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NUCLEAR ENERGY INSTITUTE

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Rules and Directives Branch
Office of Administration
U. S. Nuclear Regulatory Commission
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SUBJECT: Comments on Draft Regulatory Guide DG-1087, *Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release*
(66 *Fed. Reg.* 11611)
Request for Comments

PROJECT NUMBER: 689

Enclosed are the Nuclear Energy Institute's (NEI)[1] comments on draft Regulatory Guide DG-1087, *Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release.*

Detailed technical comments and clarifications are provided in the Enclosure. Additionally, the industry has three policy level concerns with the proposed guide. These are:

- The proposed regulatory guide states that control room habitability evaluations should consider toxic gas releases coincident with radiological consequences of a design basis accident. Typically plants are not designed for coincidental occurrences of two independent design basis accidents. This is a new regulatory position that should be evaluated against the backfitting requirements before introducing it as a regulatory guide criterion.

[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 Implementation Section of DG-1087 states:

  Except in those cases in which an applicant or licensee proposes an acceptable alternative for complying with specified portions of the NRC's regulations, the method described in the revised guide reflecting public comments will be used in evaluation of applications to renew operating licenses.

  As written, the draft Regulatory Guide is imposing a new requirement on license renewal applicants without justification. The first principle of license renewal is that, with the possible exception of certain aging effects, the current licensing basis is adequate and carries forward into the period of extended operation. The proposed language implies that a license renewal applicant would need to revise the plant licensing basis to adopt the revised regulatory guide. Furthermore, the revised regulatory guide does not address aging issues, and is therefore outside the scope of license renewal activities controlled by 10 CFR 50.54. This statement should be deleted, since it is inconsistent with the 10 CFR Part 54 licensee renewal requirements.

- A licensee who voluntarily proposes to initiate system modifications consistent with its existing licensing basis should not be placed in a position of defending to the NRC staff a decision to not apply the updated regulatory guide. This and future revised regulatory guides should contain a statement that it is not the responsibility of the licensee to defend its decision to not implement a later revision of a regulatory guide if the existing licensing basis is maintained. This recommendation is consistent with the DG-1087 Regulatory Analysis which states that the guide implementation would result in a minimal increase in core damage frequency and impact on occupational health risks.

Please direct any questions to Kurt Cozens at (202) 739-8085 or koc@nei.org, or me.

Sincerely,

Alex Marion

KOC/maa
Enclosure

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ENCLOSURE

NEI COMMENTS ON DG-1087

COMMENT NUMBER	PAGE	SECTION	PARA. NUMBER	PARA. POSITION	COMMENT	PROPOSED CORRECTIVE ACTION
1.	General	--	--	--	The draft regulatory guide includes chlorine as one of the hazardous chemicals Therefore, it is redundant to explicitly specify chlorine as one of the hazardous chemicals. Elimination of this explicit identification will avoid confusion.	Eliminate the explicit identification of chorine when providing a guide for all hazardous chemicals.
2.	2	B	--	2	The DG specifies that the guide addresses both toxic and asphyxiating chemicals, but gives no guidance on asphyxiating chemicals other than the general statement that "asphyxiating chemicals need be considered only if their release results in displacement of a significant fraction of the control room air." Table 2 allows for the determination of weights of toxic chemicals that can be exempted from further consideration. A similar table or quantitative method should also be provided to allow for determination of exempt weights of asphyxiating chemicals. Furthermore, a quantified acceptance criterion is needed if analyses are required.	Provide a table or quantitative method to determine the weights of asphyxiating chemicals that can be exempted. In addition, quantify the term, "displacement of a significant fraction of the control room air." For example, an acceptance criterion on the oxygen volume percentage could be specified.
3.	3	C	1.1	2	Footnote 1 should be included as part of Table 1. Table 1 is referenced in several sections, which does not include this note.	Move Footnote 1 to Table 1.
4.	3	C	1.1	3	The terms "including chlorine" and "onsite" in the first sentence are redundant and should be removed. The phrase hazardous chemicals include chlorine, and storage within 0.3 miles does not have to be on the site.	Delete the terms.
5.	3	C	1.1	3	This paragraph cites chlorine specific requirements, but the requirements logically apply to other hazardous chemicals. For example, it may be unacceptable to have greater than 20 pounds of ammonia stored within 330 feet of Control Room/air intakes.	Delete the chlorine specific requirements.
6.	3	C	1.1	4	Delete chlorine specific statements, since this applies to	Delete chlorine specific statements.

