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Rules and Directives Branch
Office of Administration
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: Comments on Draft Regulatory Guide DG-1111, *Atmospheric Relative Concentrations for Control Room Habitability Assessments at Nuclear Power Plants* (66 Fed. Reg. 64893)

PROJECT NUMBER: 689

Enclosed are comments on Draft Regulatory Guide DG-1111, *Atmospheric Relative Concentrations for Control Room Habitability Assessments at Nuclear Power Plants* developed by the Nuclear Energy Institute[1] (NEI) using input from its Control Room Habitability (CRH) Task Force.

The NRC staff is preparing four related draft regulatory guides to address management of control room habitability. DG-1111 was the first of these to be issued for public comment. The other draft regulatory guides in this series are:

- DG-1113, *Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors*
- DG-1114, *Control Room Habitability at Nuclear Power Reactors*, and
- DG-1115, *Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors*

The NRC has also issued DG-1113 for public comment. The CRH Task Force is currently reviewing it. We understand that DG-1114 and DG-1115 will be issued soon for public comment.

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[1] NEI is the organization responsible for establishing unified nuclear industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all utilities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, materials licensees, and other organizations and individuals involved in the nuclear energy industry

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The CRH Task Force plans to cross review DG-1111 with the criteria contained in the other three draft regulatory guides listed above. Any additional comments resulting from this cross review will be provided to the NRC within 90 days of the aforementioned draft regulatory guides being issued for public comment. NEI discussed this schedule with the staff and we understand that our approach supports the NRC's schedule to disposition public comments.

In the last few years, the NRC has issued numerous new and revised regulatory guides for public comment. In our comments on many of these, NEI expressed concern with the implementation criteria, which state that the staff plans to review all future licensing submittals in accordance with the subject regulatory guide, unless the licensee justifies another method acceptable to the NRC. DG-1111 uses similar language in its implementation criteria and during our control room habitability (CRH) meetings with the NRC, the staff suggested that licensees adopt the new approach to CRH in lieu of their existing licensing basis. The publication of a new or revised regulatory guide does not revise existing licensing commitments or direct licensees that its existing licensing basis is inadequate. We therefore request that DG-111's implementation text be revised to acknowledge that the new regulatory guide is only one acceptable method to satisfy the regulatory requirements and that licensees may use it in lieu of their existing commitments.

If you have questions, please contact Kurt Cozens, (202) 739-8085, koc@nei.org, or me.

Sincerely,

James H. Riley for

Alexander Marion

KOC/maa
Enclosure

c: Mr. F. Mark Reinhart, U. S. Nuclear Regulatory Commission
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NEI COMMENTS ON DG-1111

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1	2	A, 4th	Section A states that "this guide should be used in determining new or revised χ/Q values to be used in evaluations performed to demonstrate compliance with GDC-19 or 10CFR50.67...." This statement is more restrictive than that of Regulatory Position C.1 (page 4), which states that "licensees may also continue to use the licensing basis methodology for determining χ/Q values for newly identified source-receptor combinations or re-generating the approved χ/Q values using more recently collected meteorological data sets."	Revise Section A to be consistent with Regulatory Position C.1 and its allowance for continued use of the licensing basis methodology. One approach is as follows: 1) Delete the word "Although" to leave "Holders of operating..." 2) In the next phrase delete "the methodology described in", change the word "should" to "may", and begin the new sentence: "This guide may be used in determining ...." 3) Add the following sentence to the end of this paragraph: "Licensees may also continue to use the licensing basis methodology for determining χ/Q values for newly identified source-receptor combinations or re-generating the approved χ/Q values using more recently collected meteorological data sets."
2	3	B,5th	The ARCON96 code is a general analytical tool, and the effectiveness of the code for a given application should be evaluated on a case basis. There are areas where the DG concludes that the modeling or benchmarking is insufficient for licensing application. This more specific phrasing is recommended, rather than "not adequately addressed by ARCON96."	Replace the phrase "not adequately addressed by ARCON96." with "where the modeling in ARCON96 or the application of ARCON96 is considered insufficient for these licensing evaluations."
3	3	B, 6th	This section states that analysts should not assume that the use of the ARCON96 code is acceptable for purposes other than control room radiological habitability assessments and refers to RG 1.78 for regulatory positions on performing atmospheric dispersion analyses for control room toxic gas habitability assessments. Yet, Section C.3.3 of RG 1.78 Rev. 1 states that ARCON96 may be used for toxic gas dispersion analyses.	Revise Section B to state that DG-1111 is intended to provide guidance for atmospheric dispersion analyses for control room radiological habitability assessments and RG 1.78 should be consulted for regulatory positions on performing atmospheric dispersion analyses for control room toxic gas habitability assessments. Recommend inserting the phrase "as described in this guide" after "the use of the ARCON96 code" in the first sentence.
4	4	C.1, 1st	References or guidance to help determine if "unusual siting, building arrangement, release characterization, source-receptor configuration, meteorological regimes, or terrain conditions" would be helpful.	Provide reference or guidance.
5	4	C.1, 2nd	In the phrase "...other models addressed in this guide may be used voluntarily", the word "voluntarily" should be assumed by the chosen language and may be deleted.	Remove the word 'voluntarily'

