

For this calculation, the integral given in Equation 2 will not be solved exactly. A finite difference solution will be used as shown below in Equation 3.

[Equation 3]

$$\frac{\chi}{Q}(x,u,k)=\frac{1}{\overline{F}}\frac{2}{\sqrt{(\sigma_z^2(x,k)+\sigma_l^2)}(2\pi)^{3/2}(\sigma_{x,y}^2(x,k)+\sigma_l^2)}\sum_{i=1}^{N} \exp\left[-\frac{1}{2}\left(\frac{(x-ut_i)^2}{(\sigma_{x,y}^2(x,k)+\sigma_l^2)}\right)\right]\cdot F(t_i)\cdot \Delta t$$

Where:

t_i: time step in increments of seconds ($t_i = t_{i-1} + \Delta t$)
Δt: time step increment, 1 second
N: number of time steps = T/Δt

A uniform time step (Δt) of 1 second will be used for this calculation.

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5.2 Calculations

Equation 3 will be used to calculate the effective atmospheric dispersion parameter (χ/Q). The following parameters must be calculated as input into Equation 3:

- Steam expansion volume, V
- Initial puff dispersion coefficient, σ_i
- Atmospheric puff diffusion coefficients, $\sigma_{x,y}$ and σ_z
- Puff transit time (total time for puff to completely pass over control room air intakes, T)
- Average control room intake flow rate, $\overline{F}$ (including unfiltered inleakage).

Once these parameters are calculated, they will be used with Equation 3 to determine the integrated atmospheric dispersion parameter (χ/Q) at the receptor location.

<u>Steam Expansion Volume, V</u>

The initial volume of the puff (steam volume after expansion) is calculated as follows.

The total steam mass released was given in Table 1. A total of 7.1E+06 grams was released directly as steam. Of the total of 4.8E+07 grams of coolant released from the break, the remainder of 4.1E+07 grams was released as liquid that spills on the floor in the steam tunnel. Of this 4.1E+07 grams, 1.58E+07 grams flashes to steam. Therefore the total steam mass released through the blowout panels to the environment is:

M_{steam} = 7.1E+06 gm + 1.58E+07 gm = 2.29E+07 gm

The MSLB release that exists as liquid is not considered since its volume at atmospheric conditions is much smaller and negligible compared to the steam.

The steam conditions are assumed to be saturated steam, at 100% quality. These are the approximate conditions in the steam line prior to the break.

Per Regulatory Guide 1.194 (page 1.194-19), the initial puff volume, V, is defined as that volume of steam after expansion to standard conditions. Standard conditions is recognized to be 14.696 psia (at sea level) and ~ 68°F. The volume of the steam is determined by the following equation (assuming uniform density):

$V = M_{steam} / \rho$ [Equation 4]

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Where:

M_{steam}: steam mass released, grams
ρ: steam density after expansion, g/cc

Saturated steam does not exist at "standard conditions", or 14.696 psia and 68°F. As the steam expands into the turbine building and out through the blowout panels, it will mix with the air both in the turbine building and outside in the environment. When the steam reaches atmospheric pressure, approximately 14.7 psia (adjusted for plant site elevation) it will stop expanding. No condensation during the expansion will be considered, and the steam puff dimensions will be determined based on the released steam mass at a pressure of 14.696 psia and a temperature of 212°F. No credit is taken for holdup in the turbine building per Regulatory Guide 1.194, page 1.194-18.

From Design Input 4.4, the steam density at 14.696 psia is 0.0373 lbs/ft^3 (or 0.0373 lbs/ft^3 × (454 gm/lb) × (1 ft / 30.48 cm)^3 = 5.983E-04 g/cc). Using Equation 3, the initial puff volume is calculated as follows:

$V = M_{steam} / \rho$ = (2.29E+07 gm / 5.983E-04 g/cc) (1.0E-06 m^3 / cc) = 38,277 m^3

Initial Puff Dispersion Coefficient, σ_I

From the definition given in Equation 1, the initial puff dispersion coefficient (σ_I) is calculated from the initial puff (steam) volume, V:

$$\sigma_I = \left[\frac{2 \cdot V}{(2\pi)^{3/2}}\right]^{1/3} = 16.94\, m$$

Atmospheric Puff Diffusion Coefficients, $\sigma_{x,y}$ and σ_z

The atmospheric puff diffusion coefficients for use in Equation 3 above are prescribed by Regulatory Guide 1.194, Figures 4 (page 1.194-25) and 5 (page 1.194-26). The lateral diffusion coefficient ($\sigma_{x,y}$) is given by Figure 4 and the vertical diffusion coefficient (σ_z) is given by Figure 5. Both are functions of x (downwind distance) and stability class only. Per Regulatory Guide 1.194, Stability Class F is used.

A conservative distance to the receptor is determined from Design Input 4.2. Since this is defined to be a ground level release (Reg. Guide 1.194, page 1.194-18), any difference in elevation between the control room intakes and the release location in the turbine building is not considered. Only the horizontal distance is credited. From Design Input 4.2, the minimum horizontal distance between the closest control room intake and the Unit 2 steam tunnel is 63.67 m.

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This distance also represents the distance between the puff centerline (Unit 2 steam tunnel) and the control room air intake location. For calculating diffusion coefficients, the smaller the distance that the puff travels, the less dispersed the puff will be. Underestimated diffusion coefficients are conservative, since diffusion in the lateral and vertical directions is reduced, thereby increasing the integrated relative concentration at the receptor. The dispersion of the front edge of the puff should be different from the back edge based on different distances to the receptor as shown in Figure 1.

However, per Reg. Guide 1.194, "*...(The puff dimensions that would exist when the puff is at the control room intake are assumed to exist during the entire puff transit.).*" as discussed in the definition of V in Equation 1. Therefore, use of calculated diffusion coefficients based on puff centerline will be used to characterize the diffusion of the entire puff cloud at the control room intake location (x = 63.67 m). From Figures 4 and 5 of Reg. Guide 1.194, the horizontal and vertical diffusion coefficients are as follows in the puff cloud centerline:

$\sigma_{x,y}$ = 3.0 m

σ_z = 1.5 m

It should be recognized, however, based on the form of Equation 3, the χ/Q value is not sensitive to the atmospheric diffusion coefficients because of the short travel distance.

Puff Transit Time, T

The total time for the trailing edge of the puff to pass the control room intakes is T and is the integration limit in Equation 1. The puff transit time is calculated with the following formula as given above in the definition in Equation 1. The assumed wind speed is 1 m/sec per Reg. Guide 1.194. The distance to the closest receptor is 63.67 m. Initial puff dispersion coefficient is 16.94 m. The lateral diffusion coefficient at the puff centerline is 3.0 m (puff average value).

$$T = \frac{x + 3\cdot\left[\sigma_{x,y}(x,k) + \sigma_I\right]}{u} = \frac{63.67\,\text{m} + 3\cdot\left[3.0\,\text{m} + 16.94\,\text{m}\right]}{1\,m/s} = 123.49\,\text{sec.}$$ (round up to 124 sec.)

Although the closest receptor produces the minimum transit time, it is also representative of smaller (more conservative) diffusion coefficients, therefore the use of the closest receptor location is still conservative for calculation of the puff transit time.

Control Room Intake Flow Rates

From Design Input 4.3, the current licensing basis credits CR noble gas monitor trip which actuates the control room HVAC emergency ventilation. It takes 30 seconds for the alignment to take place before charcoal filtration is credited. The basis for this calculational approach is the instantaneous transport of radionuclides into the control room from the MSLB location. For the

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puff release model per Reg. Guide 1.194, it will take a finite period of time before the puff reaches the receptor location. This will affect the time at which the radiation monitor trips and thereby delays the actuation of emergency filtration.

However, per Assumption 3.3, the licensing basis may change to credit a main steam line break signal that will actuate control room emergency filtration. It is assumed that the 0.5 second signal delay for MSIV closure applies as well to control room HVAC (Assumption 3.3).

Control room HVAC emergency filtration actuates from a main steam line break signal. Current licensing basis shows a 30 second delay per Calculation PR-C-25B, disposition 01C (Reference 8.9). The actuation time is recalculated below for crediting the MSLB signal:

Delay	Time	Reference
Signal delay	0.5 sec.	Assumption 3.3
Fan startup, etc.	16 sec.	Design Input 4.3

Total = 16.5 sec. (rounded up to 18 sec.)

Therefore, the control room flow rates, F(t), used in Equation 3 for calculation of the χ/Q are as follows:

Time	HVAC Mode	Intake Flow Rate
0 – 18 sec.	Normal	1650 cfm
18 sec – 124 sec	Emergency	2750 cfm

The average flow rate over the puff transit time is as follows. The equation used for calculating the average control room intake flow rate is given in Appendix A (Equation A10):

$$\overline{F} = \frac{\int_0^T F(t)dt}{\int_0^T dt} = \frac{\int_0^{18} 1650dt + \int_{18}^{124} 2750dt}{124\,\text{sec}} = 2590\,\text{cfm} \qquad \text{[Equation 5]}$$

Since the actuation time may change, a range of actuation times is investigated to determine the effect of change of the actuation time on the control room χ/Q. The actuation time which produces the maximum χ/Q will be reported as the bounding case. The same formula shown above (Equation 5) is used to recalculate the average intake flow rate for each actuation time.

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Unfiltered Inleakage

The behavior of Equation 3 shows that if the control room intake flow rates are non-uniform and tend to peak at the same time the airborne concentration does, then the calculated χ/Q will increase. It is assumed that control room unfiltered inleakage is a constant flow rate over the entire accident period of 30 days. Therefore, by increasing the assumed unfiltered inleakage, the effect is to reduce peaking in the control room intake flow rate and will make the flow rate function more averaged over the puff transit time. In the limit as unfiltered inleakage increases, the flow rate over the puff transit time approaches a constant, average value. Based on the results shown below, it is conservative to set the assumed unfiltered inleakage to zero over the entire puff transit time.

This argument will hold true as long as the calculated χ/Q with time-dependent flow rates is more conservative than with an average flow rate. If the opposite is true, then the flow rates are out of step with the maximum concentration and the averaging effect of unfiltered inleakage would be to increase the calculated χ/Q.

In this problem, χ/Q's calculated using time-dependent intake flow rates are more conservative than χ/Q's determined using an average intake flow rate. To verify this argument, the χ/Q is calculated with an average flow rate throughout the puff transit time to check against the variable flow cases.

Calculation of Integrated χ/Q

Equation 3 is used to determine the integrated χ/Q at the receptor location. The calculation of the integrated χ/Q is shown in Appendix B.

Table 3. Summary of Cases Analyzed

Case	Description	Intake Flow Rates	Unfiltered Inleakage
1	Average Flow Rate	N/A – the flow rate does not affect Equation 3 since the weighting factor reduces to 1.	0 cfm
2	MSLB signal (18 sec. actuation time)	0 – 18 sec: 1,650 cfm 18 sec. – 124 sec.: 2,750 cfm	0 cfm
3	30 sec. actuation time	0 – 30 sec: 1,650 cfm 30 sec. – 124 sec.: 2,750 cfm	0 cfm
4	35 sec. actuation time	0 – 35 sec: 1,650 cfm 35 sec. – 124 sec.: 2,750 cfm	0 cfm
5	40 sec. actuation time	0 – 40 sec: 1,650 cfm 40 sec. – 124 sec.: 2,750 cfm	0 cfm
6	45 sec. actuation time	0 – 45 sec: 1,650 cfm 45 sec. – 124 sec.: 2,750 cfm	0 cfm
7	55 sec. actuation time	0 – 55 sec: 1,650 cfm 55 sec. – 124 sec.: 2,750 cfm	0 cfm

Figure 2 show the relative puff concentration at the closest control room air intake for the Cases evaluated.

Figure 3 show the χ/Q as a function of control room emergency filtration actuation time.

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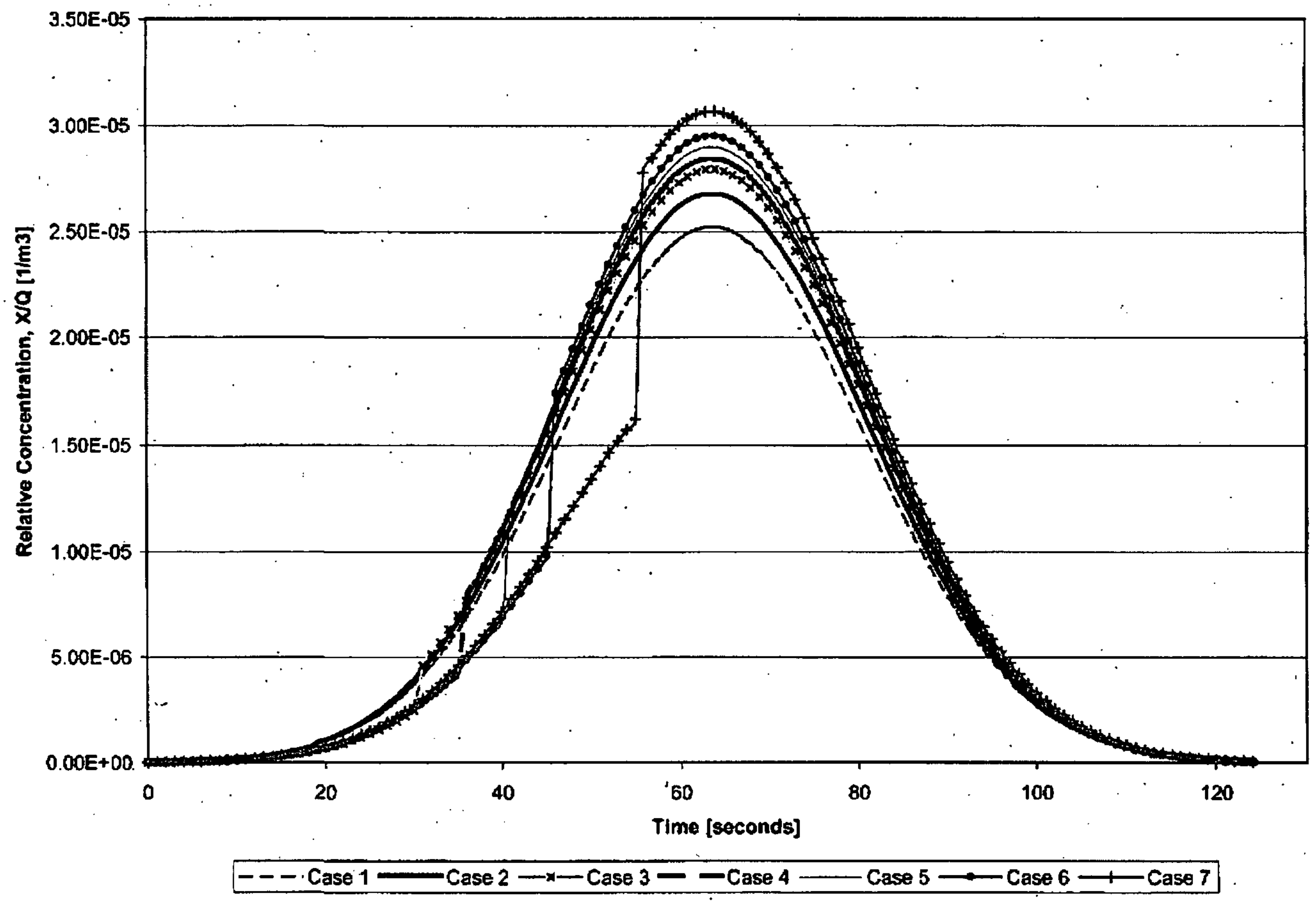