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					other hazardous chemicals also.	
7.	4	C	1.2	3	This is applicable to both stationary and mobile sources and should be repeated under C1.1, or made into a separate section.	Incorporate the proposed change.
8.	5	C	Table 1		Notes a, b, and c should be shown to apply on the right hand columns.	Incorporate the proposed change.
9.	5	C	Table 1	--	Modify the last 5 substances listed in Table 1 to line up with their associated toxicity limits.	Incorporate proposed changes
10.	6, 16, 17	C, Appendix A	Table 2	Note b	Some control rooms are designed and maintained to meet the leakage criterion of Type A or B, except for the automatic isolation feature. The requirement to use Type C weights unnecessarily penalizes a control room (CR) with low or normal leakage, but no auto-isolation. From a practical standpoint, most, if not all, hazardous chemical releases of an amount sufficient to pose a real threat are noticed and appropriately addressed by the CR operators or plant staff well before the CR concentration even approaches the IDLH limit.	Either add another CR Type (low or normal leakage and no auto-isolation) with allowable weights higher than the existing Type C CR or allow a further adjustment (increase) of Type C weights based on human detection (e.g., odor threshold).
11.	6	C	Table 2	--	Values in the columns under each CR type should be either center justified or right justified.	Correct format.
12.	6	C	Table 2	--	It is unnecessary to duplicate this table here and in Appendix A. Revise the text to eliminate the table and reference the table in Appendix A.	Incorporate the proposed revision.
13.	6	C	1.2 & Table 2	-	The ratios between the various columns are not consistent. It appears that the table needs revision. The ratios should be linear as the total amount of material is neither increasing nor decreasing (i.e., finite). The ratio for Type B is 0.25 and the ratio for Type A is 0.125. A manual isolation is an appropriate action for chemicals that have low odor thresholds and are used at a plant. Revise Table 2 to include a fourth Control Room Type for low leakage with no automatic isolation. Some control rooms are designed to meet Type A criterion, except for automatic isolation. Note b should clarify the	Incorporate the proposed Table 2 provided in Attachment A.

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					criteria for such control rooms.	
14.	6	C	2	1	The DG states: "Release events that have low probabilities (1E-6 or less) need not be considered further ....". Additional guidance is required. It is not clear what is meant by "release events." If this is just the probability of a toxic gas release occurring, then no licensee would be able to invoke the Risk Evaluation approach since the combined probability of a tank rupture or leak or valve failure would be well above 1E-6 per year (there have already been a number of such releases in the industry). Revise the "release event" to be defined as an event that involves the potential for a significant concentration in the control room. Therefore, the combined probability of having a release of sufficient size, wind direction towards the control room, adverse dispersion, high ambient temperatures causing rapid flashing/evaporation, etc. would have to be greater than 1E-6 per year to require consideration. (Note that it is assumed that the DG meant 10^{-6} per year, although no time period was specified.)	Incorporate the proposed change.
15.	6	C	2	1	The use of a specific risk cutoff point of $1x10^{-6}$ is more restrictive than previous NRC guidance. The Standard Review Plan 2.2.3, "Evaluation of Potential Accidents" (Rev 2-81) states: "Because of the difficulty of assigning accurate numerical values to the expected rate of unprecedented potential hazards...[of offsite events] ...judgement must be used as to the acceptability of the overall risk presented." This SRP also states, in relation to offsite events: "...because of the low probabilities of the events under consideration [offsite events], data are often not available to permit accurate calculation of probabilities. Accordingly, the expected rate of occurrence of potential exposures in excess of the 10 CFR 100 guidelines of approximately 10^{-6} per year is acceptable if, when combined with reasonable qualitative	Revise the text to incorporate the position permitted in Standard Review Plan 2.2.3, "Evaluation of Potential Accidents" (Rev 2-81).