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6	4-5	C.1, 4th	The (current) 2nd sentence states that the averaging periods for which control room χ/Q values "are generally determined" include 0-8 hours (or 0-2 hours and 2-8 hours), 8-24 hours, 24-96 hours, and 96-720 hours. Other averaging periods should be acceptable, if justified by the licensee.	Add the following after the (current) 2nd sentence of this paragraph: "Other similar time-averaging approaches may be justified by the licensee."
7	4-5	C.1, 4th	The discussion of applying the "limiting" χ/Q values to the limiting time window for release to the environment should be clarified. In addition to the recommended revisions, consider additional examples, especially to describe the treatment for the "sliding window" in either the 0-8 hour period, or in subsequent periods.	Move the 1st sentence of the 4th paragraph to precede the sentence that begins, "If the 0-2 hour …" to start a 5th paragraph concluding section C.1. To connect the example information to the proper place without breaking the track of the presentation, move the last 2 sentences to a note, at the end of "limiting portion of the release to the environment". For clarity, replace "start at the start of the event" with "coincide with the start of the event". Start the next sentence with "If the limiting portion of the release occurs in the first 8 hour period, for example, the 2-8 hour χ/Q value…" Add a 3rd sentence to the note, such as: "However, the start of this period should be determined as a part of the analyses for each facility."
8	5 28	C.2.1, 1st Ref. 12	The reference for Regulatory Guide 1.23 as cited from 1972 should be called Safety Guide 23, which preceded Regulatory Guide 1.23. In reality, several nuclear plant licensees made commitments to various proposed versions of RG 1.23 (1980, 1986), which were never made final Regulatory Guides, or ANSI-ANS 2.5 (1984, expired), or ANS-ANSI 3.11 (2000). NUREG-0737 and RG 1.97 were also issued to address TMI issues, some of which relate to meteorological data collection. In general, there is no single document that contains the specific requirements of a meteorological monitoring system.	The reference to the guidance in Regulatory Guide 1.23 should be changed to Safety Guide 23. In addition, the discussion and references should be generalized to incorporate legitimate quality programs that have been built on a variety of regulatory guidance documents. Additional references to industry standards would be useful.
9	5	C.2.1, 1st	The guidance of RG 1.183 calls out RG 1.23 for collection of meteorological data. Safety Guide 23 indicates that two full years of data is desirable. As identified in NEI 99-03, 3 years of quality meteorological data should be considered sufficient to provide a robust representation of long-term trends at most sites.	Modify the value of "5 years" to "3 years". Provide additional guidance to assist licensees in determining and demonstrating that quality data is collected and maintained.
10	5-7	C.2.1, 4th & 5th, Table 1	These paragraphs provide detailed information regarding the input specifications for the ARCON96 code. This detail (along with Table 1) detracts from the presentation and would be better suited to an appendix	Remove the level of detail from the guidance document or, alternatively, move ARCON96 code input guidance in last two paragraphs and Table 1 to an appendix.
11	7	Table 1	The descriptions of ARCON96 data file format could be improved with the addition of sample input lines as examples. The Parameter descriptions for the Fields labeled "2X" should read "2 blank spaces" if this is what is intended.	Provide the recommended example as part of the descriptive material (now to be included in an appendix). Modify the Parameter descriptions as recommended.
12	7	Table 1	"Hour of day of observation Military time, 0-23, with midnight=0 as an integer" is specified. However, Military time = Zulu = GMT. Local time, 0-23 hours is the more common reference approach.	Clarify the language to specify the timescale of choice.
13	6	C.2.2, 1st	The first two sentences state "A 95th percentile χ/Q value should be determined for each identified source-receptor combination. However, it may be possible to identify bounding combinations [of release and receptor locations] in order	A statement should be added to permit the calculation of a composite value of χ/Q for these types of applications, where the licensee has demonstrated an acceptable modeling approach. Specifically, add:

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			to reduce the calculational effort." These statements should not prohibit the calculation of a "composite value" of control room χ/Q associated with two or more release pathways from a single volume containing radioactivity. One example is containment bypass leakage, which can be released through several pathways.	"The calculation of a composite value of control room χ/Q associated with two or more release pathways from a single volume containing radioactivity is also permitted, where the licensee has demonstrated an acceptable modeling approach. "
14	6	C.2.2, 2nd	This statement may not be consistent with the provisions for a given accident sequence as prescribed in the UFSAR.	Add a phrase to specify consistency with the UFSAR provisions, "... and considerations of loss of offsite power, consistent with UFSAR accident sequences and descriptions."
15	6	C.2.2.2	An acceptance for elevated releases of at least 2.5 times the height of adjacent solid structures is given here. In Regulatory Guide 1.111, Section C.2.b, there is other guidance for developing an elevated release model. RG 1.111 states "For effluents released from vents or other points at the level of or above adjacent solid structures, but lower than elevated release points, the effluent plume should be considered as an elevated release whenever the vertical exit velocity of the plume is at least five times the horizontal wind speed at the height of release."	It would be useful to clarify the differences in application, as identified in RG 1.111 (effluent releases). Refer to page D-6 of NEI 99-03, Section iii "Stack Release." Provide the basis for selecting the value of 2.5 and the appropriate references for this application.
16	6	C.2.2.2 1st	There is no guidance provided to identify the characteristics of "adjacent solid structures".	Clarify by providing a description of permissible geometries aligned with prescribed modeling techniques.
17	7	C.2.2.2 1st	The "maximum χ/Q value" at the end of the paragraph is referring to the calculated 5% χ/Q value. The modifier "maximum" is not appropriate.	Delete the word "maximum."
18	8	C.2.2.2 3rd	Pertains to the discussion about control room intakes being located "close" to the base of a tall stack and subsequent under predictions of the code and flow reversal analysis. How close is "close"?	Additional guidance is recommended on treatment of geometry and on acceptable methods for the performance of flow reversal analysis.
19	8	C.2.2.2 3rd	The last sentence in the section is somewhat ambiguous and potentially confusing: "The χ/Q values for the 24-96 and 96-720 hour intervals should be the average of the χ/Q determined with ARCON96 and the maximum χ/Q value at ground level for each of the respective periods, weighted on the basis of 1 hour of the maximum χ/Q value for each day in the interval (e.g., 3 hours and 26 hours)."	Provide additional details by presenting algorithms showing how the ARCON96 and maximum ground level χ/Q values should be averaged. For example, if PAVAN is used to generate the maximum ground level χ/Q values: $\chi/Q_{24-96hr} = \frac{3(\chi/Q)^{PAVAN}_{24-96hr} + 69(\chi/Q)^{ARCON96}_{24-96hr}}{72}$ $\chi/Q_{96-720hr} = \frac{26(\chi/Q)^{PAVAN}_{96-720hr} + 598(\chi/Q)^{ARCON96}_{96-720hr}}{624}$
20	8	C.2.2.3	This section provides direction on what modeling features in ARCON96 should not be used for vent release calculations. Guidance on acceptable modeling approaches for vent release calculations or on review criteria for licensee approaches should be provided.	Provide recommended guidance on vent release modeling approaches for ARCON96 applications and provide review criteria for other licensee approaches.