Figure 2 – Weighted Relative Puff Concentration at CR Air Intake

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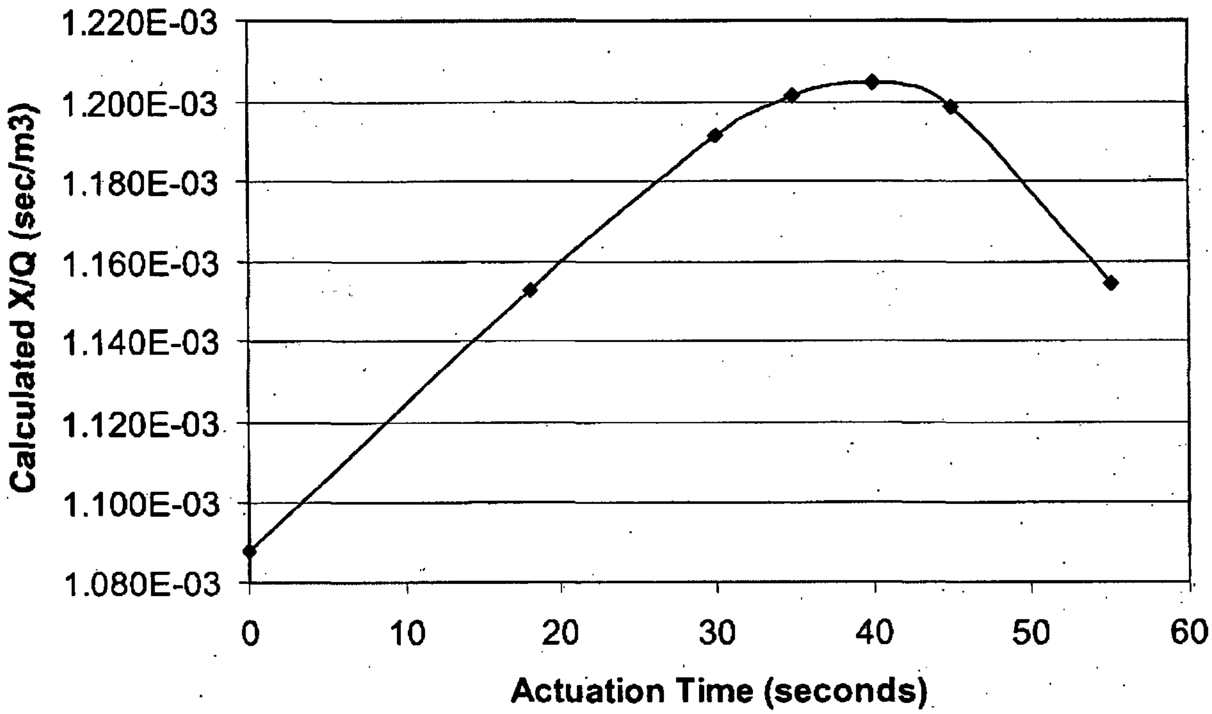

Figure 3 – Calculated χ/Q versus Control Room Emergency Ventilation Actuation Time

Note: average flow rate treated as 0 sec. actuation time in Figure 3 above.

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6. Results

The integrated χ/Q is based on an instantaneous puff centered on the Unit 2 main steam tunnel where the break occurs. The closest control room intake is chosen to minimize the distance between the puff center and receptor. The control room air intake flow rate is modeled as a constant flow rate during the entire time that the puff passes over the intakes and it is modeled as a variable flow rate. It takes approximately 124 seconds for the puff to completely pass over the closest control room air intake location.

The integrated χ/Q calculated for all Cases are presented below:

Table 4. Calculated χ/Q For Cases 1 Through 7

Case	Actuation Time (sec.)	Integrated χ/Q [sec/m^3]
1	0 (Average flow rate case)	1.088E-03
2	18	1.153E-03
3	30	1.191E-03
4	35	1.201E-03
5	40	1.204E-03
6	45	1.198E-03
7	55	1.154E-03

The bounding integrated χ/Q is 1.204E-03 sec/m^3 to the Unit 2 control room air intakes.

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7. Conclusions

The bounding integrated χ/Q at the Unit 2 control room air intakes is presented in Section 6, Results.

Per Regulatory Guide 1.194, radiological analyses of the Unit 2 control room should use control room intake flow rates and actuation times consistent with or bounded by those used in this calculation.

This calculation has determined a bounding case for actuation time. Therefore, the calculated bounding χ/Q does not depend on the control room emergency ventilation actuation time. Control room radiological analyses should, however, be consistent with the intake flow rates as follows:

These control room intake flow rates are shown below:

- Initial control room intake flow rate of 1650 cfm; and
- After actuation, emergency ventilation flow rate of 2750 cfm.

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8. References

8.1. NRC Regulatory Guide 1.194, Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants, dated June 2003.

8.2. Nine Mile Point Unit 2 Updated Safety Analysis Report (USAR), Revision 15.

8.3. Slade, D. H, et. al., *Meteorology and Atomic Energy*, U. S. Atomic Energy Commission, Document Number TID-24190, July 1968.

8.4. "Flow of Fluids Through Valves, Fittings, and Pipe," Technical Paper No. 410, Crane, 1981.

8.5. CNS Calculation NMPAST-02-001, "Calculation of Atmospheric Dispersion Coefficients (X/Qs) at the NMP Unit 1 Technical Support Center and Units 1 and 2 Control Room Intakes for All Releases", Rev. 2, dated 12/31/03.

8.6. Calculation 12177-ES-109-1, "Subcompartment Pressurization Analysis of the Main Steam Tunnel Due to HELB," Revision 1.

8.7. Calculation 12177-PR(C)-25-B, "EAB, LPZ and Control Room Doses Due to Main Steam Line Break Accident Outside Containment," Revision 1.

8.8. Calculation HVC-080, "HVC System Outside Air Makeup and Recirculation Flow Rates – Control Room Habitability Analysis Input Parameters," Revision 00.

8.9. Calculation PR-C-25-B, "Unit 2 Main Steam Line Break Doses to Unit 2 Control Room," Revision 01, Disposition 01C.

9. Appendices

Appendix A – Development of Gaussian Puff Model (6 pages)

Appendix B – Calculation of Integrated χ/Q (30 pages)

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Appendix A – Development of Gaussian Puff Model

Gaussian plume model

The Gaussian plume model is given below (Reference 8.3, Page 97, Equation 3.113). This model represents an instantaneous point source at x = 0, y = 0 and z = h (height off the ground).

$$\chi(x,y,z,t)=\frac{Q}{(2\pi)^{3/2}(\sigma_x\sigma_y\sigma_z)}\exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{\sigma_x^2}+\frac{y^2}{\sigma_y^2}+\frac{(z-h)^2}{\sigma_z^2}\right)\right] \quad \text{[Equation A1]}$$

Where:

χ(x,y,z,t)	Downwind concentration at x,y,z,t, Ci/m^3
Q	Release quantity (instantaneous), Ci
x	Distance along wind direction, m
y	Distance along lateral crosswind direction, m
z	Height off of ground, m
u	Wind speed, m/sec.
h	Release point elevation, m.
σ_x	Standard deviation, m, of the plume in the horizontal along the wind direction at the receptor location.
σ_y	Standard deviation, m, of the plume in the horizontal along the cross-wind direction at the receptor location.
σ_z	Standard deviation, m, of the puff in the vertical cross-wind direction at the receptor location.
t	Time after release, sec.

The following modifications are made to Equation A1:

- Equation A1 is conservatively multiplied by two (2) to account for assumed ground reflection.
- The puff model must consider the initial distribution of the puff volume. The source is a volume as opposed to a point and therefore the diffusion coefficients in Equation A1 will be different. To characterize the source volume, the diffusion coefficients (σ) must consider both the initial dispersion and atmospheric diffusion during transport. To account for both of these distributions, new dispersion coefficients, σ_{xP}, σ_{yP} and σ_{zP} are defined.

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With these two modifications, Equation A1 is rewritten as follows:

$$\chi(x,y,z,t)=\frac{2Q}{(2\pi)^{3/2}(\sigma_{xP}\sigma_{yP}\sigma_{zP})}\exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{\sigma_{xP}^2}+\frac{y^2}{\sigma_{yP}^2}+\frac{(z-h)^2}{\sigma_{zP}^2}\right)\right]$$ [Equation A2]

The initial puff volume (time, t = 0) is assumed to be a Gaussian distribution characterized by a standard deviation, σ_I, which is equal in all directions.

The standard deviation (σ_I) from the initial volume dispersion and the atmospheric diffusion standard deviations (σ_x, σ_y, and σ_z) are independent and therefore must be statistically summed. Hence the puff atmospheric diffusion coefficients are given below:

$$\sigma_{xP}=\sqrt{\sigma_x^2+\sigma_I^2} \qquad \sigma_{yP}=\sqrt{\sigma_y^2+\sigma_I^2} \qquad \sigma_{zP}=\sqrt{\sigma_z^2+\sigma_I^2}$$

The atmospheric diffusion coefficients (σ_x, σ_y and σ_z) are defined in Figures 4 and 5 of Regulatory Guide 1.194. The initial puff dispersion coefficient (σ_I) is defined on page 1.194-19 of Regulatory Guide 1.194:

$$\sigma_I=\left[\frac{2V}{(2\pi)^{3/2}}\right]^{\frac{1}{3}}$$

With these additional changes, Equation A2 is rewritten as follows:

$$\chi(x,y,z,t)=\frac{2Q}{(2\pi)^{3/2}\sqrt{(\sigma_x^2+\sigma_I^2)}\sqrt{(\sigma_y^2+\sigma_I^2)}\sqrt{\sigma_z^2+\sigma_I^2}}\exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{(\sigma_x^2+\sigma_I^2)}+\frac{y^2}{(\sigma_y^2+\sigma_I^2)}+\frac{(z-h)^2}{(\sigma_z^2+\sigma_I^2)}\right)\right]$$ [Equation A3]

Horizontal atmospheric diffusion both in the wind direction (x-axis) and cross-wind direction (y-axis) are assumed to be equal, hence $\sigma_x = \sigma_y$, and both are referred to as $\sigma_{x,y}$.

Additionally, the puff is conservatively assumed to pass directly over the receptor, therefore, y=0.

With these additional changes, Equation A3 becomes:

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$$\chi(x,y,z,t)=\frac{2Q}{(2\pi)^{3/2}\sqrt{(\sigma_z^2+\sigma_I^2)}(\sigma_{x,y}^2+\sigma_I^2)}\exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{(\sigma_{x,y}^2+\sigma_I^2)}+\frac{(z-h)^2}{(\sigma_z^2+\sigma_I^2)}\right)\right]$$ [Equation A4]

If the release quantity term, Q, in Equation A4 is brought over to the left-hand-side of the equation, then the resulting quotient (χ/Q) is the instantaneous relative concentration [1/m^3] of the puff at location x, y, z and time, t. To calculate the atmospheric dispersion parameter [sec/m^3] over the time period, T, the relative puff concentration (χ/Q) [1/m^3] at a specified distance, x, from the initial puff centerline must be integrated over the time period T.

Puff Transit Time, T

The integration period T (puff transit time) is defined as the total time it takes for the puff to completely pass over the receptor location.

The integration limit, T, is chosen to ensure that the entire puff passes over the receptor. From statistical theory, 99% of a normal distribution is 3$\cdot\sigma$. Hence, 99% of the puff has passed over the receptor at time, T. T is calculated as follows. In the following calculations, the assumption is made that the relative puff concentration at the receptor varies as a normal distribution with time in the wind direction (x). In other words, 3 times the puff dispersion coefficient (3$\cdot\sigma_{xP}$) (or 3 standard deviations from the puff centerline) represents 99% of the source (one-sided).

T = R / u

Where

T: total time, sec
R: distance from puff trailing edge to receptor along wind direction, m
u: mean wind speed, m/sec

The definition of this distance, R, is x + 3 σ as indicated in Figure A1.

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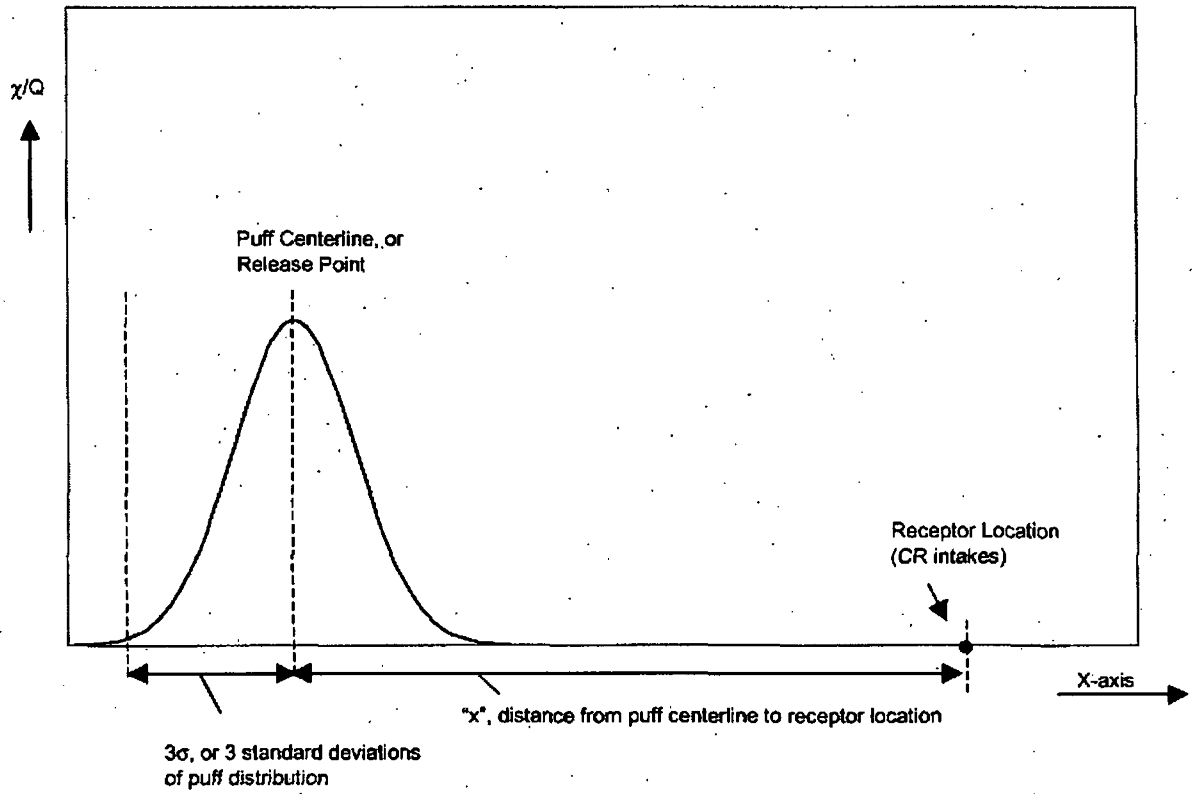

Figure A1 – Definition of Total Distance (R) for Calculating Puff Transit Time

Ref.