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					arguments, the realistic probability can be shown to be lower." The basis for the previous NRC staff position remains valid. The previous SRP position should be reinstated in the revised Regulatory Guide.	
16.	6	C	2	1"	The phrase "since such events are not likely to result in an unacceptable level of risk" does not make sense.	Revise sentence to read: "Release events that have low probabilities (10^{-6} or less) need not be considered further for detailed evaluation because such low levels of risk are considered acceptable."
17.	7	C	3	--	Clarify Section 3 to state that the implementation of protective measures for a particular chemical species is not required if the detail evaluation of control room habitability shows that the highest instantaneous concentration predicted in the control room is below the toxic limits shown in Table 1.	Add clarifying text to the section.
18.	7	C	3.1	3	The "case-by-case basis" guidance for addressing uncommon chemicals could result in inconsistent application of the regulatory guide, (e.g., in some cases, use of the odor threshold as the IDLH, for a calculation basis, would be unnecessarily conservative).	Change the second sentence in Paragraph 3 to read; "The human detection threshold (such as the odor threshold), or TLV or STEL limits, may be used when no detection instruments are available in the control room for the hazardous chemical under consideration."
19.	8	C	3.2	--	If procedures are in effect to don respiratory protective equipment within 2 minutes for a *maximum concentration* accident, there is no need to analyze a *maximum concentration-duration* accident.	Delete the criteria to analysis *a maximum concentration-duration* accident.
20.	9	C	3.2	4	Paragraph 6 of Section 3.2, states: "In the evaluation of control room habitability, it may also be appropriate to consider releases coincident with the radiological consequences of a design basis loss-of-coolant accident."	The section should be reworded to state that the effects of a seismic event do not need to be considered coincident with a radiological release event. Therefore, a seismically induced toxic gas release event need not be considered

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					Typically plants are not designed for coincidental occurrence of two independent design basis events, unless the probability of both occurring simultaneously meets the risk parameters in Section 2, or one event is a result of the other. It is recommended that the last sentence "In the evaluation - - - consider releases coincident with the radiological consequences of a design basis LOCA" should be deleted. This may be difficult to accomplish especially if the protective measures implemented in response to both types of accidents are mutually exclusive (i.e., isolation without make-up in the event of a toxic gas release versus isolation with filtered make-up air in the event of a LOCA). This would be a change of the existing licensing basis and is not appropriate without a backfitting evaluation per 10 CFR 50.109.	
21.	9	C	3.3	--	The guidance implies that the EXTRAN module of the HABIT code allows temporal as well as spatial variations in release terms and concentrations. This is an inaccurate description of EXTRAN. EXTRAN handles temporal variations in release rates only for those portion of liquid releases that are assumed to form a pool at the base of the tank. The model calculates time-varying evaporation rates for this type of release. Otherwise, EXTRAN is a steady-state release model; that is, the release rate for leaking tank scenarios is held constant at the entered value until the tank is empty. Likewise, EXTRAN does not allow either temporal or spatial variations in concentrations. It is a steady-state diffusion model; that is, one set of meteorological conditions are entered which are assumed to be constant in time and space as the plume's puffs move downwind. In addition, the guidance states atmospheric dispersion models other than EXTRAN can be used for dispersion calculations if they are capable of calculating spatial and temporal variation in release terms and concentration, simulating wake effect, and simulating near-field effect. As stated above, except for releases resulting in evaporating pools, EXTRAN is not capable of calculating spatial and temporal variations in release terms and concentrations. As such, it is unreasonable to expect other models to have this capability. Likewise, since many of the chemicals modeled	Revise the guidance text to make it technically correct.

