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May 25, 1983
4410-83-L-0092

TMI Program Office
Attn: Dr. B. J. Snyder, Program Director
US Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
General Project Design Criteria

Attached for your acceptance are GPUNC's responses to your comments on the subject document provided by your letter of January 21, 1983. These resolutions, if acceptable, will be incorporated into Revision 4 of the General Project Design Criteria.

Please contact Mr. J. J. Byrne of my staff if you have any questions.

Sincerely,

B. K. Kanga

B. K. Kanga
Director, TMI-2

BKK/JJB/jep

Attachment

CC: Mr. L. H. Barrett, Deputy Program Director - TMI Program Office

D009
1/1

General Project Design Criteria
Responses Proposed to NRC Comments

Section	
	Comment
2.5	Safety-related should not be limited to permanent plant features. The Mini-Decay Heat Removal System (MDHRS) has operability requirements in the Proposed Technical Specifications and should be interpreted as being safety-related. Also, future systems may be installed that are not permanent but are safety-related. Delete the word permanent.
	Resolution
	Comment will be incorporated in Revision 4 of the General Project Design Criteria.
2.6	Comment
	Items that assure the integrity of the Reactor Coolant Pressure Boundary but are not required to maintain the plant in a safe shutdown condition should be item "d". Examples would be the Standby Pressure Control System and Submerged Demineralizer System when in the Reactor Coolant System processing mode.
	Resolution
	The Standby Pressure Control System (SPCS) and the Submerged Demineralizer System (SDS) do not assure the Reactor Coolant Pressure Boundary. The SPCS and the SDS are indirectly connected to the Reactor Coolant System (RCS) through the Make-Up and Purification Demineralizer System. It is the safety-related isolation valves of the Make-Up and Purification System that assure the integrity of the Reactor Coolant Pressure Boundary for all three systems.
	Items that assure the integrity of the Reactor Coolant Boundary are classified "Safety-Related" per Section 2.5 of the General Project Design Criteria. This criteria would take precedence over the addition proposed in the comment. No change is required to General Project Design Criteria.
3.2.7	Comment
	It was agreed per your Documentation of Verbal Communication Form dated August 31, 1982 (Byrne to Lynch), that words should be added to this section stating that the river flow rate for assessing actual releases from TMI-2 should be obtained exclusively from the USGS gaging station at Harrisburg, PA. This requirement should be added as paragraph 3.2.8.
	Resolution
	GPUNC agrees that the river flow rate for assessing actual releases from TMI-2 should be obtained from the USGS gaging station at Harrisburg, PA, as specified in the Offsite Dose Calculation

Manual. However, this requirement is not appropriate for a Design Criteria as design is based on bounding flow conditions not actual conditions at the time of a release; hence, this requirement has not been included in the General Project Design Criteria.

3.4.1 (1) Comment

The Appendix R criteria should be retained. Exemption has not, to date, been granted and even when approved, it will apply only to certain requirements of Appendix R.

Resolution

Comments will be addressed by incorporating the following in Section 3.4.1 (1) of the General Project Design Criteria, Revision 4: 10 CFR 50, Appendix R, Fire Protection Program for Nuclear Power Facilities Operating prior to January 1, 1979. (Exemption has been requested for Sections III G and III J per GPUNC letter 4400-82-L-0102 dated June 15, 1982, J. J. Barton to B. J. Snyder, to the effect that these sections of Appendix R will not be implemented during the recovery effort.)

Table 1 Comment

Item 3 Justify the deletion of Regulatory Guide 1.26 (Quality Group Classifications).

Item 4 Justify the deletion of Regulatory Guide 1.29 (Seismic Design Classification).

Resolution

Regulatory Guides 1.26 and 1.29 are included in the list following the "Note:" near the end of Table 1. This note currently refers to the "Bechtel Nuclear Quality Assurance Manual (NQAM)" for guidance. In Revision 4 of the General Project Design Criteria, this reference will be changed to the "Recovery Quality Assurance Plan for TMI Unit 2" and Regulatory Guides 1.26 and 1.29 will be retained in the list following the note. Regulatory Guide 1.63, which is also currently in the list, will be omitted in Revision 4 of the General Project Design Criteria, as it is not addressed in the Recovery Quality Assurance Plan for TMI Unit 2. Additional reasons for omitting Regulatory Guide 1.63 from the General Project Design Criteria are given in the resolution of Item 7.