The distance, "R", is then given by the following expression:

$$R = x + 3 \cdot \sigma = x + 3\sqrt{\sigma_{x,y}^2 + \sigma_I^2} \qquad \text{[Equation A5]}$$

Where

x: distance from initial puff centerline to receptor

$$T = \frac{x + 3\sqrt{\sigma_{x,y}^2 + \sigma_I^2}}{u} \qquad \text{[Equation A6]}$$

Reg. Guide 1.194 recommends the following formula for the integration time, T:

$$T = \frac{x + 3\left(\sigma_{x,y} + \sigma_I\right)}{u} \qquad \text{[Equation A7]}$$

The formula used in Reg. Guide 1.194 (Equation A7) is conservative since integration time, T, as calculated with Equation A7 will always be larger than the corresponding value calculated with Equation A6. The sum is always greater than the square root of the sum of the squares. A longer integration time will have a marginally conservative effect on the calculation by including more of the tail of the gaussian curve representing the puff distribution. However, there is little activity in the tail beyond 3 standard deviations and therefore little effect is expected by increasing the integration time beyond that specified in Equation A6.

Adjustment for Variable Control Room Intake Flow Rate

If the control room air intake flow rate varies with time, Equation A4 is modified to account for the air intake flow rate and the equation is integrated to get the atmospheric dispersion parameter at the control room intake. The integrated value must be adjusted to account for the changing intake flow rate. Equation A8 below shows the integrated χ adjusted for control room air intake flow rate:

$$\chi(x,y,z,t) = \frac{\displaystyle\int_0^T \frac{2Q}{(2\pi)^{3/2}\sqrt{(\sigma_z^2+\sigma_I^2)}(\sigma_{x,y}^2+\sigma_I^2)} \exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{(\sigma_{x,y}^2+\sigma_I^2)} + \frac{(z-h)^2}{(\sigma_z^2+\sigma_I^2)}\right)\right] F(t)\,dt}{\dfrac{\int_0^T F(t)\,dt}{\int_0^T dt}} \qquad \text{[Equation A8]}$$

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Where

F(t) = control room intake flow rate, [cfm] as a function of time after the accident.

Without such adjustment the χ/Q value will be based on average, or constant, conditions during the puff transit time. However, the puff concentration at the control room air intakes is variable. If the maximum (or higher than average) concentration coincides with a flow rate above the average for the puff transit time, a non-conservative underestimate of the χ/Q can be made. To correct for control room air intake flow rate variation, the χ/Q is weighted by air intake flow rate during the puff transit time. The denominator in Equation A8 represents the average control room air intake flow rate during the puff transit time when the integrals are resolved. Equation A8 can be revised to a simpler form as follows:

$$\chi(x,y,z,t)=\frac{1}{\overline{F}}\cdot\frac{2Q}{(2\pi)^{3/2}\sqrt{(\sigma_z^2+\sigma_t^2)}(\sigma_{x,y}^2+\sigma_t^2)}\int_0^T \exp\left[-\frac{1}{2}\left(\frac{(x-ut)^2}{(\sigma_{x,y}^2+\sigma_t^2)}+\frac{(z-h)^2}{(\sigma_z^2+\sigma_t^2)}\right)\right]F(t)dt \qquad \text{[Equation A9]}$$

Where

$\overline{F}$ = average control room intake flow rate, [cfm] over the puff transit time, T.

$$\overline{F}=\frac{\int_0^T F(t)dt}{\int_0^T dt} \qquad \text{[Equation A10]}$$

Filter alignments, such as switchover to emergency filtration trains which would include charcoal filters are not considered in this calculation of the atmospheric dispersion parameter. The intent is to characterize the intake concentration entering the control room envelope (CRE). Filtration inside the CRE does not impact the outside air intake concentration upstream of the filters if any are present.

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Appendix B – Calculation of Integrated χ/Q

This appendix provides the calculations performed to determine the χ/Q under the following conditions:

Case	Description	Intake Flow Rates	Unfiltered Inleakage
1	Average Flow Rate	N/A – the flow rate does not affect Equation 3 since the weighting factor reduces to 1.	0 cfm
2	MSLB signal (18 sec. actuation time)	0 – 18 sec: 1,650 cfm 18 sec. – 124 sec.: 2,750 cfm	0 cfm
3	30 sec. actuation time	0 – 30 sec: 1,650 cfm 30 sec. – 124 sec.: 2,750 cfm	0 cfm
4	35 sec. actuation time	0 – 35 sec: 1,650 cfm 35 sec. – 124 sec.: 2,750 cfm	0 cfm
5	40 sec. actuation time	0 – 40 sec: 1,650 cfm 40 sec. – 124 sec.: 2,750 cfm	0 cfm
6	45 sec. actuation time	0 – 45 sec: 1,650 cfm 45 sec. – 124 sec.: 2,750 cfm	0 cfm
7	55 sec. actuation time	0 – 55 sec: 1,650 cfm 55 sec. – 124 sec.: 2,750 cfm	0 cfm

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In the following tables, the following formulas were used:

Column "χ/Q(x,u,k,t)"

$$\frac{\chi}{Q}(x,u,k,t_i)=\frac{1}{\overline{F}}\frac{2}{\sqrt{\left(\sigma_z^2(x,k)+\sigma_I^2\right)}(2\pi)^{3/2}\left(\sigma_{x,y}^2(x,k)+\sigma_I^2\right)}\exp\left[-\frac{1}{2}\left(\frac{(x-ut_i)^2}{\left(\sigma_{x,y}^2(x,k)+\sigma_I^2\right)}\right)\right]\cdot F(t_i)$$

Column "Integrated χ/Q(x,u,k,t)"

$$Integrated\ \frac{\chi}{Q}(x,u,k,t_i)=\frac{\chi}{Q}(x,u,k,t_i)\cdot\Delta t+Integrated\ \frac{\chi}{Q}(x,u,k,t_{i-1})$$

As an example at time = 1 sec in Table B-1:

$$\frac{\chi}{Q}(x,u,k,t_i)=\frac{1}{1.0}\frac{2}{\sqrt{\left(1.5^2+16.94^2\right)}(2\pi)^{3/2}\left(3.0^2+16.94^2\right)}\exp\left[-\frac{1}{2}\left(\frac{(63.67-1(1.0))^2}{\left(3.0^2+16.94^2\right)}\right)\right]\cdot 1.0$$

$$\frac{\chi}{Q}(x,u,k,t_i)=3.312E-08\ m^{-3}$$

$$Integrated\ \frac{\chi}{Q}(x,u,k,t_i)=3.312E-08\ m^{-3}\cdot(1\ \text{sec})+0=3.312E-08\ \text{sec}/m^3$$

Ref.

Table B-1. Calculation of Integrated χ/Q (Case 1: Average Flow Rate)

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_1	F(t)	χ/Q(x,u,k,t)	Integrated χ/Q(x,u,k,t)
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
0	63.67	1	1.5	3	16.94	1	2.675E-08	0.000E+00
1	63.67	1	1.5	3	16.94	1	3.312E-08	3.312E-08
2	63.67	1	1.5	3	16.94	1	4.086E-08	7.398E-08
3	63.67	1	1.5	3	16.94	1	5.024E-08	1.242E-07
4	63.67	1	1.5	3	16.94	1	6.157E-08	1.858E-07
5	63.67	1	1.5	3	16.94	1	7.520E-08	2.610E-07
6	63.67	1	1.5	3	16.94	1	9.153E-08	3.525E-07
7	63.67	1	1.5	3	16.94	1	1.110E-07	4.636E-07
8	63.67	1	1.5	3	16.94	1	1.342E-07	5.978E-07
9	63.67	1	1.5	3	16.94	1	1.618E-07	7.596E-07
10	63.67	1	1.5	3	16.94	1	1.943E-07	9.538E-07
11	63.67	1	1.5	3	16.94	1	2.325E-07	1.186E-06
12	63.67	1	1.5	3	16.94	1	2.773E-07	1.464E-06
13	63.67	1	1.5	3	16.94	1	3.296E-07	1.793E-06
14	63.67	1	1.5	3	16.94	1	3.906E-07	2.184E-06
15	63.67	1	1.5	3	16.94	1	4.611E-07	2.645E-06
16	63.67	1	1.5	3	16.94	1	5.427E-07	3.188E-06
17	63.67	1	1.5	3	16.94	1	6.364E-07	3.824E-06
18	63.67	1	1.5	3	16.94	1	7.439E-07	4.568E-06
19	63.67	1	1.5	3	16.94	1	8.666E-07	5.435E-06
20	63.67	1	1.5	3	16.94	1	1.006E-06	6.441E-06
21	63.67	1	1.5	3	16.94	1	1.164E-06	7.605E-06
22	63.67	1	1.5	3	16.94	1	1.342E-06	8.947E-06
23	63.67	1	1.5	3	16.94	1	1.543E-06	1.049E-05
24	63.67	1	1.5	3	16.94	1	1.767E-06	1.226E-05
25	63.67	1	1.5	3	16.94	1	2.017E-06	1.427E-05
26	63.67	1	1.5	3	16.94	1	2.295E-06	1.657E-05
27	63.67	1	1.5	3	16.94	1	2.602E-06	1.917E-05
28	63.67	1	1.5	3	16.94	1	2.940E-06	2.211E-05
29	63.67	1	1.5	3	16.94	1	3.311E-06	2.542E-05
30	63.67	1	1.5	3	16.94	1	3.716E-06	2.914E-05
31	63.67	1	1.5	3	16.94	1	4.157E-06	3.330E-05
32	63.67	1	1.5	3	16.94	1	4.635E-06	3.793E-05
33	63.67	1	1.5	3	16.94	1	5.149E-06	4.308E-05
34	63.67	1	1.5	3	16.94	1	5.702E-06	4.878E-05
35	63.67	1	1.5	3	16.94	1	6.293E-06	5.507E-05

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Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
36	63.67	1	1.5	3	16.94	1	6.921E-06	6.200E-05
37	63.67	1	1.5	3	16.94	1	7.587E-06	6.958E-05
38	63.67	1	1.5	3	16.94	1	8.288E-06	7.787E-05
39	63.67	1	1.5	3	16.94	1	9.024E-06	8.689E-05
40	63.67	1	1.5	3	16.94	1	9.792E-06	9.669E-05
41	63.67	1	1.5	3	16.94	1	1.059E-05	1.073E-04
42	63.67	1	1.5	3	16.94	1	1.141E-05	1.187E-04
43	63.67	1	1.5	3	16.94	1	1.226E-05	1.309E-04
44	63.67	1	1.5	3	16.94	1	1.312E-05	1.441E-04
45	63.67	1	1.5	3	16.94	1	1.400E-05	1.581E-04
46	63.67	1	1.5	3	16.94	1	1.489E-05	1.730E-04
47	63.67	1	1.5	3	16.94	1	1.578E-05	1.887E-04
48	63.67	1	1.5	3	16.94	1	1.667E-05	2.054E-04
49	63.67	1	1.5	3	16.94	1	1.754E-05	2.230E-04
50	63.67	1	1.5	3	16.94	1	1.840E-05	2.414E-04
51	63.67	1	1.5	3	16.94	1	1.924E-05	2.606E-04
52	63.67	1	1.5	3	16.94	1	2.005E-05	2.806E-04
53	63.67	1	1.5	3	16.94	1	2.082E-05	3.015E-04
54	63.67	1	1.5	3	16.94	1	2.155E-05	3.230E-04
55	63.67	1	1.5	3	16.94	1	2.222E-05	3.452E-04
56	63.67	1	1.5	3	16.94	1	2.285E-05	3.681E-04
57	63.67	1	1.5	3	16.94	1	2.341E-05	3.915E-04
58	63.67	1	1.5	3	16.94	1	2.390E-05	4.154E-04
59	63.67	1	1.5	3	16.94	1	2.432E-05	4.397E-04
60	63.67	1	1.5	3	16.94	1	2.467E-05	4.644E-04
61	63.67	1	1.5	3	16.94	1	2.493E-05	4.893E-04
62	63.67	1	1.5	3	16.94	1	2.512E-05	5.144E-04
63	63.67	1	1.5	3	16.94	1	2.521E-05	5.396E-04
64	63.67	1	1.5	3	16.94	1	2.523E-05	5.649E-04
65	63.67	1	1.5	3	16.94	1	2.516E-05	5.900E-04
66	63.67	1	1.5	3	16.94	1	2.500E-05	6.150E-04
67	63.67	1	1.5	3	16.94	1	2.477E-05	6.398E-04
68	63.67	1	1.5	3	16.94	1	2.445E-05	6.642E-04
69	63.67	1	1.5	3	16.94	1	2.405E-05	6.883E-04
70	63.67	1	1.5	3	16.94	1	2.358E-05	7.119E-04
71	63.67	1	1.5	3	16.94	1	2.304E-05	7.349E-04
72	63.67	1	1.5	3	16.94	1	2.244E-05	7.574E-04
73	63.67	1	1.5	3	16.94	1	2.178E-05	7.791E-04
74	63.67	1	1.5	3	16.94	1	2.107E-05	8.002E-04
75	63.67	1	1.5	3	16.94	1	2.031E-05	8.205E-04
76	63.67	1	1.5	3	16.94	1	1.952E-05	8.400E-04

