BSC

Calculation/Analysis Change Notice

Complete only applicable items.

1. QA: QA
2. Page 1 of 6

3. Document Identifier:	4. Rev.:	5. CACN:
000-00C-MGR0-02800-000	00B	001

6. Title:
General Public Atmospheric Dispersion Factors

7. Reason for Change:
This calculation determines the atmospheric dispersion factors for acute (short-term) and chronic (long-term) exposures due to a radioactive material ground-level point release. DTN MO0610METMND05.000 (Reference 2.2.29), providing meteorological monitoring data for 2005, has been superseded by DTN MO0708METMND05.001, and DTN SN0612GEOCOORD.001 (Reference 2.2.33), providing coordinates of meteorological sites, has been superseded by DTN MO0708ABS14MSP.000. This CACN updates the calculation to address these new DTNs.

DTN MO0708METMND05.001 corrects an error in the site 8 precipitation data for day 153. This calculation uses data from site 1 only; therefore, this correction does not affect the calculated results.

DTN MO0708ABS14MSP.000 provides qualified surveyed coordinates for the meteorological stations. This calculation uses the latitude of site 1 to determine the coriolis force. The value used in the calculation is rounded to the nearest second of latitude from that given in DTN MO0708ABS14MSP.000, which is the same value as the value given in the superseded DTN SN0612GEOCOORD.001.

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, and conclusions of this calculation by this CACN due to the new DTNs.

References 2.2.29, 2.2.32 and 2.2.33 are updated. Discussions in Section 6.1.1 and 6.1.2 are revised to refer to the updated references, and a minor typo is corrected in Section 6.1.7.

Affected calculation pages: 12, 13, 45, 46, and 47.

The detailed changes to the calculation are presented in the following affected pages.

11. REVIEWS AND APPROVAL

Printed Name	Signature	Date
11a. Originator: J. Schulz	Jorge Schulz	3/3/2008
11b. Checker: D. T. Dexheimer	H. T. Dexheimer	3/3/08
11c. EGS: S. S. Tsai	Sen-Sung Tsai	3/3/2008
11d. DEM: M. R. Wisenburg	M. R. Wisenburg	3/3/2008
11e. Design Authority: B. Rusinko	B. Rusinko	3/3/08

2.2.18 Ramsdell, J.V., Jr. and Simonen, C.A. 1997. *Atmospheric Relative Concentrations in Building Wakes.* NUREG/CR-6331, Rev. 1. Washington, D.C.: U.S. Nuclear Regulatory Commission. TIC: 233690. [DIRS 164547]

2.2.19 Ramsdell, J.V., Jr.; Simonen, C.A.; Burk, K.W.; and Stage, S.A. 1996. "Atmospheric Dispersion and Deposition of {superscript 131}I Released from the Hanford Site." *Health Physics, 71,* (4), 568-577. [Baltimore, Maryland: Lippincott Williams & Wilkins]. TIC: 258631. [DIRS 177811]

2.2.20 Regulatory Guide 1.23, Rev. 0. 1972. *Onsite Meteorological Programs.* Washington, D.C.: U.S. Atomic Energy Commission. TIC: 2937. [DIRS 103640]

2.2.21 Regulatory Guide 1.111, Rev. 1. 1977. *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.* Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20050516.0410. [DIRS 103765]

2.2.22 Regulatory Guide 1.145, Rev. 1. 1982. *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants.* Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: HQS.19880517.2794. [DIRS 103651]

2.2.23 Regulatory Guide 1.194. 2003. *Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants.* Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: MOL.20060105.0194. [DIRS 165736]

2.2.24 Sagendorf, J.F.; Goll, J.T.; and Sandusky, W.F. 1982. *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations.* NUREG/CR-2919. Washington, D.C.: U.S. Nuclear Regulatory Commission. ACC: HQZ.19870615.6280. [DIRS 175686]

2.2.25 MO0305SEP01MET.002. Meteorological Monitoring Data for 2001. Submittal date: 05/21/2003. [DIRS 166164]

2.2.26 MO0305SEP02MET.002. Meteorological Monitoring Data for 2002. Submittal date: 05/21/2003. [DIRS 166163]

2.2.27 MO0503SEPMMD03.001. Meteorological Monitoring Data for 2003. Submittal date: 03/03/2005. [DIRS 176097]

2.2.28 MO0607SEPMMD04.001. Meteorological Monitoring Data for 2004. Submittal date: 07/18/2006. [DIRS 178311]

2.2.29 MO0708METMND05.001. Meteorological Monitoring Data for 2005. Submittal date: 08/22/2007. [DIRS 182647]

2.2.30 MO9905COV99168.000. Coverage: YMPWITHDWLS. Submittal date: 05/04/1999. [DIRS 176475]

2.2.31 MO9908COV97558.000. Coverage Name: ROAD24KS. Submittal date: 08/11/1999. [DIRS 177334]

2.2.32 BSC (Bechtel SAIC Company) 2008. *IED Surface Facility and Environment.* 100-IED-WHS0-00201-000-00D. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080211.0001.