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21	8	C.2.2.4	The discussion of diffuse area sources assumes the release is from a building volume. Other types of releases, however, can behave as a diffuse source, especially if the receptor (i.e., the control room HVAC intake) is nearby. Specifically, the steam release from a set of PWR steam generator relief valves usually creates a cloud of steam in the vicinity of the release point. This cloud generally stays together for some time and meanders about over adjacent building surfaces. To a nearby receptor, such a large cloud would appear as a diffuse source. The adjustment of the cloud dispersion coefficients (sigma values) by the cloud dimensions would be applicable in this scenario (using equations 1 and 2 in Section 2.2.4.4).	This treatment would reduce the overly conservative results which are usually obtained by the application of current NRC staff practices for this type of release (see also the Regulatory Analysis, I. Statement of Problem, bulleted item 6, page 34).
22	9	C.2.2.4.2	The application of diffuse area source methods should be permitted if multiple penetrations are present on a building surface and leakage is no more probable at one than another, the leakage could approximate a diffuse area source. Selection of only the most limiting penetration is unnecessarily conservative.	Expand clarification of intent to endorse applications such as that described in this example.
23	9	C.2.2.4.3	The discussion of the application of the diffuse source χ/Q in assessments is incomplete. This statement would appear to be more appropriate as an application example versus a Regulatory Position.	This Regulatory Position should be reviewed to assure that it is not outside the intended bounds of specific guidance.
24	9	C.2.2.4.3 5th line	"circumferential surface area above grade" is not specifically descriptive.	Replace word "circumferential" with "containment"
25	9	C.2.2.4.4	It is not clear why these equations for initial diffusion coefficients sigma-y and sigma-z are preferred for diffuse area sources, rather than the formulas provided in the ARCON96 manual (NUREG/CR-6331).	Explain the basis/derivation of the initial diffusion coefficients sigma-y and sigma-z in equations (1) and (2).
26	9-10	C.2.2.4.5	(See attached sketch, Figure A) Use of the diffuse source option is permitted for releases from volumes with a homogeneous concentration of radiological source (2.2.4.1). The total release rate must be assumed (2.2.4.2). The DG restricts the selection of diffusion coefficients more than the values recommended in the NUREG (2.2.4.3). The shortest horizontal distance from the source building surface along the line of sight to the source building centerline (Line A on the sketch) is used rather than a slant range to the geometric center of the effective diffuse source plane (2.2.4.5). Credit has not usually been allowed for holdup or retention in the release building (2.2.4.8), and decay during transport time is not credited by	(1) Base the source to receptor distance on the source building centerline (Line C on the sketch) or some point between the building surface and the centerline. (e.g., Line B on the sketch is approximately half the distance between the closest point along the line from the intake to the source building center and the source building centerline) (2) Allow the source to receptor distance to be a slant range.

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			codes like RADTRAD. Based on these provisions, the guideline for calculating the source to receptor distance is more conservative than necessary.	
27	10	C.2.2.4.6	In the 2nd sentence, replace "if" with "for time spans over which" to provide clear and consistent guidance. As revised, this sentence states "The diffuse area source model may be appropriate for time spans over which the [secondary containment or annulus] ventilation system is not capable of maintaining the requisite negative pressure differential specified in the technical specifications or in the FSAR."	Implement the recommended wording changes. If the annulus ventilation system can achieve the requisite negative pressure differential within one minute of the initiating event (drawdown time), then the diffuse area source model need not be used at all. This is consistent with the Staff expectation in Standard Review Plan (SRP) Section 6.2.3.
28	10	C.2.2.4.8	This section states that the diffuse area source model for large louvered panels or large openings is applicable only when the line of sight from the louvered panel or open to the control room intake subtends an angle no less than 45 degrees with reference to the surface of the panel or opening. Even if the subtended angle is less than 45 degrees, credit for a vertical area source should still be allowed.	Revise Section C.2.2.4.8 to state that if the line of sight from the louvered panel or opening to the control room intake subtends an angle less than 45 degrees, initial diffusion coefficients are found by: $\sigma_{y_0} = 0$ $\sigma_{z_0} = \frac{Height_{area\ source}}{6}$
29	11	C.2.3.2	The criteria listed here will not be applicable to the licensing basis for every site. In addition, this section gives the impression that it is written to provide guidance to the design of future plants or for configuration additions or system modifications, rather than for the purpose of analyzing layouts. For example, the statement "The outside air intakes should be located with the intent of providing a low contamination intake regardless of wind direction". This type of statement more appropriately belongs in SRP 6.4 if it belongs in any form of regulatory guidance.	Rather than provide general guidance that may not be applicable to all plants, refer to the specific plant licensing basis. Assure that guidance for existing plants versus that for future plants is clear throughout the document. This paragraph should be restricted to examples or descriptions of the various configurations of intakes and the restraints imposed on each type for the purpose of analyses.
30	11	C.2.3.2	This section does not provide guidance for maintenance activities that may render one outside air intake initially unavailable for the design basis event, when that activity is not governed by TS Allowable Outage Time (AOT) considerations or other appropriate procedural controls. Furthermore, for outside air intakes with automatic selection controls, valid failure modes could cause an outside air intake to close inadvertently. In either case, a facility with two outside air intakes might be in the limiting single intake configuration at least in the initial phase of a design basis event. Additional positions pertaining to the assumed availability of both outside air intakes in a dual intake configuration may be warranted. A failure analysis should be performed on the dual intake configuration to verify that no valid failure can cause the inadvertent closure of one intake. If any such failure modes are identified, one intake only should be assumed to be open at the initiation of an event.	For many sites this issue will be addressed via TS Allowable Outage Time (AOT) considerations or other appropriate procedural controls. If not, the following guidance is recommended: One approach would be to specify that credit may be allowed for a dual intake configuration, provided that administrative controls are in place as follows: The time span for which one intake may be closed (for maintenance activity) shall not exceed 24 hours. In this case, it is acceptable to assume that both intakes of a dual intake configuration perform their safety function as designed. This position is consistent with action statements in some plant technical specification pertaining to breach of control room pressure boundaries.