Item 7 Comment

Justify the deletion of Regulatory Guide 1.63 (Electrical Penetration Assemblies in Containment . . .).

Resolution

Based on the TMI-2 FSAR, low voltage (600V) penetrations are subject to the requirements of IEEE 317, 1971. This standard does not require testing or design to meet the single failure criteria that is called for in later IEEE 317 revisions (1972 and 1976). (The single failure criteria for penetrations requires that the penetration remain leaktight under the maximum possible short circuit for a duration equal to the time it takes for the backup protective device to operate assuming the primary protective device has failed.) The FSAR does not require the penetrations and their circuits to meet Regulatory Guide 1.63 which invokes the later IEEE 317 revisions and single failure criteria for maximum short circuits.

Based on the foregoing, it is our conclusion that Regulatory Guide 1.63 does not apply to the Recovery Program at TMI-2 and should not be included in the General Project Design Criteria.

Item 10 Comment

Justify the deletion of Regulatory Guide 1.111 (Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents. . .).

Resolution

Section 3.2.6 of the General Project Design Criteria includes the following: "The site meteorology used for these analyses will be based on that contained in the ODCM."

The tables in the Offsite Dose Calculation Manual (ODCM) are being used since they contain site specific data. For those cases where the tables may be inappropriate, the ODCM specifies that Regulatory Guide 1.111 be utilized. For these reasons direct reference to Regulatory Guide 1.111 was deleted from the General Project Design Criteria.

BECHTEL

GPU SERVICE CORPORATION

THREE MILE ISLAND - UNIT 2

RECOVERY FACILITIES

DESIGN CRITERIA DOCUMENTS

COVER SHEET

JOB NO: 13587 **DISCIPLINE:** General Section

3	[illegible]	Revised as Noted and Issued for Use	RBH	ETS	[illegible]	—
2	8/20/82	Revised as Noted and Issued for Use Upon GPUN Approval	RBH	ETS	RW	—
1	7/21/81	Revised as Noted and Issued for Use Upon GPUSC Approval	ETS	WHH	RW	
0	12/22/80	Issued for Use Upon GPUSC Approval	ETS	WHH	RW	KL
REV. NO.	**DATE**	**REVISION DESCRIPTION**	**ORIGINATOR**	**GROUP SUPV.**	**PROJECT ENG.**	**GPUSC**
				APPROVAL		

Dup 8211170221

SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.	SHEET	LATEST REV.
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DESIGN CRITERIA DOCUMENTS
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1.0 GENERAL

1.1 INTRODUCTION

1.1.1 This design criteria is applicable only to those facilities and activities for which Bechtel has design responsibility.

1.1.2 This section of the General Project Design Criteria contains information common to all disciplines.

1.1.3 The General Project Design Criteria is applicable to facilities designed by Bechtel for the TMI-2 recovery effort. The criteria presented herein are not applicable to the rebuilding of the unit for power generation. The General Project Design Criteria is to be applied to each facility by reference in each facility's specific design criteria document. Any conflicts between the general and specific criteria must be identified in the specific design criteria document.

1.1.4 Existing plant systems interfacing recovery systems need not be upgraded to current codes and standards applicable to the recovery systems and associated tie-ins.

1.1.5 Recovery project designs pertaining to systems, structures, and components classified as safety related or important to safety shall incorporate pertinent requirements from applicable NRC Regulatory Guides listed in the Project Nuclear Quality Assurance Manual. Systems, structures, and components to which the Project Nuclear Quality Assurance Program applies are identified in the Project Q-List, document number 13587-2-G20-100, and the Project NSQ-List, document number 13587-2-G20-101.

1.2 PROJECT OBJECTIVES

1.2.1 There are four main objectives of the TMI-2 recovery. These objectives are:

1) Decontaminate the reactor building and equipment contained therein

2) Remove and store the reactor core

3) Decontaminate the Reactor Coolant System

4) Process radioactive waste

1.2.2 In order to achieve these objectives additional facilities and systems will be required. Some of these facilities will be permanent in nature; others will only be for the recovery of the unit and will be removed prior to the unit returning to service.

1.2.3 In addition to the facilities and systems to be provided, there will be plans developed for many of the activities required to achieve the project objectives.