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Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
77	63.67	1	1.5	3	16.94	1	1.869E-05	8.587E-04
78	63.67	1	1.5	3	16.94	1	1.784E-05	8.766E-04
79	63.67	1	1.5	3	16.94	1	1.696E-05	8.935E-04
80	63.67	1	1.5	3	16.94	1	1.608E-05	9.096E-04
81	63.67	1	1.5	3	16.94	1	1.519E-05	9.248E-04
82	63.67	1	1.5	3	16.94	1	1.430E-05	9.391E-04
83	63.67	1	1.5	3	16.94	1	1.342E-05	9.525E-04
84	63.67	1	1.5	3	16.94	1	1.255E-05	9.651E-04
85	63.67	1	1.5	3	16.94	1	1.170E-05	9.768E-04
86	63.67	1	1.5	3	16.94	1	1.087E-05	9.876E-04
87	63.67	1	1.5	3	16.94	1	1.006E-05	9.977E-04
88	63.67	1	1.5	3	16.94	1	9.282E-06	1.007E-03
89	63.67	1	1.5	3	16.94	1	8.535E-06	1.016E-03
90	63.67	1	1.5	3	16.94	1	7.821E-06	1.023E-03
91	63.67	1	1.5	3	16.94	1	7.143E-06	1.030E-03
92	63.67	1	1.5	3	16.94	1	6.502E-06	1.037E-03
93	63.67	1	1.5	3	16.94	1	5.899E-06	1.043E-03
94	63.67	1	1.5	3	16.94	1	5.333E-06	1.048E-03
95	63.67	1	1.5	3	16.94	1	4.805E-06	1.053E-03
96	63.67	1	1.5	3	16.94	1	4.315E-06	1.057E-03
97	63.67	1	1.5	3	16.94	1	3.862E-06	1.061E-03
98	63.67	1	1.5	3	16.94	1	3.445E-06	1.065E-03
99	63.67	1	1.5	3	16.94	1	3.063E-06	1.068E-03
100	63.67	1	1.5	3	16.94	1	2.713E-06	1.070E-03
101	63.67	1	1.5	3	16.94	1	2.396E-06	1.073E-03
102	63.67	1	1.5	3	16.94	1	2.108E-06	1.075E-03
103	63.67	1	1.5	3	16.94	1	1.849E-06	1.077E-03
104	63.67	1	1.5	3	16.94	1	1.616E-06	1.078E-03
105	63.67	1	1.5	3	16.94	1	1.408E-06	1.080E-03
106	63.67	1	1.5	3	16.94	1	1.222E-06	1.081E-03
107	63.67	1	1.5	3	16.94	1	1.058E-06	1.082E-03
108	63.67	1	1.5	3	16.94	1	9.120E-07	1.083E-03
109	63.67	1	1.5	3	16.94	1	7.838E-07	1.084E-03
110	63.67	1	1.5	3	16.94	1	6.714E-07	1.084E-03
111	63.67	1	1.5	3	16.94	1	5.731E-07	1.085E-03
112	63.67	1	1.5	3	16.94	1	4.876E-07	1.086E-03
113	63.67	1	1.5	3	16.94	1	4.134E-07	1.086E-03
114	63.67	1	1.5	3	16.94	1	3.493E-07	1.086E-03
115	63.67	1	1.5	3	16.94	1	2.942E-07	1.087E-03
116	63.67	1	1.5	3	16.94	1	2.469E-07	1.087E-03
117	63.67	1	1.5	3	16.94	1	2.066E-07	1.087E-03

Project: Nine Mile Point Nuclear Station Unit: _2__ Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
118	63.67	1	1.5	3	16.94	1	1.722E-07	1.087E-03
119	63.67	1	1.5	3	16.94	1	1.431E-07	1.087E-03
120	63.67	1	1.5	3	16.94	1	1.185E-07	1.087E-03
121	63.67	1	1.5	3	16.94	1	9.778E-08	1.088E-03
122	63.67	1	1.5	3	16.94	1	8.043E-08	1.088E-03
123	63.67	1	1.5	3	16.94	1	6.593E-08	1.088E-03
124	63.67	1	1.5	3	16.94	1	5.386E-08	1.088E-03

Project: Nine Mile Point Nuclear Station Unit: _2__ Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Table B-2. Calculation of Integrated χ/Q (Case 2)

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	χ/Q(x,u,k,t)	Integrated χ/Q(x,u,k,t)
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
0	63.67	1	1.5	3	16.94	1650	1.704E-08	0.000E+00
1	63.67	1	1.5	3	16.94	1650	2.110E-08	2.110E-08
2	63.67	1	1.5	3	16.94	1650	2.603E-08	4.712E-08
3	63.67	1	1.5	3	16.94	1650	3.200E-08	7.913E-08
4	63.67	1	1.5	3	16.94	1650	3.922E-08	1.183E-07
5	63.67	1	1.5	3	16.94	1650	4.790E-08	1.662E-07
6	63.67	1	1.5	3	16.94	1650	5.830E-08	2.245E-07
7	63.67	1	1.5	3	16.94	1650	7.073E-08	2.953E-07
8	63.67	1	1.5	3	16.94	1650	8.551E-08	3.808E-07
9	63.67	1	1.5	3	16.94	1650	1.030E-07	4.838E-07
10	63.67	1	1.5	3	16.94	1650	1.237E-07	6.076E-07
11	63.67	1	1.5	3	16.94	1650	1.481E-07	7.557E-07
12	63.67	1	1.5	3	16.94	1650	1.766E-07	9.323E-07
13	63.67	1	1.5	3	16.94	1650	2.100E-07	1.142E-06
14	63.67	1	1.5	3	16.94	1650	2.488E-07	1.391E-06
15	63.67	1	1.5	3	16.94	1650	2.937E-07	1.685E-06
16	63.67	1	1.5	3	16.94	1650	3.457E-07	2.030E-06
17	63.67	1	1.5	3	16.94	1650	4.054E-07	2.436E-06
18	63.67	1	1.5	3	16.94	1650	4.739E-07	2.910E-06
19	63.67	1	1.5	3	16.94	2750	9.200E-07	3.830E-06
20	63.67	1	1.5	3	16.94	2750	1.068E-06	4.898E-06
21	63.67	1	1.5	3	16.94	2750	1.236E-06	6.134E-06
22	63.67	1	1.5	3	16.94	2750	1.425E-06	7.559E-06
23	63.67	1	1.5	3	16.94	2750	1.638E-06	9.196E-06
24	63.67	1	1.5	3	16.94	2750	1.876E-06	1.107E-05
25	63.67	1	1.5	3	16.94	2750	2.141E-06	1.321E-05
26	63.67	1	1.5	3	16.94	2750	2.436E-06	1.565E-05
27	63.67	1	1.5	3	16.94	2750	2.762E-06	1.841E-05
28	63.67	1	1.5	3	16.94	2750	3.121E-06	2.153E-05
29	63.67	1	1.5	3	16.94	2750	3.515E-06	2.505E-05
30	63.67	1	1.5	3	16.94	2750	3.946E-06	2.899E-05
31	63.67	1	1.5	3	16.94	2750	4.413E-06	3.341E-05
32	63.67	1	1.5	3	16.94	2750	4.920E-06	3.833E-05
33	63.67	1	1.5	3	16.94	2750	5.467E-06	4.380E-05
34	63.67	1	1.5	3	16.94	2750	6.054E-06	4.985E-05
35	63.67	1	1.5	3	16.94	2750	6.681E-06	5.653E-05

Project: Nine Mile Point Nuclear Station Unit: 2 Disposition:

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
36	63.67	1	1.5	3	16.94	2750	7.348E-06	6.388E-05
37	63.67	1	1.5	3	16.94	2750	8.054E-06	7.193E-05
38	63.67	1	1.5	3	16.94	2750	8.799E-06	8.073E-05
39	63.67	1	1.5	3	16.94	2750	9.580E-06	9.031E-05
40	63.67	1	1.5	3	16.94	2750	1.040E-05	1.007E-04
41	63.67	1	1.5	3	16.94	2750	1.124E-05	1.119E-04
42	63.67	1	1.5	3	16.94	2750	1.212E-05	1.241E-04
43	63.67	1	1.5	3	16.94	2750	1.302E-05	1.371E-04
44	63.67	1	1.5	3	16.94	2750	1.393E-05	1.510E-04
45	63.67	1	1.5	3	16.94	2750	1.487E-05	1.659E-04
46	63.67	1	1.5	3	16.94	2750	1.581E-05	1.817E-04
47	63.67	1	1.5	3	16.94	2750	1.675E-05	1.984E-04
48	63.67	1	1.5	3	16.94	2750	1.769E-05	2.161E-04
49	63.67	1	1.5	3	16.94	2750	1.862E-05	2.348E-04
50	63.67	1	1.5	3	16.94	2750	1.954E-05	2.543E-04
51	63.67	1	1.5	3	16.94	2750	2.043E-05	2.747E-04
52	63.67	1	1.5	3	16.94	2750	2.128E-05	2.960E-04
53	63.67	1	1.5	3	16.94	2750	2.210E-05	3.181E-04
54	63.67	1	1.5	3	16.94	2750	2.287E-05	3.410E-04
55	63.67	1	1.5	3	16.94	2750	2.359E-05	3.646E-04
56	63.67	1	1.5	3	16.94	2750	2.425E-05	3.888E-04
57	63.67	1	1.5	3	16.94	2750	2.485E-05	4.137E-04
58	63.67	1	1.5	3	16.94	2750	2.537E-05	4.390E-04
59	63.67	1	1.5	3	16.94	2750	2.582E-05	4.649E-04
60	63.67	1	1.5	3	16.94	2750	2.619E-05	4.911E-04
61	63.67	1	1.5	3	16.94	2750	2.647E-05	5.175E-04
62	63.67	1	1.5	3	16.94	2750	2.666E-05	5.442E-04
63	63.67	1	1.5	3	16.94	2750	2.677E-05	5.710E-04
64	63.67	1	1.5	3	16.94	2750	2.678E-05	5.977E-04
65	63.67	1	1.5	3	16.94	2750	2.671E-05	6.244E-04
66	63.67	1	1.5	3	16.94	2750	2.654E-05	6.510E-04
67	63.67	1	1.5	3	16.94	2750	2.629E-05	6.773E-04
68	63.67	1	1.5	3	16.94	2750	2.595E-05	7.032E-04
69	63.67	1	1.5	3	16.94	2750	2.553E-05	7.288E-04
70	63.67	1	1.5	3	16.94	2750	2.504E-05	7.538E-04
71	63.67	1	1.5	3	16.94	2750	2.446E-05	7.783E-04
72	63.67	1	1.5	3	16.94	2750	2.383E-05	8.021E-04
73	63.67	1	1.5	3	16.94	2750	2.313E-05	8.252E-04
74	63.67	1	1.5	3	16.94	2750	2.237E-05	8.476E-04
75	63.67	1	1.5	3	16.94	2750	2.157E-05	8.692E-04
76	63.67	1	1.5	3	16.94	2750	2.072E-05	8.899E-04

Project: Nine Mile Point Nuclear Station Unit: 2 Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	χ/Q(x,u,k,t)	Integrated χ/Q(x,u,k,t)
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
77	63.67	1	1.5	3	16.94	2750	1.984E-05	9.097E-04
78	63.67	1	1.5	3	16.94	2750	1.894E-05	9.287E-04
79	63.67	1	1.5	3	16.94	2750	1.801E-05	9.467E-04
80	63.67	1	1.5	3	16.94	2750	1.707E-05	9.637E-04
81	63.67	1	1.5	3	16.94	2750	1.613E-05	9.799E-04
82	63.67	1	1.5	3	16.94	2750	1.519E-05	9.951E-04
83	63.67	1	1.5	3	16.94	2750	1.425E-05	1.009E-03
84	63.67	1	1.5	3	16.94	2750	1.333E-05	1.023E-03
85	63.67	1	1.5	3	16.94	2750	1.242E-05	1.035E-03
86	63.67	1	1.5	3	16.94	2750	1.154E-05	1.047E-03
87	63.67	1	1.5	3	16.94	2750	1.068E-05	1.057E-03
88	63.67	1	1.5	3	16.94	2750	9.854E-06	1.067E-03
89	63.67	1	1.5	3	16.94	2750	9.061E-06	1.076E-03
90	63.67	1	1.5	3	16.94	2750	8.303E-06	1.084E-03
91	63.67	1	1.5	3	16.94	2750	7.584E-06	1.092E-03
92	63.67	1	1.5	3	16.94	2750	6.903E-06	1.099E-03
93	63.67	1	1.5	3	16.94	2750	6.262E-06	1.105E-03
94	63.67	1	1.5	3	16.94	2750	5.662E-06	1.111E-03
95	63.67	1	1.5	3	16.94	2750	5.102E-06	1.116E-03
96	63.67	1	1.5	3	16.94	2750	4.581E-06	1.121E-03
97	63.67	1	1.5	3	16.94	2750	4.100E-06	1.125E-03
98	63.67	1	1.5	3	16.94	2750	3.657E-06	1.128E-03
99	63.67	1	1.5	3	16.94	2750	3.251E-06	1.132E-03
100	63.67	1	1.5	3	16.94	2750	2.881E-06	1.134E-03
101	63.67	1	1.5	3	16.94	2750	2.543E-06	1.137E-03
102	63.67	1	1.5	3	16.94	2750	2.238E-06	1.139E-03
103	63.67	1	1.5	3	16.94	2750	1.963E-06	1.141E-03
104	63.67	1	1.5	3	16.94	2750	1.716E-06	1.143E-03
105	63.67	1	1.5	3	16.94	2750	1.495E-06	1.144E-03
106	63.67	1	1.5	3	16.94	2750	1.298E-06	1.146E-03
107	63.67	1	1.5	3	16.94	2750	1.123E-06	1.147E-03
108	63.67	1	1.5	3	16.94	2750	9.682E-07	1.148E-03
109	63.67	1	1.5	3	16.94	2750	8.321E-07	1.149E-03
110	63.67	1	1.5	3	16.94	2750	7.127E-07	1.149E-03
111	63.67	1	1.5	3	16.94	2750	6.084E-07	1.150E-03
112	63.67	1	1.5	3	16.94	2750	5.176E-07	1.150E-03
113	63.67	1	1.5	3	16.94	2750	4.389E-07	1.151E-03
114	63.67	1	1.5	3	16.94	2750	3.709E-07	1.151E-03
115	63.67	1	1.5	3	16.94	2750	3.123E-07	1.152E-03
116	63.67	1	1.5	3	16.94	2750	2.622E-07	1.152E-03
117	63.67	1	1.5	3	16.94	2750	2.193E-07	1.152E-03