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					can be up to five miles away, it seems unreasonable to require alternative models to unconditionally simulate wake and near-field effects for these releases. Furthermore, 3.3 inaccurately states that EXTRAN assumes uniform mixing between the ground and the elevation of the fresh air intake, which DG-1087 assumed to be 15 meters. In reality, EXTRAN assumes Gaussian dispersion in the vertical direction and the user supplies the height of the air intake as input to the model.	
22.	9	C	3.3	--	The option to consider buoyancy effects for lighter-than-air gases should permitted.	Allow consideration for additional dispersion of gases less dense than air.
23.	9	C	3.3	--	Use of wind tunnel testing results for dispersion estimates in lieu of models should be permitted on a case-by-case basis.	Revise the text to permit use of wind tunnel testing results for dispersion estimates in lieu of models on a case-by-case basis.
24.	10	C	3.4	2	The paragraph refers to "outside air." The term should be clarified.	Revise "outside air' to 'atmospheric ambient air". Otherwise the outside may be interpreted as adjacent rooms internal to a building.
25.	10	C	3.4	2	Delete "chlorine-"; leaving the sentence to imply any type of contaminant.	Incorporate proposed change.
26.	11	C	3.4	1	Delete this paragraph since it provides superfluous information about chlorine.	Delete this paragraph
27.	11	C	3.4	6	The phrase "for the particulate considered" should be deleted so the sentence refers generally to removal system.	Incorporate the proposed change.
28.	11	C	4	--	Delete "automatically" in Item 2, since manual isolation may also be acceptable in case of some of the control rooms.	Incorporate the proposed change.
29.	11	C	4	--	Item 3 is not addressed in the following sections, unlike the statement "guidance for each of the above design features is provided below."	Add a section for "Control Room Leak Tightness."
30.	11	C	4.1	--	The regulatory guide criteria should be that the control room is habitable, not that it is prevented from becoming contaminated. This section should be rewritten to require maintaining the concentration less than the toxic limit	Rewrite section to reflect the point that the control room is to be habitable.

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					discussed in section 3.1 rather than prevention of contamination (3rd, 4th, and 5th paragraphs).	
31.	11	C	4.1	--	Seismic qualification of detectors is unnecessary if chemicals that may affect the control room are stored in seismically qualified containers. Environmental qualification of the detectors is unnecessary; the detectors are acceptable as long as they are designed/purchased for their expected environment.	Revise first paragraph of 4.1 to read: "The detection system should be able to detect and signal a concentration level that is significantly lower than the IDLH level. For chlorine, a concentration level of 5 ppm is recommended. The detection system should be shown capable of operating in the expected environments. The system should also be designated as Seismic Category I, if stored chemicals having an impact on the control room (i.e., result in exceeding toxicity limits to control room personnel), are not stored or contained in a Seismic Category I container or structure. The manufacturer's recommendations for maintenance, testing, and calibration are acceptable provided they follow sound engineering practices and are compatible with the proposed application."
32.	11	C	4.1 & 4.2	5 & 1	Section 4.1 states that local detectors (control room intake) should have a very short isolation time such that the isolation damper closes before the gas gets from the detector to the damper. Section 4.2 specifies that the isolation time in most cases should be less than 10 seconds. These requirements are impractical and unnecessary. There are five factors that affect the time for a hazardous chemical traveling from the intake to the control room and the subsequent closure of the dampers. These are: ▪ The time for the intake concentration to reach a concentration that would cause an alarm/trip signal; this could take over 10 seconds. ▪ The time for the activity in the intake to reach the chlorine detector as the detector relies on an offline sample; this is typically about 2 seconds. ▪ The time for the sensor to respond to a given	Delete any specifics on isolation time.

