Office of Environment, Health, Safety and Security

Operating Experience Level 3

OE-3: 2015-02 April 2015

Atmospheric Dispersion Parameter (χ/Q) for Calculation of Co-located Worker Dose

PURPOSE

This Operating Experience Level 3 (OE-3) document informs the complex of the issuance of a technical document on the basis for the default atmospheric dispersion parameter (χ/Q) used to determine co-located worker dose in accident analysis calculations. It also provides recommendations for ensuring an appropriate χ/Q is used where the default χ/Q may not result in a conservative estimate of dispersion.

BACKGROUND

Department of Energy (DOE)-Standard (STD)-1189-2008, *Integration of Safety into the Design Process*, requires a default χ/Q value of 3.5×10^{-3} second per cubic meter (s/m^3) to be used for radiological dispersion calculations at the co-located worker distance of 100 meters. These calculations are then used in safety analysis to determine whether safety significant controls should be established to prevent and/or mitigate a release of radioactive material.

DISCUSSION

The DOE Nuclear Safety Research and Development Program, within the Office of Environment, Health, Safety and Security, has performed an evaluation of the technical bases for the default χ/Q value for radiological releases, and the appropriateness of its use when calculating the dispersion of chemical releases. The evaluation is described in Nuclear Safety Research and Development report: NSRD-2015-TD01, *Technical Report for Calculations of Atmospheric Dispersion at Onsite Locations for Department of Energy Nuclear Facilities*.

The evaluation consisted of a review of:
(1) the regulatory and technical bases for the value,
(2) analysis of the parameter's sensitivities to various factors that affect the dispersion of radioactive material, and
(3) additional independent calculations to assess the appropriate use of the default χ/Q value for both radiological and chemical releases.

ANALYSIS

Results of the technical report indicate that the default χ/Q parameter provides a conservative estimate for both radiological and chemical releases in calculating the exposure to co-located workers where dispersion near the nuclear facility is subject to aerodynamic effects from buildings. However, the evaluation also concluded that for situations where the release is from a facility smaller than that assumed in the default parameter (i.e., a 10 meter tall by 36 meter wide building), or if a building is not present, the default χ/Q value may not provide a conservative estimate of dispersion.

RECOMMENDATIONS

Nuclear facilities that are potentially affected by the situation described above should review their atmospheric dispersion assumptions and NSRD-2015-TD01. Attachment C of NSRD-2015-TD01 provides an approach for determining a χ/Q value under this situation.

This is consistent with direction found in DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, which adopted the default χ/Q value for ground level releases but cautions that "this value may not be appropriate for certain unique situations such as operations not conducted within a physical structure." For these situations, the standard requires that "when an alternate value is used, the DSA shall provide a technical basis supporting the need for the alternate value and the value selected."

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This OE-3 document requires no follow-up report or written response.

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