Project: Nine Mile Point Nuclear Station Unit: _2__ Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
118	63.67	1	1.5	3	16.94	2750	1.828E-07	1.152E-03
119	63.67	1	1.5	3	16.94	2750	1.519E-07	1.152E-03
120	63.67	1	1.5	3	16.94	2750	1.258E-07	1.153E-03
121	63.67	1	1.5	3	16.94	2750	1.038E-07	1.153E-03
122	63.67	1	1.5	3	16.94	2750	8.538E-08	1.153E-03
123	63.67	1	1.5	3	16.94	2750	6.999E-08	1.153E-03
124	63.67	1	1.5	3	16.94	2750	5.718E-08	1.153E-03

Project: Nine Mile Point Nuclear Station Unit: 2 Disposition:

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Table B-3. Calculation of Integrated χ/Q (Case 3)

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
0	63.67	1	1.5	3	16.94	1650	1.777E-08	0.000E+00
1	63.67	1	1.5	3	16.94	1650	2.200E-08	2.200E-08
2	63.67	1	1.5	3	16.94	1650	2.714E-08	4.914E-08
3	63.67	1	1.5	3	16.94	1650	3.337E-08	8.252E-08
4	63.67	1	1.5	3	16.94	1650	4.090E-08	1.234E-07
5	63.67	1	1.5	3	16.94	1650	4.995E-08	1.734E-07
6	63.67	1	1.5	3	16.94	1650	6.080E-08	2.342E-07
7	63.67	1	1.5	3	16.94	1650	7.376E-08	3.079E-07
8	63.67	1	1.5	3	16.94	1650	8.918E-08	3.971E-07
9	63.67	1	1.5	3	16.94	1650	1.075E-07	5.046E-07
10	63.67	1	1.5	3	16.94	1650	1.290E-07	6.336E-07
11	63.67	1	1.5	3	16.94	1650	1.544E-07	7.880E-07
12	63.67	1	1.5	3	16.94	1650	1.842E-07	9.722E-07
13	63.67	1	1.5	3	16.94	1650	2.190E-07	1.191E-06
14	63.67	1	1.5	3	16.94	1650	2.594E-07	1.451E-06
15	63.67	1	1.5	3	16.94	1650	3.063E-07	1.757E-06
16	63.67	1	1.5	3	16.94	1650	3.605E-07	2.117E-06
17	63.67	1	1.5	3	16.94	1650	4.228E-07	2.540E-06
18	63.67	1	1.5	3	16.94	1650	4.942E-07	3.034E-06
19	63.67	1	1.5	3	16.94	1650	5.756E-07	3.610E-06
20	63.67	1	1.5	3	16.94	1650	6.683E-07	4.278E-06
21	63.67	1	1.5	3	16.94	1650	7.733E-07	5.052E-06
22	63.67	1	1.5	3	16.94	1650	8.917E-07	5.943E-06
23	63.67	1	1.5	3	16.94	1650	1.025E-06	6.968E-06
24	63.67	1	1.5	3	16.94	1650	1.174E-06	8.142E-06
25	63.67	1	1.5	3	16.94	1650	1.340E-06	9.482E-06
26	63.67	1	1.5	3	16.94	1650	1.524E-06	1.101E-05
27	63.67	1	1.5	3	16.94	1650	1.728E-06	1.273E-05
28	63.67	1	1.5	3	16.94	1650	1.953E-06	1.469E-05
29	63.67	1	1.5	3	16.94	1650	2.200E-06	1.689E-05
30	63.67	1	1.5	3	16.94	1650	2.469E-06	1.936E-05
31	63.67	1	1.5	3	16.94	2750	4.603E-06	2.396E-05
32	63.67	1	1.5	3	16.94	2750	5.131E-06	2.909E-05
33	63.67	1	1.5	3	16.94	2750	5.701E-06	3.479E-05
34	63.67	1	1.5	3	16.94	2750	6.313E-06	4.110E-05
35	63.67	1	1.5	3	16.94	2750	6.967E-06	4.807E-05

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Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
36	63.67	1	1.5	3	16.94	2750	7.663E-06	5.573E-05
37	63.67	1	1.5	3	16.94	2750	8.400E-06	6.413E-05
38	63.67	1	1.5	3	16.94	2750	9.176E-06	7.331E-05
39	63.67	1	1.5	3	16.94	2750	9.991E-06	8.330E-05
40	63.67	1	1.5	3	16.94	2750	1.084E-05	9.414E-05
41	63.67	1	1.5	3	16.94	2750	1.172E-05	1.059E-04
42	63.67	1	1.5	3	16.94	2750	1.264E-05	1.185E-04
43	63.67	1	1.5	3	16.94	2750	1.357E-05	1.321E-04
44	63.67	1	1.5	3	16.94	2750	1.453E-05	1.466E-04
45	63.67	1	1.5	3	16.94	2750	1.550E-05	1.621E-04
46	63.67	1	1.5	3	16.94	2750	1.648E-05	1.786E-04
47	63.67	1	1.5	3	16.94	2750	1.747E-05	1.961E-04
48	63.67	1	1.5	3	16.94	2750	1.845E-05	2.145E-04
49	63.67	1	1.5	3	16.94	2750	1.942E-05	2.339E-04
50	63.67	1	1.5	3	16.94	2750	2.037E-05	2.543E-04
51	63.67	1	1.5	3	16.94	2750	2.130E-05	2.756E-04
52	63.67	1	1.5	3	16.94	2750	2.220E-05	2.978E-04
53	63.67	1	1.5	3	16.94	2750	2.305E-05	3.209E-04
54	63.67	1	1.5	3	16.94	2750	2.385E-05	3.447E-04
55	63.67	1	1.5	3	16.94	2750	2.461E-05	3.693E-04
56	63.67	1	1.5	3	16.94	2750	2.529E-05	3.946E-04
57	63.67	1	1.5	3	16.94	2750	2.591E-05	4.205E-04
58	63.67	1	1.5	3	16.94	2750	2.646E-05	4.470E-04
59	63.67	1	1.5	3	16.94	2750	2.693E-05	4.739E-04
60	63.67	1	1.5	3	16.94	2750	2.731E-05	5.012E-04
61	63.67	1	1.5	3	16.94	2750	2.760E-05	5.288E-04
62	63.67	1	1.5	3	16.94	2750	2.781E-05	5.566E-04
63	63.67	1	1.5	3	16.94	2750	2.792E-05	5.845E-04
64	63.67	1	1.5	3	16.94	2750	2.793E-05	6.125E-04
65	63.67	1	1.5	3	16.94	2750	2.785E-05	6.403E-04
66	63.67	1	1.5	3	16.94	2750	2.768E-05	6.680E-04
67	63.67	1	1.5	3	16.94	2750	2.742E-05	6.954E-04
68	63.67	1	1.5	3	16.94	2750	2.707E-05	7.225E-04
69	63.67	1	1.5	3	16.94	2750	2.663E-05	7.491E-04
70	63.67	1	1.5	3	16.94	2750	2.611E-05	7.752E-04
71	63.67	1	1.5	3	16.94	2750	2.551E-05	8.007E-04
72	63.67	1	1.5	3	16.94	2750	2.485E-05	8.256E-04
73	63.67	1	1.5	3	16.94	2750	2.412E-05	8.497E-04
74	63.67	1	1.5	3	16.94	2750	2.333E-05	8.730E-04
75	63.67	1	1.5	3	16.94	2750	2.249E-05	8.955E-04

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Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_t	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
76	63.67	1	1.5	3	16.94	2750	2.161E-05	9.171E-04
77	63.67	1	1.5	3	16.94	2750	2.069E-05	9.378E-04
78	63.67	1	1.5	3	16.94	2750	1.975E-05	9.576E-04
79	63.67	1	1.5	3	16.94	2750	1.878E-05	9.764E-04
80	63.67	1	1.5	3	16.94	2750	1.780E-05	9.942E-04
81	63.67	1	1.5	3	16.94	2750	1.682E-05	1.011E-03
82	63.67	1	1.5	3	16.94	2750	1.584E-05	1.027E-03
83	63.67	1	1.5	3	16.94	2750	1.486E-05	1.042E-03
84	63.67	1	1.5	3	16.94	2750	1.390E-05	1.056E-03
85	63.67	1	1.5	3	16.94	2750	1.295E-05	1.069E-03
86	63.67	1	1.5	3	16.94	2750	1.203E-05	1.081E-03
87	63.67	1	1.5	3	16.94	2750	1.114E-05	1.092E-03
88	63.67	1	1.5	3	16.94	2750	1.028E-05	1.102E-03
89	63.67	1	1.5	3	16.94	2750	9.449E-06	1.111E-03
90	63.67	1	1.5	3	16.94	2750	8.659E-06	1.120E-03
91	63.67	1	1.5	3	16.94	2750	7.909E-06	1.128E-03
92	63.67	1	1.5	3	16.94	2750	7.199E-06	1.135E-03
93	63.67	1	1.5	3	16.94	2750	6.531E-06	1.142E-03
94	63.67	1	1.5	3	16.94	2750	5.904E-06	1.148E-03
95	63.67	1	1.5	3	16.94	2750	5.320E-06	1.153E-03
96	63.67	1	1.5	3	16.94	2750	4.778E-06	1.158E-03
97	63.67	1	1.5	3	16.94	2750	4.276E-06	1.162E-03
98	63.67	1	1.5	3	16.94	2750	3.814E-06	1.166E-03
99	63.67	1	1.5	3	16.94	2750	3.391E-06	1.169E-03
100	63.67	1	1.5	3	16.94	2750	3.004E-06	1.172E-03
101	63.67	1	1.5	3	16.94	2750	2.652E-06	1.175E-03
102	63.67	1	1.5	3	16.94	2750	2.334E-06	1.177E-03
103	63.67	1	1.5	3	16.94	2750	2.047E-06	1.179E-03
104	63.67	1	1.5	3	16.94	2750	1.789E-06	1.181E-03
105	63.67	1	1.5	3	16.94	2750	1.559E-06	1.183E-03
106	63.67	1	1.5	3	16.94	2750	1.353E-06	1.184E-03
107	63.67	1	1.5	3	16.94	2750	1.171E-06	1.185E-03
108	63.67	1	1.5	3	16.94	2750	1.010E-06	1.186E-03
109	63.67	1	1.5	3	16.94	2750	8.678E-07	1.187E-03
110	63.67	1	1.5	3	16.94	2750	7.433E-07	1.188E-03
111	63.67	1	1.5	3	16.94	2750	6.345E-07	1.188E-03
112	63.67	1	1.5	3	16.94	2750	5.398E-07	1.189E-03
113	63.67	1	1.5	3	16.94	2750	4.577E-07	1.189E-03
114	63.67	1	1.5	3	16.94	2750	3.868E-07	1.190E-03
115	63.67	1	1.5	3	16.94	2750	3.257E-07	1.190E-03

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Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
116	63.67	1	1.5	3	16.94	2750	2.734E-07	1.190E-03
117	63.67	1	1.5	3	16.94	2750	2.287E-07	1.191E-03
118	63.67	1	1.5	3	16.94	2750	1.907E-07	1.191E-03
119	63.67	1	1.5	3	16.94	2750	1.584E-07	1.191E-03
120	63.67	1	1.5	3	16.94	2750	1.312E-07	1.191E-03
121	63.67	1	1.5	3	16.94	2750	1.083E-07	1.191E-03
122	63.67	1	1.5	3	16.94	2750	8.904E-08	1.191E-03
123	63.67	1	1.5	3	16.94	2750	7.299E-08	1.191E-03
124	63.67	1	1.5	3	16.94	2750	5.963E-08	1.191E-03

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Table B-4. Calculation of Integrated χ/Q (Case 4)

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	χ/Q(x,u,k,t)	Integrated χ/Q(x,u,k,t)
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
0	63.67	1	1.5	3	16.94	1650	1.809E-08	0.000E+00
1	63.67	1	1.5	3	16.94	1650	2.240E-08	2.240E-08
2	63.67	1	1.5	3	16.94	1650	2.764E-08	5.004E-08
3	63.67	1	1.5	3	16.94	1650	3.398E-08	8.402E-08
4	63.67	1	1.5	3	16.94	1650	4.164E-08	1.257E-07
5	63.67	1	1.5	3	16.94	1650	5.086E-08	1.765E-07
6	63.67	1	1.5	3	16.94	1650	6.191E-08	2.384E-07
7	63.67	1	1.5	3	16.94	1650	7.510E-08	3.135E-07
8	63.67	1	1.5	3	16.94	1650	9.080E-08	4.043E-07
9	63.67	1	1.5	3	16.94	1650	1.094E-07	5.137E-07
10	63.67	1	1.5	3	16.94	1650	1.314E-07	6.451E-07
11	63.67	1	1.5	3	16.94	1650	1.572E-07	8.024E-07
12	63.67	1	1.5	3	16.94	1650	1.876E-07	9.899E-07
13	63.67	1	1.5	3	16.94	1650	2.230E-07	1.213E-06
14	63.67	1	1.5	3	16.94	1650	2.642E-07	1.477E-06
15	63.67	1	1.5	3	16.94	1650	3.119E-07	1.789E-06
16	63.67	1	1.5	3	16.94	1650	3.670E-07	2.156E-06
17	63.67	1	1.5	3	16.94	1650	4.305E-07	2.586E-06
18	63.67	1	1.5	3	16.94	1650	5.031E-07	3.090E-06
19	63.67	1	1.5	3	16.94	1650	5.861E-07	3.676E-06
20	63.67	1	1.5	3	16.94	1650	6.805E-07	4.356E-06
21	63.67	1	1.5	3	16.94	1650	7.873E-07	5.143E-06
22	63.67	1	1.5	3	16.94	1650	9.079E-07	6.051E-06
23	63.67	1	1.5	3	16.94	1650	1.043E-06	7.095E-06
24	63.67	1	1.5	3	16.94	1650	1.195E-06	8.290E-06
25	63.67	1	1.5	3	16.94	1650	1.364E-06	9.654E-06
26	63.67	1	1.5	3	16.94	1650	1.552E-06	1.121E-05
27	63.67	1	1.5	3	16.94	1650	1.760E-06	1.297E-05
28	63.67	1	1.5	3	16.94	1650	1.989E-06	1.495E-05
29	63.67	1	1.5	3	16.94	1650	2.240E-06	1.719E-05
30	63.67	1	1.5	3	16.94	1650	2.514E-06	1.971E-05
31	63.67	1	1.5	3	16.94	1650	2.812E-06	2.252E-05
32	63.67	1	1.5	3	16.94	1650	3.135E-06	2.565E-05
33	63.67	1	1.5	3	16.94	1650	3.483E-06	2.914E-05
34	63.67	1	1.5	3	16.94	1650	3.857E-06	3.299E-05