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			For calculations of post accident radiation doses to the control room operators in which it is assumed that one intake of a dual intake configuration is closed, it may be desirable to show that the closed intake is opened after a time. In this case, the steps to detect a closed outside air intake and open it should be addressed in procedures and operator training. Opening a closed outside air intake during a design basis event is a safety related operator action and as such should conform to the positions of ANSI/ANS 58.8-1994, R.G. 1.97, and Generic Letter 91-18 pertaining to safety related operator actions.	Alternatively, the time span for which one intake may be closed (for maintenance activities) shall not exceed 7 days. In this case, in calculation of radiation doses to the control room operators for design basis events, a scenario should be considered for which one intake is closed at least initially but the event includes no failures. This is consistent with the single train action statement for technical specification pertaining to control room ventilation systems.
31	11	C.2.3.2	In the sentence, "The two intakes should not be within the same wind direction window, which is 45 degrees ..." The words "defined as" should be placed prior to "45 degrees" as this is the definition of wind direction window.	Clarify the definition with the addition: "The two intakes should not be within the same wind direction window, which is defined as 45 degrees on either side of a line of sight between the release point and the intake when ARCON96 is used, or as specified in Table 3
32	11, 16, 17	C.2.3.2, Table 3 Table 4	These sections do not provide sufficient guidance regarding the use of the 45 degree criteria and/or the data in Table 3. References and additional detail regarding the development and appropriate application of the guidance in this section and in Tables 3 and 4 are required. Are the values in Table 3 valid for both long (720 hour) and short (2 hour) periods. In a case where control room intakes are monitored, operators may be expected to select different intakes during the course of the event.	Amplify guidance to provide additional descriptions and references for the applications in these sections and for Tables 3 and 4. See also the comments on Sections C.3.4.1 and C.3.4.2.
33	11	C.2.3.2	The discussion regarding the placement of control room dual intakes seems to be providing guidance or emphasis on system design rather than analysis. The examples in Figure 2 focus only on one release point. Other release points (e.g., fuel building in sites A, B, and C) could result in similar impacts. Also, note that, depending on the location details and sizes of the on-site structures, it is likely that there will be some pathway of release that for some wind direction would place both intakes downwind of the source. However, this can be accommodated by determining an applicable χ/Q from a composite of the individually determined χ/Q s for each intake / receptor pair.	(1) For design purposes it would be better to provide clear guidance specifying a preference for intake locations such that one is always "clean" (outside the 90 degree window) when release is from, e.g., the reactor building or unit vent. (2) Guidance on how to weight individual χ/Q s in dose projections should be given when this condition is not met for other source-receptor pairs. The statement here appears to limit or disallow the use of ARCON96 under this condition, although this is inconsistent with other guidance. Please clarify the language or its intent. See the recommendations in Comment 34 for the formulation of an approach that should be acceptable for cases where two control room intakes are in the same wind direction window.
34	11-12	C.2.3.2.1	The position in this section is overly conservative. Allowing no dilution credit for dual intakes when the second intake is impacted, is unnecessarily conservative, especially in the case where the second impacted intake is at a much greater distance from the source than the first impacted intake. An appropriate control room χ/Q may be calculated to serve as an upper bound to	The formulation presented in attached Note (1) is recommended. This approach derives conservative methods to calculate the appropriate χ/Q for this configuration. The method also demonstrates consistent results in the derivation of limiting cases.