2.2.33 MO0708ABS14MSP.000. As-Built Survey for 14 Meteorological Sites and Precipitation Stations at Yucca Mountain. Submittal date: 08/23/2007. [DIRS 182767]

2.2.34 SNL (Sandia National Laboratories) 2006. *Data Analysis for Infiltration Modeling: Extracted Weather Station Data Used to Represent Present-Day and Potential Future Climate Conditions in the Vicinity of Yucca Mountain.* ANL-MGR-MD-000015 REV 00. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20070109.0002. [DIRS 177081]

2.2.35 YMP (Yucca Mountain Site Characterization Project) 1997. Main YMP Meteorological Data Tower Traverse for Survey Control Point, Collected September 29 and 30, 1997. [Las Vegas, Nevada: Yucca Mountain Site Characterization Office]. ACC: MOL.19980112.0349. [DIRS 178476]

2.2.36 BSC 2004. *Software Problem Report SPR026820040902, ARCON V.96.* STN: 10912-96-00. Las Vegas, NV: Bechtel SAIC Company. ACC: MOL.20040902.0466. [DIRS 181003]

2.2.37 BSC 2007. *Software Problem Report SPR011020070607, ARCON V.96.* STN: 10912-96-00. Las Vegas, NV: Bechtel SAIC Company. ACC: MOL.20070611.0309. [DIRS 182311]

2.3 DESIGN CONSTRAINTS

There are no design constraints for this calculation.

2.4 DESIGN OUTPUTS

This calculation does not support a specific engineering drawing, specification, or design list. The results of this calculation may be used in other preclosure safety analyses.

6. BODY OF CALCULATION

6.1 DESIGN INPUTS

6.1.1 Meteorological Tower Location

The location of the meteorological tower at Site 1 is selected to represent the area of repository surface facilities. Per Reference 2.2.33, DTN: MO0708ABS14MSP.000, As-Built Survey for 14 Meteorological Sites and Precipitation Stations at Yucca Mountain shows that the tower at Site 1 is located at coordinates 761,796.42 feet North and 569,127.13 feet East in the Nevada State Plane Coordinates. The locations of the meteorological towers given in DTN: MO0708ABS14MSP.000 were qualified within a tolerance of 27 meters in ANL-MGR-MD-000015 REV00 (Reference 2.2.34). This tolerance is acceptable for the intended purposes of this calculation. Reference 2.2.33 also shows that Site 1 is located at latitude 36° 50' 33.82" (rounded to 36° 50' 34") north and longitude 116° 25' 49.53" (rounded to 116° 25' 50") west. This DTN is listed in the information exchange document (IED), 100-IED-WHS0-00201-000-00D (Reference 2.2.32). This information is corroborated by Reference 2.2.35, which shows that this tower is located at coordinates 761,796.168 feet North and 569,127.073 feet East in the Nevada State Plane Coordinates. The latitude of the location is used to determine the coriolis force as described in section 4.9.

Suitability for Use: The Site 1 is located approximately 1-km south-south-west of the North Portal. Releases during normal operations and from event sequences can be from surface facilities processing waste forms and from the subsurface exhaust shafts. For surface facility releases, Site 1 is the closest meteorological site to the surface facilities and therefore most appropriate for use in calculating atmospheric dispersion factors for the surface facilities. For subsurface releases, Site 2 is closer to the subsurface exhaust shafts. However, the meteorological conditions at Site 2 result in consistently higher wind speeds due to a high elevation, 4,850.50 ft at Site 2 vs. 3,751.78 ft at Site 1. As atmospheric dispersion factors are inversely proportional to wind speed, this results in greater atmospheric dispersion using data from Site 2 as compared to Site 1. Greater atmospheric dispersion results in lower dose consequences, therefore, it is conservative to use Site 1 data to evaluate release from the subsurface exhaust shafts. The selected meteorological tower is located in the area of repository surface facilities; it is the best available location to link the meteorological information with the potential radionuclide source releases for the preclosure safety analysis.

The difference in the coordinates between references 2.2.35 and 2.2.33, based on different surveys is less than 1 foot in the east and north direction; therefore, they are in good agreement, and the latitude and longitude given in reference 2.2.33 is suitable for the intended use in section 4.9.

6.1.2 Meteorological Data

Meteorology data set from the Yucca Mountain site is available for the 5-year period of 2001 through 2005. The meteorological data used for χ/Q value, absolute humidity, and average rainfall calculations are based on site-specific measurements made at air quality and meteorology

monitoring Site 1, which is a 60-m tower located approximately 1-km south–southwest of the North Portal. The temperature difference (ΔT) is provided between 10 and 60 m.

