BSC

Calculation/Analysis Change Notice

Complete only applicable items.

1. QA: QA
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3. Document Identifier: 000-PSA-MGR0-00600-000	4. Rev.: 00B	5. CACN: 001

6. Title:
GROA Airborne Release Dispersion Factor Calculations

7. Reason for Change:
This calculation determines the atmospheric dispersion factors from releases from the surface and subsurface facilities in the geologic repository operations area (GROA). This CACN is needed because the revised calculation *Subsurface Ventilation Network Model for LA* (800-KVC-VUE0-00200-000-00B, a new revision to Reference 2.2.8) provides updated subsurface exhaust shaft flow rates. In addition calculation *Ventilation Network Model Parameters for LA* (800-KVC-VUE0-00100-000-00A, Reference 2.2.6) has been superseded by calculation (800-KVC-VUE0-00200-000-00B).

8. Supersedes Change Notice: ☐ Yes If, Yes, CACN No.: ________ ☒ No

9. Change Impact:

Inputs Changed:	☒ Yes	☐ No	Results Impacted:	☐ Yes	☒ No
Assumptions Changed:	☐ Yes	☒ No	Design Impacted:	☐ Yes	☒ No

10. Description of Change:

There is no change to the calculation method, results, or conclusions of this calculation by this CACN due to the revised calculation *Subsurface Ventilation Network Model for LA* (800-KVC-VUE0-00200-000-00B, a new revision to Reference 2.2.8). The revised flow rates do not impact the results nor impact other disciplines or organizations.

The detailed description of the impacts to the atmospheric dispersion factors due to the increase in subsurface ventilation flow is provided in the pages following the CACN cover sheet, and will not be incorporated verbatim into the calculation. BR 2/21/08

11. REVIEWS AND APPROVAL

Printed Name	Signature	Date
11a. Originator: J. Schulz	Jorge Schulz	2/21/2008
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Subsurface Facility Exhaust Ventilation Parameters (Table 5)

As discussed in Section 6.1.3, the ventilation parameters are obtained from references 2.2.6 and 2.2.8. Reference 2.2.6 has been superseded by revision B to reference 2.2.8.

The exhaust shaft cross-sectional areas that were obtained from reference 2.2.6 are available in sections 6.2.7 and 6.2.8 of revision B to reference 2.2.8. The values have not changed.

The exhaust flow rates have increased as shown in the following table.

Table 1. Subsurface Facilities Exhaust Ventilation Parameters

Facility	Release Code	Description	Initial Airflow[a] (cfm)	Revised Airflow[b] (cfm)	Difference (%)
ES	ES1	Exhaust Shaft 1 (Formerly Exhaust Raise 1)	347,000	397,000	14.4
	ES2	Exhaust Shaft 2 (Formerly Exhaust Shaft 3)	717,000	807,000	12.6
	ES3N	Exhaust Shaft 3N (Formerly Exhaust Shaft 2)	832,000	944,000	13.5
	ES3S	Exhaust Shaft 3S (Formerly Exhaust Raise 2)	347,000	397,000	14.4
	ES4	Exhaust Shaft 4 (Formerly Exhaust Shaft 1)	842,000	959,000	13.9
	ECRB	ECRB Exhaust Shaft	817,000	932,000	14.1

Sources: [a] 800-KVC-VUE0-00200-000-00A Reference 2.2.8, Table 2
[b] 800-KVC-VUE0-00200-000-00B, revision B to Reference 2.2.8, Table 19

Impact on Atmospheric Dispersion Factors

As discussed in Assumption 3.2.1, all releases except from the aging pads are modeled as vent releases. The point source atmospheric dispersion factor (χ/Q) can be corrected for exhaust vent flow using Equation 18 of NUREG/CR-6331 (Reference 2.2.24):

$$(\chi / Q')^* = \frac{1}{\frac{1}{\chi / Q'} + F} \quad \text{Equation 1}$$

Where χ/Q' is the uncorrected point source atmospheric dispersion factor (s/m^3), $(\chi/Q')^*$ is the corrected atmospheric dispersion factor, and F is the exhaust flow (m^3/s).

As shown in Equation 1, the atmospheric dispersion factor is inversely proportional to the exhaust flow; therefore, any increase in the flow rate would correspondingly decrease the atmospheric dispersion factor. Thus, the subsurface exhaust shaft χ/Qs determined in this calculation and presented in Tables 26 through 31 are conservative and appropriate for use in dose consequence calculations. The magnitude of the conservatism is discussed as follows.

Equation 1 is solved to determine the uncorrected atmospheric dispersion factor as a function of the corrected atmospheric dispersion factor and the exhaust flow:

$$\frac{1}{\chi / Q'} = \frac{1}{(\chi / Q')^*} - F \quad \text{Equation 2}$$

Consider an increased exhaust flow of $F' = F + \Delta F$, then the corrected atmospheric dispersion factor using Equation 1 is:

$$(\chi / Q')^{**} = \frac{1}{\frac{1}{\chi / Q'} + F'} \qquad \text{Equation 3}$$

Using Equation 2 in Equation 3 and the definition of F' results in:

$$(\chi / Q')^{**} = \frac{1}{\frac{1}{(\chi / Q')^{*}} - F + (F + \Delta F)} \qquad \text{Equation 4}$$

or:

$$(\chi / Q')^{**} = \frac{1}{\frac{1}{(\chi / Q')^{*}} + \Delta F} \qquad \text{Equation 5}$$

As shown in Equation 5, the $(\chi/Q')^{**}$ is inversely proportional to the flow increase ΔF. Therefore, the largest ΔF will have the most impact on the resulting $(\chi/Q')^{**}$. A review of the flow rates presented in Table 1 indicates that the largest ΔF is 117,000 cfm (55.22 m^3/s) for exhaust shaft 4. The smaller the $(\chi/Q')^{*}$, the less influence the ΔF will have on the resulting $(\chi/Q')^{**}$; therefore to estimate the magnitude of the change in $(\chi/Q')^{**}$, the largest $(\chi/Q')^{*}$ is selected. Table 30 of the calculation indicates that the largest $(\chi/Q')^{*}$ for exhaust shaft 4 is to the intake shaft 4. The 95th percentile $(\chi/Q')^{*}$ value is 7.16×10^{-5} s/m^3. Entering these values into Equation 5 results in:

$$(\chi / Q')^{**} = \frac{1}{\frac{1}{7.16\times10^{-5}} + 55.22} = 7.13\times10^{-5}\ s/m^3$$

The difference in the $(\chi/Q')^{**}$ is -0.4%. Since the combination of a release from exhaust shaft 4 to the intake shaft 4 is the one where the influence of the ΔF is the largest, all other combinations will have decreases less than 0.4%. Therefore, the calculated $(\chi/Q')^{*}$ presented in Tables 26 through 31 of the calculation do not appreciably change due to the increase in exhaust flow, and because the change results in a slight decrease of the $(\chi/Q')^{**}$ values, the results are conservative and appropriate for use in dose consequence calculations.