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			capture the effect of both outside air intakes of the Control Room Ventilation System being in the same wind direction window as described in Note (1).	
35	12	C.2.3.2.2	Equation 5 in DG-1111 does not converge to taking half of the upper bound control room χ/Q in the limiting case, where the airflows in the two Control Room Ventilation System outside air intakes are balanced. See Note (2).	The formulation presented in attached Note (2) is recommended. This approach derives conservative methods to calculate the appropriate χ/Q for this configuration. The method also demonstrates consistent results in the derivation of limiting cases.
36	12	C.2.3.2.3	This section deals with manual operator actions to manually select the least contaminated outside air intake as a source of makeup air. The first paragraph requires that "... this protocol is acceptable only if ... there are redundant, ESF-grade radiation monitors within each intake, with control room indication and alarm, to monitor the intakes." When discussing assumptions for the delay times to be assumed for operator actions, the second paragraph states that "[t]his delay period should consider: (1) the time for the operator to recognize the radiation monitor alarm and *determine its validity (e.g., channel check)*, ..." [emphasis added].	In an accident scenario, the operators would probably not have the time to order a "channel check" of the monitors. In most plants, this terminology has Technical Specification (TS) connotations that would require rigorous testing. If the Staff's intent is to have these ESF-grade radiation monitors required per TS, along with the necessary surveillances, then the fact that the monitors are operable, per TS, should be sufficient for their use in accident scenarios. The additional time to perform a Channel check should not be required to be assumed in the analysis.
37	12-13	C.2.3.2.3 C.2.3.2.4	The basis for reducing a single intake control room χ/Q by 4 for two intakes with manual selection controls and by 10 for two intakes with automatic selection controls is incomplete. What happens if both intakes are in the same wind direction window or if the airflow in the intakes is not balanced?	Consider documentation or references that will provide additional supporting information for the rationale to limit the credit for manual and automatic selection controls to 4 and 10, respectively.
38	13	C.2.3.3, 1st	The position presented in this section goes beyond current requirements for several existing facilities and systems. In addition, at least one portion appears to require clarification and reinforcement. 1. The last sentence is "The situation can be further compounded if the χ/Q for the unfiltered pathway is more limiting than that for the control room outside air intake." The idea behind this statement is underdeveloped. A position should be included in the regulatory guide to state that control room χ/Q's for unfiltered inleakage are unnecessary if an evaluation demonstrates that all of them are bounded by the control room χ/Q values for the outside air intakes. This position could be coupled with the mathematical identity (6), so that if either the identity (6) is not met or if an evaluation cannot show that control room χ/Q's for the outside air intakes are bounding, then the "95th percentile χ/Q values for each infiltration path needs to be determined." See also, comments on Equation (6) below. 2. With the possible exceptions of some control room doors, the items on the list of "infiltration pathways" are not true points of entry of unfiltered inleakage into the plant. All of them may be paths of unfiltered inleakage into the control room but not into the plant. Rather, these "infiltration pathways" are likely to be contained within completely enclosed safety-related Seismic	Drop second paragraph and the bulleted list. This information is not appropriate for DG-1111. Rather, this information appears to be more suitable for discussion in DG-1114 or DG-1115.

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			Category I structures (e.g., the Auxiliary Building). More likely, points of entry for unfiltered inleakage include the control room doors, doorways to service buildings and turbine buildings, for example. This guidance is better suited for other DGs in this series.	
39	13 14	C.2.3.3.1	Per Section 2.3.3.1 and its Equation (6), if the iodine/particulate [i/p] activity present in the total amount of unfiltered inleakage exceeds ten percent of the i/p activity introduced into the CR Envelope via the CR outside air intake flow, then a 95th percentile χ/Q value should be determined for each infiltration path. [1] The ten percent cut-off is arbitrary and overly restrictive. [2] Failure to satisfy the equality would require determination of χ/Q values for all unfiltered inleakage patχ/Q has, even those with low unfiltered inleakage rates. In addition, the equation provided does not describe what filter efficiency is used. Assuming an emergency ventilation intake flow of 1000 CFM and 99% filter efficiency for radioiodine this would require inleakage less than 1 CFM to avoid multiple χ/Q calculations. On the other hand, assuming 0% filtration of noble gases would result in a criterion of 100 CFM inleakage. Neither result would be tractable.	A more reasonable requirement would be to individually compare the i/p activity present in each of the unfiltered inleakage paths to the i/p activity introduced into the CR Envelope via the CR outside air intake flow. If the i/p activity present in an unfiltered inleakage path exceeds twenty [20] percent of the i/p activity introduced into the CR Envelope via the CR outside air intake flow, then a 95th percentile χ/Q value should be determined for that infiltration path. If Equation (6) is not modified with adequate technical justification and guidance, then Section C.2.3.3.1 should be deleted.
40	14	C.2.3.3.2	Per Section 2.3.3.2, the selection of one or more bounding inleakage paths for the χ/Q evaluation may be sufficient to establish compliance with regulatory guidelines. The word "bounding" is not specific and can lead to interpretation disagreements.	Define "bounding" or provide more specific guidance on the expectations here. See also Comment 35.
41	14	C.2.3.3.2	The suggestion to use the shortest distance to the CRE is unnecessarily conservative.	If inleakage points are unknown and ventilation assures homogeneous distribution of radioactivity, the receptor point should be reasonably located at the geometric center of the CRE. Alternatively, the location where control room operators are expected to spend most of their time may be selected.
42	14	C.2.4, 2nd	The specification that "source-to-receptor distance is the shortest horizontal distance between the release point and the intake" is too prescriptive without a basis (or bases). It should be acceptable to use the horizontal distance around the building, when it is longer than the horizontal distance over the building (and/or in cases where the effluent would be unlikely to go over the building).	Specify the criteria for determining if the effluent could go over the building and to the control room intakes.
43	15 17 23	C.3.2, C.3.4, Figure 1	Section 3.2, Section 3.4 (Equation 9), and Figure 1 define parameter "s" as the shortest distance between building surface and receptor location. This definition differs from that of the Murphy-Campe paper, which does not use the word "shortest" in its definition of parameter "s". The proposed definition is overly conservative for containment building activity release scenarios, where leakage could originate from many points on the surface of the	For activity releases that may originate from many points on the surface of a large building, redefine parameter "s" to be the average distance from the building surfaces to the receptor location. This average distance could be the centerline of a cylindrical containment building.