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					concentration and provide a high alarm signal. This is dependent on the assumed concentration. At very high concentrations, this may only require a couple seconds. However, at a concentration corresponding to the alarm setpoint, which is typically near the low threshold of the detector, this could take over 10 seconds. ▪ The time to convert the high alarm signal to a damper trip signal. This typically includes a time delay built into the software to prevent trips from spurious electrical signals. Other processing time delays would be insignificant compared to this built-in delay, which is typically 2 seconds. ▪ The time for the dampers to close, which is typically 2 to 5 seconds. Therefore, 20 to 40 seconds may elapse from plume arrival to the damper closure. Since it typically takes only a few seconds for the gas to get from the sample location to the isolation damper, there is likely to be a number of seconds of gas intake via normal ventilation prior to isolation. This is acceptable provided the calculated control room concentration remains within the acceptance criteria at 2 minutes post detection.	
33.	5 & 7	C	Table 1 & 3.1	1	Section 3.1, states that 10 ppm limit is based on the 30 minute immediately dangerous to life and health (IDLH) values from NIOSH. It then assumes for control room habitability purposes, that the operators would be exposed to this toxicity limit for 2 minutes. By this time the operator would have dressed in respiratory protective equipment. Since this evaluates a transient condition following a spill, the control room concentration is increasing. The average concentration during these two minutes will be significantly less than the toxicity limit. Credit for lower concentration should be considered as part of the acceptance criteria. NUREG/CR-5669, "Evaluation of Exposure Limits to Toxic Gases for Nuclear Reactor Control Room Operators" states the following: "Our preliminary recommendations for two minute exposure limits and the rationale for them were discussed and a consensus was reached on the final recommendations.	Revise the chlorine limit listed in Table 1 from 10 ppm to 30 ppm. Change references to "IDLH concentration levels" throughout the Draft Guide to "toxicity limits."

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					These recommendations are: 1) ammonia - 300 ppm; 2) chlorine - 30 ppm; 3) Halon 1301 - 5%; Halon 1211 - 2%; and 4) Sulfur dioxide - 100 ppm. Control room operators should be able to tolerate two minute exposures to these levels, donning fresh-air masks, and continue to operate the reactor if the toxic material is eliminated, or safely shut down the reactor if the toxic gas remains." NUREG/CR-5669 supporting documentation is based on recent peer review documentation (Malhum and Sasser, 1991) performed for the NRC. NUREG/CR-6624 states that, compared to the IDLH, the Emergency Response Planning Guidelines (ERPG) were developed with more vigor in terms of documentation, peer review and use of current primary references. They were also derived directly from the toxicological data without the explicit use of safety factors. The ERPG-3 is defined as "the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects." The ERPG-3 toxicity limit for Chlorine in 20 ppm. Imposition of the more restrictive limit of 10 ppm for chlorine in lieu of the current limit of 15 ppm or proposed limit of 30 ppm invalidates the conclusions of the NRC Cost/Benefit Analysis. Since chlorine is one of the more widely used chemicals, a more restrictive limit has a fair probability of requiring more restrictive controls, such as lower trip setpoints for the chlorine monitors and hence more spurious alarms. These more restrictive requirements would not result in any increased safety benefit.	
34.	12	C	4.1	4	Delete "automatically" since manual isolation may be acceptable.	Incorporate the proposed change.
35.	12	C	4.2	4	Delete this paragraph. The first sentence can be moved to the top of the section as: " The capability to manually isolate the control room should be provided. The capability to automatically close the air ducts of the control room..."	Delete paragraph.