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Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
35	63.67	1	1.5	3	16.94	1650	4.256E-06	3.725E-05
36	63.67	1	1.5	3	16.94	2750	7.802E-06	4.505E-05
37	63.67	1	1.5	3	16.94	2750	8.552E-06	5.360E-05
38	63.67	1	1.5	3	16.94	2750	9.343E-06	6.295E-05
39	63.67	1	1.5	3	16.94	2750	1.017E-05	7.312E-05
40	63.67	1	1.5	3	16.94	2750	1.104E-05	8.416E-05
41	63.67	1	1.5	3	16.94	2750	1.194E-05	9.610E-05
42	63.67	1	1.5	3	16.94	2750	1.287E-05	1.090E-04
43	63.67	1	1.5	3	16.94	2750	1.382E-05	1.228E-04
44	63.67	1	1.5	3	16.94	2750	1.479E-05	1.376E-04
45	63.67	1	1.5	3	16.94	2750	1.578E-05	1.534E-04
46	63.67	1	1.5	3	16.94	2750	1.678E-05	1.701E-04
47	63.67	1	1.5	3	16.94	2750	1.779E-05	1.879E-04
48	63.67	1	1.5	3	16.94	2750	1.879E-05	2.067E-04
49	63.67	1	1.5	3	16.94	2750	1.977E-05	2.265E-04
50	63.67	1	1.5	3	16.94	2750	2.074E-05	2.472E-04
51	63.67	1	1.5	3	16.94	2750	2.169E-05	2.689E-04
52	63.67	1	1.5	3	16.94	2750	2.260E-05	2.915E-04
53	63.67	1	1.5	3	16.94	2750	2.347E-05	3.150E-04
54	63.67	1	1.5	3	16.94	2750	2.429E-05	3.393E-04
55	63.67	1	1.5	3	16.94	2750	2.505E-05	3.643E-04
56	63.67	1	1.5	3	16.94	2750	2.575E-05	3.901E-04
57	63.67	1	1.5	3	16.94	2750	2.639E-05	4.165E-04
58	63.67	1	1.5	3	16.94	2750	2.694E-05	4.434E-04
59	63.67	1	1.5	3	16.94	2750	2.742E-05	4.708E-04
60	63.67	1	1.5	3	16.94	2750	2.781E-05	4.986E-04
61	63.67	1	1.5	3	16.94	2750	2.810E-05	5.267E-04
62	63.67	1	1.5	3	16.94	2750	2.831E-05	5.551E-04
63	63.67	1	1.5	3	16.94	2750	2.842E-05	5.835E-04
64	63.67	1	1.5	3	16.94	2750	2.844E-05	6.119E-04
65	63.67	1	1.5	3	16.94	2750	2.836E-05	6.403E-04
66	63.67	1	1.5	3	16.94	2750	2.819E-05	6.685E-04
67	63.67	1	1.5	3	16.94	2750	2.792E-05	6.964E-04
68	63.67	1	1.5	3	16.94	2750	2.756E-05	7.239E-04
69	63.67	1	1.5	3	16.94	2750	2.711E-05	7.511E-04
70	63.67	1	1.5	3	16.94	2750	2.658E-05	7.776E-04
71	63.67	1	1.5	3	16.94	2750	2.598E-05	8.036E-04
72	63.67	1	1.5	3	16.94	2750	2.530E-05	8.289E-04
73	63.67	1	1.5	3	16.94	2750	2.455E-05	8.535E-04
74	63.67	1	1.5	3	16.94	2750	2.375E-05	8.772E-04

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Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
75	63.67	1	1.5	3	16.94	2750	2.290E-05	9.001E-04
76	63.67	1	1.5	3	16.94	2750	2.200E-05	9.221E-04
77	63.67	1	1.5	3	16.94	2750	2.107E-05	9.432E-04
78	63.67	1	1.5	3	16.94	2750	2.011E-05	9.633E-04
79	63.67	1	1.5	3	16.94	2750	1.912E-05	9.824E-04
80	63.67	1	1.5	3	16.94	2750	1.813E-05	1.001E-03
81	63.67	1	1.5	3	16.94	2750	1.713E-05	1.018E-03
82	63.67	1	1.5	3	16.94	2750	1.612E-05	1.034E-03
83	63.67	1	1.5	3	16.94	2750	1.513E-05	1.049E-03
84	63.67	1	1.5	3	16.94	2750	1.415E-05	1.063E-03
85	63.67	1	1.5	3	16.94	2750	1.319E-05	1.076E-03
86	63.67	1	1.5	3	16.94	2750	1.225E-05	1.089E-03
87	63.67	1	1.5	3	16.94	2750	1.134E-05	1.100E-03
88	63.67	1	1.5	3	16.94	2750	1.046E-05	1.110E-03
89	63.67	1	1.5	3	16.94	2750	9.621E-06	1.120E-03
90	63.67	1	1.5	3	16.94	2750	8.817E-06	1.129E-03
91	63.67	1	1.5	3	16.94	2750	8.053E-06	1.137E-03
92	63.67	1	1.5	3	16.94	2750	7.330E-06	1.144E-03
93	63.67	1	1.5	3	16.94	2750	6.649E-06	1.151E-03
94	63.67	1	1.5	3	16.94	2750	6.012E-06	1.157E-03
95	63.67	1	1.5	3	16.94	2750	5.417E-06	1.162E-03
96	63.67	1	1.5	3	16.94	2750	4.865E-06	1.167E-03
97	63.67	1	1.5	3	16.94	2750	4.354E-06	1.171E-03
98	63.67	1	1.5	3	16.94	2750	3.883E-06	1.175E-03
99	63.67	1	1.5	3	16.94	2750	3.452E-06	1.179E-03
100	63.67	1	1.5	3	16.94	2750	3.059E-06	1.182E-03
101	63.67	1	1.5	3	16.94	2750	2.701E-06	1.185E-03
102	63.67	1	1.5	3	16.94	2750	2.377E-06	1.187E-03
103	63.67	1	1.5	3	16.94	2750	2.084E-06	1.189E-03
104	63.67	1	1.5	3	16.94	2750	1.822E-06	1.191E-03
105	63.67	1	1.5	3	16.94	2750	1.587E-06	1.192E-03
106	63.67	1	1.5	3	16.94	2750	1.378E-06	1.194E-03
107	63.67	1	1.5	3	16.94	2750	1.192E-06	1.195E-03
108	63.67	1	1.5	3	16.94	2750	1.028E-06	1.196E-03
109	63.67	1	1.5	3	16.94	2750	8.836E-07	1.197E-03
110	63.67	1	1.5	3	16.94	2750	7.568E-07	1.198E-03
111	63.67	1	1.5	3	16.94	2750	6.460E-07	1.198E-03
112	63.67	1	1.5	3	16.94	2750	5.496E-07	1.199E-03
113	63.67	1	1.5	3	16.94	2750	4.660E-07	1.199E-03
114	63.67	1	1.5	3	16.94	2750	3.938E-07	1.200E-03

Project: Nine Mile Point Nuclear Station Unit: _2_ Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
115	63.67	1	1.5	3	16.94	2750	3.317E-07	1.200E-03
116	63.67	1	1.5	3	16.94	2750	2.784E-07	1.200E-03
117	63.67	1	1.5	3	16.94	2750	2.329E-07	1.201E-03
118	63.67	1	1.5	3	16.94	2750	1.941E-07	1.201E-03
119	63.67	1	1.5	3	16.94	2750	1.613E-07	1.201E-03
120	63.67	1	1.5	3	16.94	2750	1.336E-07	1.201E-03
121	63.67	1	1.5	3	16.94	2750	1.102E-07	1.201E-03
122	63.67	1	1.5	3	16.94	2750	9.066E-08	1.201E-03
123	63.67	1	1.5	3	16.94	2750	7.432E-08	1.201E-03
124	63.67	1	1.5	3	16.94	2750	6.071E-08	1.201E-03

Project: Nine Mile Point Nuclear Station Unit: 2 Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Table B-5. Calculation of Integrated χ/Q (Case 5)

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
0	63.67	1	1.5	3	16.94	1650	1.843E-08	0.000E+00
1	63.67	1	1.5	3	16.94	1650	2.281E-08	2.281E-08
2	63.67	1	1.5	3	16.94	1650	2.815E-08	5.096E-08
3	63.67	1	1.5	3	16.94	1650	3.461E-08	8.557E-08
4	63.67	1	1.5	3	16.94	1650	4.241E-08	1.280E-07
5	63.67	1	1.5	3	16.94	1650	5.180E-08	1.798E-07
6	63.67	1	1.5	3	16.94	1650	6.305E-08	2.428E-07
7	63.67	1	1.5	3	16.94	1650	7.649E-08	3.193E-07
8	63.67	1	1.5	3	16.94	1650	9.248E-08	4.118E-07
9	63.67	1	1.5	3	16.94	1650	1.114E-07	5.233E-07
10	63.67	1	1.5	3	16.94	1650	1.338E-07	6.571E-07
11	63.67	1	1.5	3	16.94	1650	1.602E-07	8.172E-07
12	63.67	1	1.5	3	16.94	1650	1.910E-07	1.008E-06
13	63.67	1	1.5	3	16.94	1650	2.271E-07	1.235E-06
14	63.67	1	1.5	3	16.94	1650	2.690E-07	1.504E-06
15	63.67	1	1.5	3	16.94	1650	3.177E-07	1.822E-06
16	63.67	1	1.5	3	16.94	1650	3.738E-07	2.196E-06
17	63.67	1	1.5	3	16.94	1650	4.384E-07	2.634E-06
18	63.67	1	1.5	3	16.94	1650	5.125E-07	3.147E-06
19	63.67	1	1.5	3	16.94	1650	5.970E-07	3.744E-06
20	63.67	1	1.5	3	16.94	1650	6.931E-07	4.437E-06
21	63.67	1	1.5	3	16.94	1650	8.019E-07	5.239E-06
22	63.67	1	1.5	3	16.94	1650	9.247E-07	6.163E-06
23	63.67	1	1.5	3	16.94	1650	1.063E-06	7.226E-06
24	63.67	1	1.5	3	16.94	1650	1.217E-06	8.443E-06
25	63.67	1	1.5	3	16.94	1650	1.390E-06	9.833E-06
26	63.67	1	1.5	3	16.94	1650	1.581E-06	1.141E-05
27	63.67	1	1.5	3	16.94	1650	1.792E-06	1.321E-05
28	63.67	1	1.5	3	16.94	1650	2.025E-06	1.523E-05
29	63.67	1	1.5	3	16.94	1650	2.281E-06	1.751E-05
30	63.67	1	1.5	3	16.94	1650	2.560E-06	2.007E-05
31	63.67	1	1.5	3	16.94	1650	2.864E-06	2.294E-05
32	63.67	1	1.5	3	16.94	1650	3.193E-06	2.613E-05
33	63.67	1	1.5	3	16.94	1650	3.547E-06	2.968E-05
34	63.67	1	1.5	3	16.94	1650	3.928E-06	3.360E-05
35	63.67	1	1.5	3	16.94	1650	4.335E-06	3.794E-05

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Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
36	63.67	1	1.5	3	16.94	1650	4.768E-06	4.271E-05
37	63.67	1	1.5	3	16.94	1650	5.226E-06	4.793E-05
38	63.67	1	1.5	3	16.94	1650	5.710E-06	5.364E-05
39	63.67	1	1.5	3	16.94	1650	6.217E-06	5.986E-05
40	63.67	1	1.5	3	16.94	1650	6.746E-06	6.661E-05
41	63.67	1	1.5	3	16.94	2750	1.216E-05	7.876E-05
42	63.67	1	1.5	3	16.94	2750	1.310E-05	9.187E-05
43	63.67	1	1.5	3	16.94	2750	1.408E-05	1.059E-04
44	63.67	1	1.5	3	16.94	2750	1.507E-05	1.210E-04
45	63.67	1	1.5	3	16.94	2750	1.608E-05	1.371E-04
46	63.67	1	1.5	3	16.94	2750	1.710E-05	1.542E-04
47	63.67	1	1.5	3	16.94	2750	1.812E-05	1.723E-04
48	63.67	1	1.5	3	16.94	2750	1.913E-05	1.914E-04
49	63.67	1	1.5	3	16.94	2750	2.014E-05	2.116E-04
50	63.67	1	1.5	3	16.94	2750	2.113E-05	2.327E-04
51	63.67	1	1.5	3	16.94	2750	2.209E-05	2.548E-04
52	63.67	1	1.5	3	16.94	2750	2.302E-05	2.778E-04
53	63.67	1	1.5	3	16.94	2750	2.390E-05	3.017E-04
54	63.67	1	1.5	3	16.94	2750	2.474E-05	3.265E-04
55	63.67	1	1.5	3	16.94	2750	2.552E-05	3.520E-04
56	63.67	1	1.5	3	16.94	2750	2.623E-05	3.782E-04
57	63.67	1	1.5	3	16.94	2750	2.687E-05	4.051E-04
58	63.67	1	1.5	3	16.94	2750	2.744E-05	4.325E-04
59	63.67	1	1.5	3	16.94	2750	2.792E-05	4.604E-04
60	63.67	1	1.5	3	16.94	2750	2.832E-05	4.888E-04
61	63.67	1	1.5	3	16.94	2750	2.863E-05	5.174E-04
62	63.67	1	1.5	3	16.94	2750	2.884E-05	5.462E-04
63	63.67	1	1.5	3	16.94	2750	2.895E-05	5.752E-04
64	63.67	1	1.5	3	16.94	2750	2.897E-05	6.041E-04
65	63.67	1	1.5	3	16.94	2750	2.889E-05	6.330E-04
66	63.67	1	1.5	3	16.94	2750	2.871E-05	6.617E-04
67	63.67	1	1.5	3	16.94	2750	2.843E-05	6.902E-04
68	63.67	1	1.5	3	16.94	2750	2.807E-05	7.182E-04
69	63.67	1	1.5	3	16.94	2750	2.761E-05	7.458E-04
70	63.67	1	1.5	3	16.94	2750	2.708E-05	7.729E-04
71	63.67	1	1.5	3	16.94	2750	2.646E-05	7.994E-04
72	63.67	1	1.5	3	16.94	2750	2.577E-05	8.252E-04
73	63.67	1	1.5	3	16.94	2750	2.501E-05	8.502E-04
74	63.67	1	1.5	3	16.94	2750	2.419E-05	8.744E-04
75	63.67	1	1.5	3	16.94	2750	2.332E-05	8.977E-04