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			containment structure, including the far side of containment.	
44	15 17	C.3.2, C.3.4	The intention of "building surface" is poorly defined in the description for parameter 's'. Does 's' mean the distance to the surface of the building causing the wake or to the diffuse building source?	Clarify definition of 's' given the statements that precede Equation (9) on page 17. There may be two distances that are being referenced in different sections of the text, but it is unclear.
45	16	C.3.4.1 1st	The mechanics of the analysis discussed in Section C.3.4 is confusing. As an example, one meteorologist is concerned by the following interpretation of and comments on the application process: "The correction to the wind speed is counter-intuitive and makes the χ/Q values more conservative than needed. Wind speed (U) is expected to increase above the 5th percentile wind speed with time. Thus, in reality, the χ/Q s for longer time intervals should decrease based on larger values of U (i.e. χ/Q proportional to 1/U). " Another meteorologist has concluded that the guidance is consistent, but that the correction factor application could be confusing.	Clarify the mechanics of the approach outlined and provide clear examples of the intent and process of these correction factors. The current guidance can be misinterpreted and, therefore, could be misapplied. Is the correction to the wind speed actually intended, or is the intent to apply a correction factor to the short-term χ/Q to determine χ/Q values for longer time periods? Please clarify the intent within the guidance document. It is recommended that a note be included to clarify that Column 1 of Table 2 should be applied to the χ/Q values and not to the wind speed.
46	17	C.3.4.1 Table 2	Wind Speed Correction: Guidance is needed on how to determine corresponding wind speed percentiles for non-standard time intervals (e.g. 0-2 hours, 2-8 hours, 0-4 hours, 4-8 hours, 8-10 hours, and 10-24 hours).	Provide requested guidance and the basis for the wind speed percentiles listed in Table 2.
47	17 18	C.3.4.1	Wind Direction Correction: Guidance is requested to clarify the application of the wind direction correction in Table 4 to the calculation of χ/Q values. Add clarifications to indicate that the final χ/Q can be multiplied by the wind direction correction factor to allow for the variability of the wind direction with time. Thus, χ/Q s for longer time periods are less (i.e. only a fraction of the short-term χ/Q value).	Provide requested clarifications, guidance, and the corresponding bases or references.
48	18	C. 3.5 1st	The following two sentences in this section are confusing:\ "To qualify as a puff release, 100 percent of the radioactivity must be released directly to the environment over a period no longer than about 1 minute and the center of the puff must pass over the control room outside air intake. Releases to enclosed buildings, intermittent releases that occur over a period longer than about 1 minute (e.g., releases from relief valves, atmospheric dumps), and releases that occur over a period longer than about 1 minute should be treated as continuous point source releases (without plume rise) as addressed elsewhere in this guide." The first sentence implies that, in order to qualify as a puff release, the center of the puff must pass over the control room intake. What is meant is, given a	Reword these two sentences as follows: "One hundred percent of the radioactivity must be released directly to the environment over a period no longer than about 1 minute to qualify as a puff release. Releases to enclosed buildings and intermittent releases that occur over a period longer than about 1 minute (e.g., releases from relief valves, atmospheric dumps) should be treated as continuous point source releases."

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			release is classified as a puff release, its center should be assumed to pass over the center of the control room intake. The last half of the second sentence states that all releases occurring over a period longer than about 1 minute should be treated as continuous point source releases without plume rise. Releases from relief values and atmospheric dump valves are high energy releases that can be modeled with plume rise (whether they are intermittent or continuous releases) if they meet the criteria for plume rise presented in Section 4 of the guide.	
49	18	C.3.5	This section presents an algorithm (Equation 10) to be used to model "instantaneous puff releases" which are defined as releases with duration of less than one minute. This same algorithm was presented in Appendix B to Rev 0 of RG 1.78 but was deleted from the recently issued Rev 1 to RG 1.78. RG 1.78 Rev 1 now references the use of HABIT/EXTRAN computer code to model both puff and continuous toxic gas releases. Note that EXTRAN implements the same "composite diffusion coefficients" (σ_y and σ_z values) as ARCON96 for both puff and continuous releases.	Revise Section C.3.5 to recommend or allow the use of the EXTRAN to model puff releases. In addition the additional background explanation as discussed in the comment should be added and expanded as appropriate.
50	18	C.3.5	The presentation of the exponential term in Equation (10) is incorrect. The general form of the correct solution for this application is shown to the right.	The exponential term in Equation 10 is in error (Reference, for example, Section 1 of Appendix B to RG 1.78 Rev. 0). It should read: $\exp\left[-\frac{1}{2}\left(\frac{x^2}{\sigma_x^2+\sigma_I^2}+\frac{z^2}{\sigma_z^2+\sigma_I^2}\right)\right]$
51	18	C.3.5	This section uses releases from "atmospheric dumps" as a possible type of an intermittent puff release that could last over one minute and should be modeled as a continuous point source. As expressed in the Comment 21 on Section C.2.2.4, this type of release could be modeled as a continuous diffuse source release.	Implement the recommendation contained in Comment 21.
52	19	C.3.5, 3rd	The phrase "solving Equation 10 *reiteratively* for the release activity…during *individual* one-second time steps." is not the most accurate description of the solution process.	Recommended wording is: "solving Equation 10 repeatedly for the release activity…during sequential one-second time steps."
53	19	C.4	This section references DOE/TIC-27601 (DG-1111 Reference 16) as the source of plume rise equations 12, 13, and 14. A better reference for these equations is DOE/TIC-11223. This document provides a direct source for the presentation of the theory and equations.	Revise this section to reference DOE/TIC-11223 (S.R. Hanna et al., "Handbook on Atmospheric Diffusion," DOE/TIC-11223, 1982, available from NTIS via Order Number DE82002045).
54	20	C.5	In addition to site-specific site environs testing, the application of wind tunnel testing should be included as an option to derive (or to contribute to the derivation of) site-specific χ/Q values. Wind tunnel testing is a widely used	Change the 4th sentence in the first paragraph to add the bolded phrase: "Licensees may opt to propose alternative methods and parameters that are based in part on data obtained from site-specific

