



U.S. NUCLEAR REGULATORY COMMISSION
STANDARD REVIEW PLAN
OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 2.3.5

LONG TERM DIFFUSION ESTIMATES

REVIEW RESPONSIBILITIES

Primary - Site Analysis Branch (SAB)

Secondary - Effluent Treatment Systems Branch (ETSB)

I. AREAS OF REVIEW

Information is presented by the applicant and reviewed by the staff concerning atmospheric diffusion estimates for routine releases of effluents to the atmosphere. The review covers the following specific areas:

1. Atmospheric diffusion models to calculate relative concentrations for routine radioactive gas release modes as determined by Effluent Treatment Systems Branch.
2. Meteorological data summaries used as input to diffusion models.
3. Derivation of diffusion parameters from meteorological data.
4. Relative concentrations used for assessment of consequences of routine airborne radioactive releases.

II. ACCEPTANCE CRITERIA

This section will be acceptable if the applicant has provided realistic estimates of atmospheric diffusion at appropriate distances from the source for routine releases of radioactive materials to the atmosphere. Guidelines for acceptability of models are Regulatory Guides 1.21, 1.42, and 1.44 (Refs. 1, 3, and 5); National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum ERL ARL-42; standard references such as "Meteorology and Atomic Energy - 196;" and Effluent Treatment Systems Branch and Site Analysis Branch positions. Since the staff makes an independent evaluation of atmospheric diffusion estimates based on data from the onsite meteorological measurements program and other nearby meteorological data, it is not necessary for the applicant to duplicate the staff's final estimates. However, the applicants diffusion estimates should reasonably reflect staff positions and state-of-the-art atmospheric diffusion knowledge. Specifically the following information is required:

USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to Revision 2 of the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20545.

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1. The atmospheric diffusion models used by the applicant to calculate concentrations resulting from routine airborne releases of radioactive gases must be documented in detail and substantiated so that the staff can evaluate their appropriateness to site and plant characteristics.
2. Meteorological data summaries to be used as input to the diffusion models must be presented in joint frequency distribution form. These summaries must have been generated from the best available annual periods of data on record and contain data acceptable to the staff which represent appropriate hourly values of wind direction, wind speed, and atmospheric stability for each mode of routine release.
3. The atmospheric diffusion parameters, such as vertical plume spread (σ_z) as a function of distance and wind speed, must be related to measured meteorological parameters and be substantiated as to their validity for use in estimating the consequences of routine releases from the site boundary to a radius of 50 miles from the plant.
4. Relative concentrations (X/Q) used for assessment of consequences of routine radioactive gas releases must be presented as described in Section 2.3.5.2 of the "Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants," Revision 2.

III. REVIEW PROCEDURES

1. Atmospheric Diffusion Models

The applicant's diffusion models are compared to the general Gaussian models which are contained in Regulatory Guide 1.00 (Ref.5) for elevated releases and ground level releases with a wake correction (See also Reference 3). The suitability of the models for mode of release, plant configuration, and site topography are reviewed. Effluent Treatment Systems Branch defines the modes of release to be considered.

A determination is made as to whether the release should be considered as an elevated point source or a ground level point source with a volumetric correction for turbulent mixing in the wake of buildings. Generally the release is considered to be elevated if the release point is at least twice as high as nearby solid structures. Otherwise, a ground level volumetric release formulation is usually based on 1/2 the height of the structure from which the effluent is released.

If a site is located such that the effluent trajectories (or vertical plume spread via diffusion) are restricted by topography (or unusual meteorological conditions), the models are examined for appropriate modification. Some of these conditions are narrow, deep valleys, "fumigation" from elevated sources, and low level subsidence inversions of temperature in the vertical direction.

2. Meteorological Data Summaries

The data summaries in joint frequency distribution form are reviewed for compatibility of data with the models utilized in the section above. General criteria are stated in Regulatory Guide 1.23 and III.2 of Standard Review Plan 2.3.3.

3. Atmospheric Diffusion Parameters

The vertical plume spread parameter, σ_z , as a function of distance and atmospheric stability is reviewed. The current procedure is to relate $\sigma_z(X)$ to vertical temperature difference classes as stated in Table 1 of Regulatory Guide 1.23 (Ref. 2). Departures from this procedure are reviewed for adequate reasons for the departures, such as in the case of unusual sites (e.g., valley or coastal). The curves of σ_z with distance, which appear in "Meteorology and Atomic Energy - 1968" are usually acceptable with the addition of a G stability class.

4. Relative Concentrations Used for Routine Releases

The X/Q values used for assessment of the consequences of routine radioactive releases are reviewed for appropriateness to site conditions and completeness of information.

An independent calculation of annual average X/Q values is made for 16 radial sectors from the site boundary to a distance of 50 miles from the plant using appropriate meteorological data in joint frequency distribution form and the computer program CHI/Q (Ref. 7). Adjustments of the X/Q output may be made through use of other offsite meteorological data when unusual topographic conditions surround the site or when the onsite meteorological data are found to be inadequate.

IV. EVALUATION FINDINGS

The reviewer verifies that adequate atmospheric diffusion models, with adequate onsite meteorological data as input to the models, have been used to calculate relative concentrations at appropriate distances and directions from postulated release points during routine airborne releases of radioactive gases. If adequate onsite meteorological data are not available for the construction permit review, the reviewer must assure that adequate conservatism has been applied to the calculated relative concentrations for routine airborne effluent releases based on available data. The reviewer's evaluation must support the following type of concluding statement, to be included in the staff's safety evaluation report:

"Reasonable estimates of average atmospheric diffusion conditions have been made by the staff from the applicant's meteorological data and appropriate diffusion models."

The input to the safety evaluation report will also include a brief summary of the relative concentrations (X/Q) calculated by the staff, reference to diffusion models used, and a comparison between the values computed by the staff and the applicant.

V. REFERENCES

1. Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1.
2. Regulatory Guide 1.23, "Onsite Meteorological Programs."
3. Regulatory Guide 1.42, "Interim Licensing Policy on As Low As Practicable for Gaseous Radioactive Releases from Light-Water-Cooled Nuclear Power Reactors."
4. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," Revision 2.
5. Regulatory Guide 1.DD, "Methods for Estimating Atmospheric Dispersion of Gaseous Effluents from Routine Releases," attachment to Concluding Statement of Position of the Regulatory Staff, Docket No. RM-50-2, February 20, 1974.
6. D. H. Slade, (ed.), "Meteorology and Atomic Energy - 1968," TID-24190, Division of Technical Information, USAEC (1968).
7. J. F. Sagendorf, "A Program for Evaluating Atmospheric Dispersion From a Nuclear Power Station," Technical Memorandum ERL ARL-42, National Oceanic and Atmospheric Administration (1974).

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