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					The second sentence is adequately covered by section 5. The last sentence seems to imply two independent DBEs (one to cause initial isolation of the control room and a second toxic chemical release) and a requirement for a toxic chemical cleanup filter or system. Neither of these is a requirement nor are they consistent with most current control room designs.	
36.	12	C	4.2	4	Delete chlorine specific reference. This should not be limited to "onsite chlorine storage."	Delete chlorine specific reference
37.	12	C	4.3	1	Delete "including chlorine," since hazardous chemical is all-inclusive.	Incorporate the proposed change.
38.	12	C	4.3	2	The phrase, "meet the single-failure criterion" lacks clarity. Redundancy could mean respirators = 2 x people. Separation could mean two separate storage cabinets. Protective clothing failure could mean two layers of clothing. Duration of a toxic chemical incident could mean that there is a long-term period requiring passive failures. A single toxic event should not prevent the utilization of these systems to respond to the event. Using single-failure criterion invokes other design considerations to go beyond the mere impact from a single toxic event.	Revise to read: "Breathing apparatus, air supply equipment, and protective clothing should meet the criterion that a single toxic gas event would not render these systems non functional, i.e., physical separation to accomplish decoupling of the effects of unsafe environmental factors resulting from the event and physical constraints."
39.	13	D	--	--	The Implementation Section states: "Except in those cases in which an applicant or licensee proposes an acceptable alternative for complying with specified portions of the NRC's regulations, the method described in the revised guide reflecting public comments will be used in evaluation of applications to renew operating licenses." This statement should be deleted. As written the NRC is imposing a new requirement on license renewal applicants without justification. The first principle of license renewal is that, with the possible exception of certain aging effects, the current licensing basis is adequate and carries forward into the period of extended operation. This draft regulatory guide is a proposed Revision 1 to Regulatory Guides 1.78, and incorporates parts of RG 1.95.	Delete from Section D implementation considerations addressing "applications to renew operating license."

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					A licensee's current licensing basis may include a commitment to implement Revision 0 of RG 1.78 and Revision 1 of 1.95. The existing language implies that a renewal applicant would need to revise the licensing basis to adopt the revised regulatory guide. Furthermore, the revised regulatory guide does not address aging issues, and is therefore outside the scope of license renewal activities controlled by 10 CFR 50.54.	
40.	13	C	5.0	--	Many of the descriptions do not appear to be in the area of "emergency planning," e.g., instrument sensitivity, maintenance, calibration, sensitivity, technical specification limits on availability, etc. Instrument sensitivity, technical specification limitations, maintenance, testing, calibration, etc. does not belong in the EP procedures. This type of information belongs in other procedures and programs such as the PM program, and the calibration program, etc.	The fourth sentence should be modified to read: " Described the instrumentation provided for the detection of hazardous chemical releases and the actions to be taken when the instrumentation go into the alarm or alert mode."
41.	16	App. A & Table 2	--	--	Whether or not the boiling point of the chemical is less than or greater than the ambient temperature is a significant factor that should be considered in determining the weight threshold. For example, a significantly smaller fraction of sulfuric acid will vaporize compared to chlorine since sulfuric acid is a liquid at ambient conditions.	An adjustment factor should be provided for chemicals that are a liquid at ambient conditions.

Proposed Table 2 Identified in Comment Number 13

TABLE 2

WEIGHTS OF HAZARDOUS CHEMICALS THAT REQUIRE CONSIDERATION IN CONTROL ROOM EVALUATIONS (FOR A 50 mg/m ^{3} TOXICITY LIMIT AND STABLE METEOROLOGICAL CONDITIONS)

Distance From Control Room (miles)[a]	Weight (1000 lb)		
	Type A Control Room [b]	Type B Control Room [b]	Type C Control Room [b]
0.3 to 0.5	9	2.25	0.11
0.5 to 0.7	35	8.75	0.43
0.7 to 1.0	120	30	1.5
1 to 2	270	67.52	3.37
2 to 3	1300	325	16.25
3 to 4	3700	925	46.25
4 to 5	8800	2200	110

[a] All hazardous chemicals present in weights greater than 100 lb within 0.3 mile of the control room should be considered in a control room evaluation.

[b] Control room types: Type A- A "tight" control room has low-leakage construction features and the capability to detect at the fresh-air intake those hazardous chemicals stored or transported near the site. Detection of the chemical and automatic isolation of the control room are assumed to have occurred. An air exchange rate of 0.015 per hour is assumed (0.015 of the control room air by volume is replaced with outside air in one hour). The control room volume is defined as the volume of the entire zone serviced by the control room ventilation system.

Type B- Same as Type A, but with an air exchange rate of 0.06 per hour. This value is typical of a control room with normal leakage construction features. This type control room is also typical of a control room where manual isolation is used.

Type C- A control room that has not been isolated, has no provision for detecting hazardous chemicals, and has an air exchange rate of 1.2 per hour.