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Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
76	63.67	1	1.5	3	16.94	2750	2.241E-05	9.201E-04
77	63.67	1	1.5	3	16.94	2750	2.146E-05	9.415E-04
78	63.67	1	1.5	3	16.94	2750	2.048E-05	9.620E-04
79	63.67	1	1.5	3	16.94	2750	1.948E-05	9.815E-04
80	63.67	1	1.5	3	16.94	2750	1.846E-05	1.000E-03
81	63.67	1	1.5	3	16.94	2750	1.744E-05	1.017E-03
82	63.67	1	1.5	3	16.94	2750	1.642E-05	1.034E-03
83	63.67	1	1.5	3	16.94	2750	1.541E-05	1.049E-03
84	63.67	1	1.5	3	16.94	2750	1.441E-05	1.064E-03
85	63.67	1	1.5	3	16.94	2750	1.343E-05	1.077E-03
86	63.67	1	1.5	3	16.94	2750	1.248E-05	1.090E-03
87	63.67	1	1.5	3	16.94	2750	1.155E-05	1.101E-03
88	63.67	1	1.5	3	16.94	2750	1.066E-05	1.112E-03
89	63.67	1	1.5	3	16.94	2750	9.799E-06	1.122E-03
90	63.67	1	1.5	3	16.94	2750	8.980E-06	1.131E-03
91	63.67	1	1.5	3	16.94	2750	8.202E-06	1.139E-03
92	63.67	1	1.5	3	16.94	2750	7.466E-06	1.146E-03
93	63.67	1	1.5	3	16.94	2750	6.773E-06	1.153E-03
94	63.67	1	1.5	3	16.94	2750	6.123E-06	1.159E-03
95	63.67	1	1.5	3	16.94	2750	5.517E-06	1.165E-03
96	63.67	1	1.5	3	16.94	2750	4.955E-06	1.170E-03
97	63.67	1	1.5	3	16.94	2750	4.434E-06	1.174E-03
98	63.67	1	1.5	3	16.94	2750	3.955E-06	1.178E-03
99	63.67	1	1.5	3	16.94	2750	3.516E-06	1.181E-03
100	63.67	1	1.5	3	16.94	2750	3.115E-06	1.185E-03
101	63.67	1	1.5	3	16.94	2750	2.751E-06	1.187E-03
102	63.67	1	1.5	3	16.94	2750	2.421E-06	1.190E-03
103	63.67	1	1.5	3	16.94	2750	2.123E-06	1.192E-03
104	63.67	1	1.5	3	16.94	2750	1.856E-06	1.194E-03
105	63.67	1	1.5	3	16.94	2750	1.616E-06	1.195E-03
106	63.67	1	1.5	3	16.94	2750	1.403E-06	1.197E-03
107	63.67	1	1.5	3	16.94	2750	1.214E-06	1.198E-03
108	63.67	1	1.5	3	16.94	2750	1.047E-06	1.199E-03
109	63.67	1	1.5	3	16.94	2750	8.999E-07	1.200E-03
110	63.67	1	1.5	3	16.94	2750	7.708E-07	1.201E-03
111	63.67	1	1.5	3	16.94	2750	6.580E-07	1.201E-03
112	63.67	1	1.5	3	16.94	2750	5.598E-07	1.202E-03
113	63.67	1	1.5	3	16.94	2750	4.747E-07	1.202E-03
114	63.67	1	1.5	3	16.94	2750	4.011E-07	1.203E-03
115	63.67	1	1.5	3	16.94	2750	3.378E-07	1.203E-03

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M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_1	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
116	63.67	1	1.5	3	16.94	2750	2.835E-07	1.203E-03
117	63.67	1	1.5	3	16.94	2750	2.372E-07	1.204E-03
118	63.67	1	1.5	3	16.94	2750	1.977E-07	1.204E-03
119	63.67	1	1.5	3	16.94	2750	1.643E-07	1.204E-03
120	63.67	1	1.5	3	16.94	2750	1.360E-07	1.204E-03
121	63.67	1	1.5	3	16.94	2750	1.123E-07	1.204E-03
122	63.67	1	1.5	3	16.94	2750	9.234E-08	1.204E-03
123	63.67	1	1.5	3	16.94	2750	7.569E-08	1.204E-03
124	63.67	1	1.5	3	16.94	2750	6.184E-08	1.204E-03

Project: Nine Mile Point Nuclear Station Unit: _2__ Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Table B-6. Calculation of Integrated χ/Q (Case 6)

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	χ/Q(x,u,k,t)	Integrated χ/Q(x,u,k,t)
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
0	63.67	1	1.5	3	16.94	1650	1.878E-08	0.000E+00
1	63.67	1	1.5	3	16.94	1650	2.324E-08	2.324E-08
2	63.67	1	1.5	3	16.94	1650	2.868E-08	5.192E-08
3	63.67	1	1.5	3	16.94	1650	3.526E-08	8.719E-08
4	63.67	1	1.5	3	16.94	1650	4.321E-08	1.304E-07
5	63.67	1	1.5	3	16.94	1650	5.278E-08	1.832E-07
6	63.67	1	1.5	3	16.94	1650	6.424E-08	2.474E-07
7	63.67	1	1.5	3	16.94	1650	7.794E-08	3.254E-07
8	63.67	1	1.5	3	16.94	1650	9.423E-08	4.196E-07
9	63.67	1	1.5	3	16.94	1650	1.135E-07	5.331E-07
10	63.67	1	1.5	3	16.94	1650	1.363E-07	6.695E-07
11	63.67	1	1.5	3	16.94	1650	1.632E-07	8.326E-07
12	63.67	1	1.5	3	16.94	1650	1.946E-07	1.027E-06
13	63.67	1	1.5	3	16.94	1650	2.314E-07	1.259E-06
14	63.67	1	1.5	3	16.94	1650	2.741E-07	1.533E-06
15	63.67	1	1.5	3	16.94	1650	3.237E-07	1.856E-06
16	63.67	1	1.5	3	16.94	1650	3.809E-07	2.237E-06
17	63.67	1	1.5	3	16.94	1650	4.467E-07	2.684E-06
18	63.67	1	1.5	3	16.94	1650	5.221E-07	3.206E-06
19	63.67	1	1.5	3	16.94	1650	6.082E-07	3.814E-06
20	63.67	1	1.5	3	16.94	1650	7.061E-07	4.521E-06
21	63.67	1	1.5	3	16.94	1650	8.170E-07	5.338E-06
22	63.67	1	1.5	3	16.94	1650	9.422E-07	6.280E-06
23	63.67	1	1.5	3	16.94	1650	1.083E-06	7.363E-06
24	63.67	1	1.5	3	16.94	1650	1.240E-06	8.603E-06
25	63.67	1	1.5	3	16.94	1650	1.416E-06	1.002E-05
26	63.67	1	1.5	3	16.94	1650	1.611E-06	1.163E-05
27	63.67	1	1.5	3	16.94	1650	1.826E-06	1.346E-05
28	63.67	1	1.5	3	16.94	1650	2.064E-06	1.552E-05
29	63.67	1	1.5	3	16.94	1650	2.324E-06	1.784E-05
30	63.67	1	1.5	3	16.94	1650	2.609E-06	2.045E-05
31	63.67	1	1.5	3	16.94	1650	2.918E-06	2.337E-05
32	63.67	1	1.5	3	16.94	1650	3.253E-06	2.662E-05
33	63.67	1	1.5	3	16.94	1650	3.614E-06	3.024E-05
34	63.67	1	1.5	3	16.94	1650	4.002E-06	3.424E-05

Project: Nine Mile Point Nuclear Station Unit: _2__ Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
35	63.67	1	1.5	3	16.94	1650	4.417E-06	3.866E-05
36	63.67	1	1.5	3	16.94	1650	4.858E-06	4.351E-05
37	63.67	1	1.5	3	16.94	1650	5.325E-06	4.884E-05
38	63.67	1	1.5	3	16.94	1650	5.817E-06	5.466E-05
39	63.67	1	1.5	3	16.94	1650	6.334E-06	6.099E-05
40	63.67	1	1.5	3	16.94	1650	6.873E-06	6.786E-05
41	63.67	1	1.5	3	16.94	1650	7.433E-06	7.530E-05
42	63.67	1	1.5	3	16.94	1650	8.011E-06	8.331E-05
43	63.67	1	1.5	3	16.94	1650	8.605E-06	9.191E-05
44	63.67	1	1.5	3	16.94	1650	9.212E-06	1.011E-04
45	63.67	1	1.5	3	16.94	1650	9.828E-06	1.110E-04
46	63.67	1	1.5	3	16.94	2750	1.742E-05	1.284E-04
47	63.67	1	1.5	3	16.94	2750	1.846E-05	1.468E-04
48	63.67	1	1.5	3	16.94	2750	1.949E-05	1.663E-04
49	63.67	1	1.5	3	16.94	2750	2.052E-05	1.868E-04
50	63.67	1	1.5	3	16.94	2750	2.153E-05	2.084E-04
51	63.67	1	1.5	3	16.94	2750	2.251E-05	2.309E-04
52	63.67	1	1.5	3	16.94	2750	2.345E-05	2.543E-04
53	63.67	1	1.5	3	16.94	2750	2.435E-05	2.787E-04
54	63.67	1	1.5	3	16.94	2750	2.520E-05	3.039E-04
55	63.67	1	1.5	3	16.94	2750	2.600E-05	3.299E-04
56	63.67	1	1.5	3	16.94	2750	2.673E-05	3.566E-04
57	63.67	1	1.5	3	16.94	2750	2.738E-05	3.840E-04
58	63.67	1	1.5	3	16.94	2750	2.796E-05	4.120E-04
59	63.67	1	1.5	3	16.94	2750	2.845E-05	4.404E-04
60	63.67	1	1.5	3	16.94	2750	2.885E-05	4.693E-04
61	63.67	1	1.5	3	16.94	2750	2.917E-05	4.984E-04
62	63.67	1	1.5	3	16.94	2750	2.938E-05	5.278E-04
63	63.67	1	1.5	3	16.94	2750	2.950E-05	5.573E-04
64	63.67	1	1.5	3	16.94	2750	2.951E-05	5.868E-04
65	63.67	1	1.5	3	16.94	2750	2.943E-05	6.162E-04
66	63.67	1	1.5	3	16.94	2750	2.925E-05	6.455E-04
67	63.67	1	1.5	3	16.94	2750	2.897E-05	6.745E-04
68	63.67	1	1.5	3	16.94	2750	2.860E-05	7.031E-04
69	63.67	1	1.5	3	16.94	2750	2.814E-05	7.312E-04
70	63.67	1	1.5	3	16.94	2750	2.759E-05	7.588E-04
71	63.67	1	1.5	3	16.94	2750	2.696E-05	7.857E-04
72	63.67	1	1.5	3	16.94	2750	2.625E-05	8.120E-04
73	63.67	1	1.5	3	16.94	2750	2.548E-05	8.375E-04
74	63.67	1	1.5	3	16.94	2750	2.465E-05	8.621E-04

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Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
75	63.67	1	1.5	3	16.94	2750	2.376E-05	8.859E-04
76	63.67	1	1.5	3	16.94	2750	2.283E-05	9.087E-04
77	63.67	1	1.5	3	16.94	2750	2.186E-05	9.306E-04
78	63.67	1	1.5	3	16.94	2750	2.087E-05	9.514E-04
79	63.67	1	1.5	3	16.94	2750	1.985E-05	9.713E-04
80	63.67	1	1.5	3	16.94	2750	1.881E-05	9.901E-04
81	63.67	1	1.5	3	16.94	2750	1.777E-05	1.008E-03
82	63.67	1	1.5	3	16.94	2750	1.673E-05	1.025E-03
83	63.67	1	1.5	3	16.94	2750	1.570E-05	1.040E-03
84	63.67	1	1.5	3	16.94	2750	1.468E-05	1.055E-03
85	63.67	1	1.5	3	16.94	2750	1.369E-05	1.069E-03
86	63.67	1	1.5	3	16.94	2750	1.271E-05	1.081E-03
87	63.67	1	1.5	3	16.94	2750	1.177E-05	1.093E-03
88	63.67	1	1.5	3	16.94	2750	1.086E-05	1.104E-03
89	63.67	1	1.5	3	16.94	2750	9.984E-06	1.114E-03
90	63.67	1	1.5	3	16.94	2750	9.149E-06	1.123E-03
91	63.67	1	1.5	3	16.94	2750	8.356E-06	1.132E-03
92	63.67	1	1.5	3	16.94	2750	7.606E-06	1.139E-03
93	63.67	1	1.5	3	16.94	2750	6.900E-06	1.146E-03
94	63.67	1	1.5	3	16.94	2750	6.239E-06	1.152E-03
95	63.67	1	1.5	3	16.94	2750	5.621E-06	1.158E-03
96	63.67	1	1.5	3	16.94	2750	5.048E-06	1.163E-03
97	63.67	1	1.5	3	16.94	2750	4.518E-06	1.167E-03
98	63.67	1	1.5	3	16.94	2750	4.030E-06	1.171E-03
99	63.67	1	1.5	3	16.94	2750	3.583E-06	1.175E-03
100	63.67	1	1.5	3	16.94	2750	3.174E-06	1.178E-03
101	63.67	1	1.5	3	16.94	2750	2.803E-06	1.181E-03
102	63.67	1	1.5	3	16.94	2750	2.466E-06	1.183E-03
103	63.67	1	1.5	3	16.94	2750	2.163E-06	1.186E-03
104	63.67	1	1.5	3	16.94	2750	1.891E-06	1.188E-03
105	63.67	1	1.5	3	16.94	2750	1.647E-06	1.189E-03
106	63.67	1	1.5	3	16.94	2750	1.430E-06	1.191E-03
107	63.67	1	1.5	3	16.94	2750	1.237E-06	1.192E-03
108	63.67	1	1.5	3	16.94	2750	1.067E-06	1.193E-03
109	63.67	1	1.5	3	16.94	2750	9.169E-07	1.194E-03
110	63.67	1	1.5	3	16.94	2750	7.854E-07	1.195E-03
111	63.67	1	1.5	3	16.94	2750	6.704E-07	1.195E-03
112	63.67	1	1.5	3	16.94	2750	5.704E-07	1.196E-03
113	63.67	1	1.5	3	16.94	2750	4.836E-07	1.196E-03
114	63.67	1	1.5	3	16.94	2750	4.087E-07	1.197E-03

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Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_t	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
115	63.67	1	1.5	3	16.94	2750	3.442E-07	1.197E-03
116	63.67	1	1.5	3	16.94	2750	2.889E-07	1.197E-03
117	63.67	1	1.5	3	16.94	2750	2.416E-07	1.198E-03
118	63.67	1	1.5	3	16.94	2750	2.015E-07	1.198E-03
119	63.67	1	1.5	3	16.94	2750	1.674E-07	1.198E-03
120	63.67	1	1.5	3	16.94	2750	1.386E-07	1.198E-03
121	63.67	1	1.5	3	16.94	2750	1.144E-07	1.198E-03
122	63.67	1	1.5	3	16.94	2750	9.408E-08	1.198E-03
123	63.67	1	1.5	3	16.94	2750	7.712E-08	1.198E-03
124	63.67	1	1.5	3	16.94	2750	6.300E-08	1.198E-03