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			and accepted approach in a number of industrial applications. Wind tunnel test results have also been use to benchmark the adequacy of ARCON96.	experimental field **and/or wind tunnel** measurements."
55	20	C.5	As a benefit for new construction, it would be nice to see a section similar to Regulatory Position 5 discussing acceptability of a plant-specific computational fluid dynamics assessment. Details of the actual plant structures could be included as a modification of the actual site meteorological data taken prior to construction of the facility.	Include recommended language.
56	20	C.5.1	For experimental programs, "credentials in air pollution dispersion meteorology and modeling" are given as a standard. Is the word "pollution" necessary?	Delete the word "pollution" and/or identify more general terminology for the credentials desired.
57	31	Table A-1	Average Sector Width Constant: "Although the default value is 4, a value of 4.3 is preferred."	Clarify why "4.3" is the preferred value for the averaging sector width constant.
58	29	Table A-1	A reference to this table should be added into the body of the document.	Add recommended reference to the table from within the body of the document.
59	29	Table A-1	"Stability Class" would be appropriate to include in the parameter list along with acceptable temperature measurement levels to be used.	Add recommended definitions, discussion, and acceptable input guidance to the table.

IMPLEMENTATION COMMENTS:

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60	22	D	The second sentence of the second paragraph reads: "Except in those cases in which a licensee or applicant proposes an acceptable alternative method for complying with specified portions of the NRC's regulations, the methods to be described in the final guide reflecting public comments will be used in the evaluation of (1) license amendments at operating reactors, (2) combined operating license applications, (3) construction permit applications, (4) operating license applications, and (5) design certification applications." This sentence establishes DG-1111 as a de-facto regulation, rather than one acceptable method to satisfy the regulations. The sentence infers that the final version of DG-1111 will be used as a metric for judging other acceptable methods in lieu of the regulations. Furthermore, the implementation section does not address how the regulatory guide is to be used in conjunction with the licensee's existing licensing basis. Section A acknowledges that the new guide is a change to a previous NRC	Revise the second paragraph of Section D to read: "This regulatory guide provides one acceptable method of satisfying the regulatory requirements identified in Section A. Licensees may use this guidance in lieu of the methods used to justify its current licensing basis."

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			position when it states that many of the regulatory positions presented in this guide represent substantial changes from procedures previously used [by licensees and approved by the NRC] to determine atmospheric relative concentrations for assessing the potential control room radiological consequences for a range of postulated accidental releases of radioactive material to the atmosphere. Imposition of such guidance on licensees constitutes backfitting per 10 CFR 50.109 because Section D established this regulatory guide as a metric for judging other methods. Paragraph (a)(1) of the backfitting rule states: "(a)(1) Backfitting is defined as the modification … procedures … which may result from a new or amended … regulatory staff position interpreting the Commission rules that is either new or different from a previous staff position …" Regulatory guides do not have the authority to require a revision to existing licensing bases. Section D should be revised to reflect that it is up to the licensee to determine if they will revise its existing licensing basis or design inputs to implement the guidance provided in DG-1111. Alternatively, the NRC would need to determine that the analysis method used in the NRC approved plant licensing basis is no longer acceptable to the NRC Staff. Furthermore, Section D indicates that DG-1111 is being implemented to address regulations on construction permits or operating licensees under Part 50 and applicants for design certifications or applicants for combined licensees under Part 52. These three categories are outside of the scope of implementing regulations identified in Section A. Footnote 1 of Section A indicates that this guidance may be useful for this application. However, it is not appropriate for Section D to include these activities unless they are formally within the scope of the regulatory guide. These areas should be deleted from Section D.	

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61	35	Reg. Analysis III and Footnote 2	The paragraph states: "The staff has determined that holders of operating licenses may continue to use χ/Q values determined with methodologies that were previously approved by the NRC. The staff expects that licensees would utilize the information in the guide if they voluntarily decide to replace the facility χ/Q values and methodology described in the plant's licensing basis with values determined using ARCON96 code.[2]" [2] The guide notes that if (1) the previously approved values are based on a misapplication of a methodology, (2) calculational errors are identified, or (3) changes are necessary to ensure adequate protection of the health and safety of the public, the staff will pursue necessary corrections with the applicant. The Regulatory Analysis states that a backfitting analysis is not necessary. Yet here it can be interpreted that the regulatory guide could change a NRC position that has been approved for licensee continued application, even in cases where licensees are re-performing χ/Q calculations and not changing methodology. If the NRC believes that these existing χ/Q evaluations are acceptable for continued use, they should be considered acceptable for future evaluations.	Delete the second paragraph of III and Footnote 2. Alternatively, assure that the language in these citations only describes staff expectations for cases which include changes in fundamental analysis methodology, and which has not been approved by the NRC for similar applications. Use of previously approved methodology to calculate new χ/Q values should be allowed.