The meteorological data included in the relevant DTNs listed below are used as direct inputs to this calculation. These DTNs are listed in the information exchange document (IED), 100-IED-WHS0-00201-000-00D (Reference 2.2.32). The data set consists of hourly measured data collected under quality assurance procedures that are submitted to the Technical Data Management System under the following data tracking numbers (DTNs):

DTN: MO0305SEP01MET.002 (Reference 2.2.25 [DIRS 166164]) Meteorological Monitoring Data for 2001. Submittal date: 05/21/2003.

DTN: MO0305SEP02MET.002 (Reference 2.2.26 [DIRS 166163]) Meteorological Monitoring Data for 2002. Submittal date: 05/21/2003.

DTN: MO0503SEPMMD03.001 (Reference 2.2.27 [DIRS 176097]) Meteorological Monitoring Data for 2003. Submittal date: 03/03/2005.

DTN: MO0607SEPMMD04.001 (Reference 2.2.28 [DIRS 178311]) Meteorological Monitoring Data for 2004. Submittal date: 07/18/2006.

DTN: MO0708METMND05.001 (Reference 2.2.29 [DIRS 182647]) Meteorological Monitoring Data for 2005. Submittal date: 08/22/2007.

The meteorological data was formatted into the ARCON96 format in file *ymp.met* as discussed in section 6.9.1 and into the GENII format in file *ymp01-05.met* as discussed in section 6.10.4.

Rationale: The qualified data cited provides the appropriate meteorological information for the repository. This data is consistent with the regulatory positions of Regulatory Guide 1.23 (Reference 2.2.20 [DIRS 103640]) that is cited in Regulatory Guide 1.145 (Reference 2.2.22 [DIRS 103651]).

6.1.3 Surface Roughness Length

Per Regulatory Guide 1.194 Table A-2 (Reference 2.2.23 [DIRS 165736]), reasonable values for the surface roughness length are 0.1 m for sites with low surface vegetation to 0.5 m for forest-covered sites. Since the Yucca Mountain site is a desert site with low surface vegetation, a value of 0.1 m is used for the surface roughness length.

Suitability for Use: This is appropriate regulatory guidance for this parameter. It is used for meteorological database generation, which is documented in section 6.10.4

6.1.4 Transfer Resistance

Transfer resistances are usually associated with the characteristics of the depositing material and surface type (Reference 2.2.19 [DIRS 177811], p.570). The transfer resistance is used as a mathematical device to establish an upper limit on the deposition velocity. The user can enter transfer resistance, but as a default, 10 and 100 s/m are assumed for gas (iodine) and particles,

respectively (Reference 2.2.17 [DIRS 179908], Section 5.3.5.1). For the purposes of this calculation the transfer resistance for particles (100 s/m) is used for both particles and iodines. This is conservative because the higher transfer resistance results in lower deposition velocities and higher depleted χ/Q values.

Suitability for Use: As the parameter is an empirical value to fit the mathematical model for the dry deposition velocity and this model is provided as an option in GENIIv2, the default parameter values are appropriate to use.

6.1.5 Repository Exhaust Shaft Coordinates

As shown in drawing 800-P00-TUN0-00701-000-00A (Reference 2.2.6 [DIRS 165314]), there are three exhaust shafts and two exhaust raises for the subsurface facilities. Drawing 800-P00-TUN0-00701-000-00A (Reference 2.2.6 [DIRS 165314]) presents the coordinates for each of the exhaust shafts and raises. These coordinates are shown in Table 5.

Table 5 — Subsurface Facilities Exhaust Shaft Coordinates

	East (ft)	North (ft)
Exhaust Shaft 1	559,368	770,604
Exhaust Shaft 2	563,658	775,360
Exhaust Shaft 3	559,937	757,357
Exhaust Raise 1	560,005	767,748
Exhaust Raise 2	563,942	769,618

Rationale: The cited reference provides the coordinates of the exhaust shafts and raises for the subsurface facility.

6.1.6 Nearest Resident

The closest residents to the repository are located in the Amargosa Valley at the intersection of U.S. Highway 95 and Nevada State Route 373 as discussed in the Biosphere Model Report (Reference 2.2.8 [DIRS 169460] Section 6.1.1.3 and Table 1 and Figure 1 of Reference 2.2.7 [DIRS 168723].

Rationale: The cited references provide the location of the nearest resident. This is the best available data.

6.1.7 Initial Handling Facility Building Dimensions

As discussed in assumption 3.2.5, the IHF is used to determine the building wake effect. A review of the preliminary layout drawings 51A-P0K-IH00-10101-000-00B (Reference 2.2.11), 51A-P0K-IH00-10103-000-00B (Reference 2.2.12), and 51A-P0K-IH00-10104-000-00B (Reference 2.2.13), shows that the building cross-sectional area between columns 5 and 10 results in the smallest area. This conservatively excludes the area between columns 1 and 5. Relevant building dimensions obtained from the above drawings are presented in Table 6.