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Table B-7. Calculation of Integrated χ/Q (Case 7)

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	χ/Q(x,u,k,t)	Integrated χ/Q(x,u,k,t)
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
0	63.67	1	1.5	3	16.94	1650	1.951E-08	0.000E+00
1	63.67	1	1.5	3	16.94	1650	2.416E-08	2.416E-08
2	63.67	1	1.5	3	16.94	1650	2.980E-08	5.396E-08
3	63.67	1	1.5	3	16.94	1650	3.665E-08	9.061E-08
4	63.67	1	1.5	3	16.94	1650	4.491E-08	1.355E-07
5	63.67	1	1.5	3	16.94	1650	5.485E-08	1.904E-07
6	63.67	1	1.5	3	16.94	1650	6.676E-08	2.571E-07
7	63.67	1	1.5	3	16.94	1650	8.099E-08	3.381E-07
8	63.67	1	1.5	3	16.94	1650	9.792E-08	4.360E-07
9	63.67	1	1.5	3	16.94	1650	1.180E-07	5.540E-07
10	63.67	1	1.5	3	16.94	1650	1.417E-07	6.957E-07
11	63.67	1	1.5	3	16.94	1650	1.696E-07	8.653E-07
12	63.67	1	1.5	3	16.94	1650	2.023E-07	1.068E-06
13	63.67	1	1.5	3	16.94	1650	2.404E-07	1.308E-06
14	63.67	1	1.5	3	16.94	1650	2.849E-07	1.593E-06
15	63.67	1	1.5	3	16.94	1650	3.364E-07	1.929E-06
16	63.67	1	1.5	3	16.94	1650	3.958E-07	2.325E-06
17	63.67	1	1.5	3	16.94	1650	4.642E-07	2.789E-06
18	63.67	1	1.5	3	16.94	1650	5.426E-07	3.332E-06
19	63.67	1	1.5	3	16.94	1650	6.321E-07	3.964E-06
20	63.67	1	1.5	3	16.94	1650	7.338E-07	4.698E-06
21	63.67	1	1.5	3	16.94	1650	8.491E-07	5.547E-06
22	63.67	1	1.5	3	16.94	1650	9.791E-07	6.526E-06
23	63.67	1	1.5	3	16.94	1650	1.125E-06	7.651E-06
24	63.67	1	1.5	3	16.94	1650	1.289E-06	8.940E-06
25	63.67	1	1.5	3	16.94	1650	1.471E-06	1.041E-05
26	63.67	1	1.5	3	16.94	1650	1.674E-06	1.209E-05
27	63.67	1	1.5	3	16.94	1650	1.898E-06	1.398E-05
28	63.67	1	1.5	3	16.94	1650	2.145E-06	1.613E-05
29	63.67	1	1.5	3	16.94	1650	2.415E-06	1.854E-05
30	63.67	1	1.5	3	16.94	1650	2.711E-06	2.125E-05
31	63.67	1	1.5	3	16.94	1650	3.032E-06	2.429E-05
32	63.67	1	1.5	3	16.94	1650	3.381E-06	2.767E-05
33	63.67	1	1.5	3	16.94	1650	3.756E-06	3.142E-05
34	63.67	1	1.5	3	16.94	1650	4.159E-06	3.558E-05
35	63.67	1	1.5	3	16.94	1650	4.590E-06	4.017E-05

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M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_l	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
36	63.67	1	1.5	3	16.94	1650	5.048E-06	4.522E-05
37	63.67	1	1.5	3	16.94	1650	5.534E-06	5.075E-05
38	63.67	1	1.5	3	16.94	1650	6.046E-06	5.680E-05
39	63.67	1	1.5	3	16.94	1650	6.582E-06	6.338E-05
40	63.67	1	1.5	3	16.94	1650	7.142E-06	7.052E-05
41	63.67	1	1.5	3	16.94	1650	7.724E-06	7.825E-05
42	63.67	1	1.5	3	16.94	1650	8.325E-06	8.657E-05
43	63.67	1	1.5	3	16.94	1650	8.942E-06	9.552E-05
44	63.67	1	1.5	3	16.94	1650	9.573E-06	1.051E-04
45	63.67	1	1.5	3	16.94	1650	1.021E-05	1.153E-04
46	63.67	1	1.5	3	16.94	1650	1.086E-05	1.262E-04
47	63.67	1	1.5	3	16.94	1650	1.151E-05	1.377E-04
48	63.67	1	1.5	3	16.94	1650	1.216E-05	1.498E-04
49	63.67	1	1.5	3	16.94	1650	1.280E-05	1.626E-04
50	63.67	1	1.5	3	16.94	1650	1.342E-05	1.760E-04
51	63.67	1	1.5	3	16.94	1650	1.403E-05	1.901E-04
52	63.67	1	1.5	3	16.94	1650	1.462E-05	2.047E-04
53	63.67	1	1.5	3	16.94	1650	1.519E-05	2.199E-04
54	63.67	1	1.5	3	16.94	1650	1.572E-05	2.356E-04
55	63.67	1	1.5	3	16.94	1650	1.621E-05	2.518E-04
56	63.67	1	1.5	3	16.94	2750	2.777E-05	2.796E-04
57	63.67	1	1.5	3	16.94	2750	2.846E-05	3.080E-04
58	63.67	1	1.5	3	16.94	2750	2.905E-05	3.371E-04
59	63.67	1	1.5	3	16.94	2750	2.957E-05	3.667E-04
60	63.67	1	1.5	3	16.94	2750	2.999E-05	3.967E-04
61	63.67	1	1.5	3	16.94	2750	3.031E-05	4.270E-04
62	63.67	1	1.5	3	16.94	2750	3.053E-05	4.575E-04
63	63.67	1	1.5	3	16.94	2750	3.065E-05	4.881E-04
64	63.67	1	1.5	3	16.94	2750	3.067E-05	5.188E-04
65	63.67	1	1.5	3	16.94	2750	3.058E-05	5.494E-04
66	63.67	1	1.5	3	16.94	2750	3.040E-05	5.798E-04
67	63.67	1	1.5	3	16.94	2750	3.011E-05	6.099E-04
68	63.67	1	1.5	3	16.94	2750	2.972E-05	6.396E-04
69	63.67	1	1.5	3	16.94	2750	2.924E-05	6.689E-04
70	63.67	1	1.5	3	16.94	2750	2.867E-05	6.975E-04
71	63.67	1	1.5	3	16.94	2750	2.801E-05	7.255E-04
72	63.67	1	1.5	3	16.94	2750	2.728E-05	7.528E-04
73	63.67	1	1.5	3	16.94	2750	2.648E-05	7.793E-04
74	63.67	1	1.5	3	16.94	2750	2.562E-05	8.049E-04
75	63.67	1	1.5	3	16.94	2750	2.470E-05	8.296E-04

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M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_1	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m³]	[s/m³]
76	63.67	1	1.5	3	16.94	2750	2.373E-05	8.533E-04
77	63.67	1	1.5	3	16.94	2750	2.272E-05	8.761E-04
78	63.67	1	1.5	3	16.94	2750	2.168E-05	8.978E-04
79	63.67	1	1.5	3	16.94	2750	2.062E-05	9.184E-04
80	63.67	1	1.5	3	16.94	2750	1.955E-05	9.379E-04
81	63.67	1	1.5	3	16.94	2750	1.847E-05	9.564E-04
82	63.67	1	1.5	3	16.94	2750	1.739E-05	9.738E-04
83	63.67	1	1.5	3	16.94	2750	1.632E-05	9.901E-04
84	63.67	1	1.5	3	16.94	2750	1.526E-05	1.005E-03
85	63.67	1	1.5	3	16.94	2750	1.422E-05	1.020E-03
86	63.67	1	1.5	3	16.94	2750	1.321E-05	1.033E-03
87	63.67	1	1.5	3	16.94	2750	1.223E-05	1.045E-03
88	63.67	1	1.5	3	16.94	2750	1.128E-05	1.056E-03
89	63.67	1	1.5	3	16.94	2750	1.038E-05	1.067E-03
90	63.67	1	1.5	3	16.94	2750	9.508E-06	1.076E-03
91	63.67	1	1.5	3	16.94	2750	8.684E-06	1.085E-03
92	63.67	1	1.5	3	16.94	2750	7.905E-06	1.093E-03
93	63.67	1	1.5	3	16.94	2750	7.171E-06	1.100E-03
94	63.67	1	1.5	3	16.94	2750	6.483E-06	1.106E-03
95	63.67	1	1.5	3	16.94	2750	5.842E-06	1.112E-03
96	63.67	1	1.5	3	16.94	2750	5.246E-06	1.118E-03
97	63.67	1	1.5	3	16.94	2750	4.695E-06	1.122E-03
98	63.67	1	1.5	3	16.94	2750	4.188E-06	1.126E-03
99	63.67	1	1.5	3	16.94	2750	3.723E-06	1.130E-03
100	63.67	1	1.5	3	16.94	2750	3.299E-06	1.133E-03
101	63.67	1	1.5	3	16.94	2750	2.913E-06	1.136E-03
102	63.67	1	1.5	3	16.94	2750	2.563E-06	1.139E-03
103	63.67	1	1.5	3	16.94	2750	2.248E-06	1.141E-03
104	63.67	1	1.5	3	16.94	2750	1.965E-06	1.143E-03
105	63.67	1	1.5	3	16.94	2750	1.712E-06	1.145E-03
106	63.67	1	1.5	3	16.94	2750	1.486E-06	1.146E-03
107	63.67	1	1.5	3	16.94	2750	1.286E-06	1.148E-03
108	63.67	1	1.5	3	16.94	2750	1.109E-06	1.149E-03
109	63.67	1	1.5	3	16.94	2750	9.529E-07	1.150E-03
110	63.67	1	1.5	3	16.94	2750	8.162E-07	1.150E-03
111	63.67	1	1.5	3	16.94	2750	6.967E-07	1.151E-03
112	63.67	1	1.5	3	16.94	2750	5.927E-07	1.152E-03
113	63.67	1	1.5	3	16.94	2750	5.026E-07	1.152E-03
114	63.67	1	1.5	3	16.94	2750	4.247E-07	1.153E-03
115	63.67	1	1.5	3	16.94	2750	3.577E-07	1.153E-03

Project: Nine Mile Point Nuclear Station Unit: 2 Disposition: ____

Originator/Date	Checker/Date	Calculation No.	Revision
M. D. Elo	A. G. Klazura	H21C-094	0

Ref.

Time, t	Distance, x	Wind Speed, u	$\sigma_z(x,k)$	$\sigma_{x,y}(x,k)$	σ_I	F(t)	$\chi/Q(x,u,k,t)$	Integrated $\chi/Q(x,u,k,t)$
[s]	[m]	[m/s]	[m]	[m]	[m]	[cfm]	[1/m^3]	[s/m^3]
116	63.67	1	1.5	3	16.94	2750	3.002E-07	1.153E-03
117	63.67	1	1.5	3	16.94	2750	2.511E-07	1.154E-03
118	63.67	1	1.5	3	16.94	2750	2.094E-07	1.154E-03
119	63.67	1	1.5	3	16.94	2750	1.739E-07	1.154E-03
120	63.67	1	1.5	3	16.94	2750	1.440E-07	1.154E-03
121	63.67	1	1.5	3	16.94	2750	1.189E-07	1.154E-03
122	63.67	1	1.5	3	16.94	2750	9.777E-08	1.154E-03
123	63.67	1	1.5	3	16.94	2750	8.015E-08	1.154E-03
124	63.67	1	1.5	3	16.94	2750	6.547E-08	1.154E-03

- FINAL -

ATTACHMENT 1: DESIGN VERIFICATION REPORT

Document being design-verified: ☐ DCP ☒ Calc ☐ Spec ☐ NER ☐ DBD ☐ Other

Doc#, Rev and Title: H21C-094, Rev. 0, "Calculation of Atmospheric Dispersion Parameter for MSLB Release to Unit 2 Control Room

Extent of Design Verification (Briefly describe):
Model derivation, methodology and results were reviewed for applicability, consistency, and reasonability when compared to expected results.

Method of Design Verification:

☒ Design Review ☐ Qualification Testing
☒ Alternate Calculations ☐ Applicability of Proven Design

Results of Design Verification:

☒ Fully acceptable with no issues identified
☐ Fully acceptable based on the following issues identified and resolved:

The X/Q value generated in the calculation incorporates the time dependency of the transport model by integrating over the time that the puff passes a receptor point. It is similar in form to a X/Q that is generated for a constant release rate, but is intended for use with an integrated release (Ci, uCi, etc) not a release rate (Ci/sec, etc.). Therefore when it is used in a calculation (computer model, or simple approximation), it is combined with the total release. So, if a release period (e.g., 5 sec) is used, the release rate multiplied by the release period equals the total release. If it is used in a simple approximation with the total release, the dose integration time period will drop out of the equation.

The X/Q is reasonable compared to a simplified conservative model. $X/Q = 1 / (U \times \pi \times \sigma_y \times \sigma_z)$
Calculated X/Q = 1.204E-03
Simplified model $X/Q = 1 / (U \times \pi \times \sigma_y \times \sigma_z) = 1 / (1 \times \pi \times 16.94 \times 16.94) = 1.11E-03$

☐ Continuation Page Follows

Discipline Involvement and Approvals:

	Name	Signature	Date
Lead Design Verifier:	John Rich	John Rich	3/15/04

Discipline Design Verifiers, if required:

Discipline	Name	Signature	Date

ATTACHMENT 2: DESIGN VERIFICATION CHECKLIST

The following questions are required to be addressed based on the Nine Mile Point commitment to NQA-1 (1983) for design verification activities. This checklist is intended to assist when using the Design Review method of design verification to ensure relevant items are addressed in the verification effort. Each "No" answer will require correction or resolution by the originator of the document being verified prior to full acceptance by the design verifier(s).

Doc #: H21C-094

Lead Design Verifiers Name: John Rich [signature]

Items Addressed with Basis of Review Answer	Review Check		
	Yes	No	N/A
1. Were the inputs correctly selected ?	X		
2. Are assumptions necessary to perform the design activity adequately described and reasonable ? Where necessary, are the assumptions identified for subsequent re-verifications when the detailed activities are completed ?	X		
3. Was an appropriate design method used?	X		
4. Were the design inputs correctly incorporated into the design ?	X		
5. Is the design output reasonable compared to design inputs ?	X		
6. Are the necessary design input and verification requirements for interfacing organizations specified in the design documents or in supporting procedures or instructions ?			X