GENERAL COMMENTS:

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62	5	C.2.1, 1st	Reference 13 is apparently the basis for evaluating "local effects such as building and cooling tower wakes, brush and vegetation, or terrain." Reference 13 is not available on ADAMS.	Reference 13 should be available in ADAMS for reference and consideration by licensees.
63		General	There has been discussion of a future release of ARCON96 to incorporate additional capabilities related to high velocity vented releases.	Update NUREG/CR-6331 to reflect this guidance when any future version of the code is released to reduce confusion over use of methods considered to be inappropriate.

EDITORIAL COMMENTS:

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64	2	B, 1st	Blank spaces and line in paragraph	Remove blank spaces and line
65	10	C.2.2.4.8	Section contains a line that is half blank	Delete unnecessary spaces
66	11	C.2.3.2	Ninth line, end of line "signt" should be "sight".	Make editorial change
67	18	C.3.5, Equation (10)	The definition for the LHS variable should be written as $\chi(x)$ versus X(x)	Make editorial change
68	20		Editorial. The definition for parameter "s" is missing units of s^{-2} for the A, B, C and D stability value.	Add units to the A, B, C and D stability value.
69	25	Figure 3 and 4	Definition of "B – Moderately Stable" is missing from legend. Note that it may be shown in the electronic version, on-screen display and yet hidden in the printed copies.	Definition of "B – Moderately Stable" should be included in Figures 3 and 4.

Note (1):

This pertains to Comment 34 on Section C.2.3.2.1. The position in this section is unnecessarily conservative. A composite control room χ/Q may be calculated to serve as an upper bound to the effect of both outside air intakes of the Control Room (CR) Ventilation System being in the same wind direction window as follows (4.1):

$$\overline{\left(\chi/Q\right)}=\frac{\max(F_1,F_2)\max\left(\left(\chi/Q\right)_1,\left(\chi/Q\right)_2\right)+\min(F_1,F_2)\min\left(\left(\chi/Q\right)_1,\left(\chi/Q\right)_2\right)}{F_1+F_2}.$$

In (1), all variables are as defined in Section 2.3.2.2 of DG-1111. In addition,

$\max(x,y) = x$ if $x \geq y$ and y if $x < y$.

Also, $\min(x,y) = x$ if $x \leq y$ and y if $x > y$.

Eq (1) is based on the assumption that there is an imbalance in airflow into the two CR Ventilation System outside air intakes, and that this imbalance can shift between the two intakes. If it can be demonstrated that an imbalance in airflow into the CR Ventilation System outside air intakes does not shift between the intakes, then the analyst should be able to use (4.2):

$$\overline{\left(\chi/Q\right)}=\frac{F_1\left(\chi/Q\right)_1+F_2\left(\chi/Q\right)_2}{F_1+F_2}.$$

Both (1) and (2) follow from the time-dependent Murphy-Campe equation modified to account for transport of radioactivity to both CR Ventilation System outside air intakes. It is assumed that the control room χ/Q for transport of radioactivity to each outside air intake has been calculated separately pursuant to the positions in this guide. Then (4.1) or as appropriate (4.2) provide an upper bound to the composite control room χ/Q for transport of radioactivity to two CR Ventilation System outside air intakes in the same wind direction window. Finally, if the airflows in the two outside air intakes are balanced, then (4.1) and (4.2) both reduce to (4.3):

$$\overline{\left(\chi/Q\right)}=\frac{1}{2}\left[\left(\chi/Q\right)_1+\left(\chi/Q\right)_2\right].$$

Note (2):

This pertains to Comment 35 on Section C.2.3.2.2. The position in this section is not internally consistent. Specifically, Equation 5 in DG-1111 does not converge to taking half of the upper bound room χ/Q in the limiting case in which the airflows in the two CR Ventilation System outside air intakes are balanced. Equation 5 is more appropriate for *both* outside air intakes in the same wind direction and no shift in the imbalance in airflow in the intakes. It is the same as Equation (4.2) of these review remarks.

If only one air intake is in any wind direction window for a given release point and the potential for imbalance in airflow in the intake and shifts in that imbalance are to be taken into account, then (4.1) reduces to (5.1)

$$\overline{\left(\chi/Q\right)}=\frac{\max(F_1,F_2)\max\left(\left(\chi/Q\right)_1,\left(\chi/Q\right)_2\right)}{F_1+F_2}.$$

If it can be demonstrated that the imbalance in airflow does not shift between the outside air intakes, then (4.2) reduces to (5.2)

$$\overline{\left(\chi/Q\right)}=\frac{\max\left(F_1\left(\chi/Q\right)_1,F_2\left(\chi/Q\right)_2\right)}{F_1+F_2}.$$

The analyst may use (5.2) for cases of no shift in the imbalance of airflow in the two outside air intakes. Finally, if the airflows in the two outside air intakes are the same, then (5.1) and (5.2) reduce to (5.3)

$$\overline{\left(\chi/Q\right)}=\frac{1}{2}\max\left(\left(\chi/Q\right)_1,\left(\chi/Q\right)_2\right)$$

which is the standard position pertaining to a composite control room χ/Q for transport of radioactivity to two open outside air intakes with balanced airflow and only one intake being in any wind direction window.

Please note that (4.3), representing a composite control room χ/Q for two outside air intakes in the same wind direction window with balanced airflow, also converges to (5.3). In summary, (4.1), (4.2), (4.3), (5.1), (5.2), and (5.3) are internally consistent and ultimately yield the standard position concerning flow to an outside air intake. In addition, (5.1) and (5.2) are based on the assumption behind (5.3) - a Staff position - that the outside air intake outside the wind direction windows is "clean." Equation 5 of DG-1111 is not consistent with that assumption.

NEI Comments on Draft Regulatory Guide DG-1111

Figure A

Diagram Related to Comment Number 26 on C.2.2.4.5