1.3 PROJECT CONCERNS

1.3.1 There are two major concerns that directly influence the design of the facilities and the operations required for the cleanup of TMI-2. These concerns are:

1) Public health and safety

2) Occupational health and safety

2.0 DEFINITIONS

2.1 SAFE SHUTDOWN EARTHQUAKE (SSE)

The safe shutdown earthquake is that earthquake which is based upon an evaluation of the maximum earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material. It is that earthquake which produces the maximum vibratory ground motion for which certain structures, systems, and components are designed to remain functional.

2.2 OPERATING BASIS EARTHQUAKE (OBE)

The operating basis earthquake is that earthquake which, considering the regional and local geology and seismology and specific characteristics of local subsurface material, could reasonably be expected to affect the plant site during the operating life of the plant; it is that earthquake which produces the vibratory ground motion for which those features of the nuclear power plant necessary for continued operation without undue risk to the health and safety of the public are designed to remain functional.

2.3 SEISMIC CATEGORY I/NON-SEISMIC CATEGORY I

Seismic Category I structures, systems, and components for seismic design purposes are defined as those structures, systems, and components important to safety that are designed to remain functional in the event of a safe shutdown earthquake. Items that are both Seismic Category I and important to safety are those structures, systems, and components:

a. that are permanent plant components necessary to ensure the integrity of the reactor coolant pressure boundary,

b. that are necessary to ensure the capability to shut down the reactor or to maintain the reactor in a safe shutdown condition (i.e., maintain subcriticality and decay heat removal), or to prevent a condition or event that could result in a return to nuclear criticality of fuel inside or outside the reactor vessel, or 2

c. whose failure could result in potential offsite exposures comparable to the guideline values of 10 CFR Part 100. (Note: for the purpose of TMI-2 recovery only, no events or accidents have been postulated which could result in such offsite exposures. Therefore, it is not expected that the guideline values of 10 CFR Part 100 will be invoked for design or operational-related activities during TMI Unit 2 recovery.) 2

Non-Seismic Category I structures, systems, and components are those whose failure would not result in the release of radioactivity in excess of 10 CFR 100 limits nor prevent reactor safe shutdown.

2.4 DESIGN BASES

Design bases are postulated events/conditions or combinations of events/conditions which establish the function and structural requirements of a structure, system, or component.

2.5 SAFETY-RELATED FEATURES

Safety-related features are those permanent plant features necessary to assure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition, or the capability to prevent or mitigate the consequences of accidents which could result in offsite exposures comparable to the guideline exposures of 10 CFR Part 100. 2

2.6 IMPORTANT TO SAFETY

Features important to safety are those structures, systems, and components that are safety related plus those:

a. Which are employed for radioactive waste management (as defined in Regulatory Guide 1.143)

b. Which are required to prevent fires or mitigate the consequences of fires in areas which contain safety-related components or significant quantities of radioactive materials (Note 1)

c. Whose failure during a safe shutdown earthquake could reduce the functioning of a safety-related plant feature.

3.0 <u>LICENSING</u>

3.1 INTRODUCTION

Recovery operations, activities, and work tasks will be performed within the existing TMI-2 Technical Specifications and in accordance with applicable NRC Regulatory Guides. Specific design criteria shall identify applicable Technical Specifications and Regulatory Guide requirements.

Note 1: Defined as the quantity of radioactive materials which, in case of fire in the facility, could cause an airborne release to the environment which could exceed the limits of 10 CFR Part 20, Appendix B, Table II, Column 1.

3.2 BASIC CRITERIA

3.2.1 Facilities and systems constructed to support the recovery shall not be designed to requirements based on the hypothesis of accidents at power.

3.2.2 Facilities and systems constructed for the life of the plant shall be designed to the applicable requirements specified in Chapter 3 of the TMI-2 FSAR in addition to the requirements necessary for the recovery. The latest applicable codes and standards will be employed.

3.2.3 To the extent practicable, facilities and services constructed for the recovery effort will be separate from existing facilities and services.

Where it is not practicable to separate the facilities and services constructed for the recovery effort from existing facilities and services, design requirements will be imposed as necessary in order not to compromise the original design bases of the existing facilities and services. These requirements shall be identified in the specific design criteria for the facility and service to be provided. The following will serve as guidelines:

a. Where piping and cables to be left in place when the unit is returned to service are routed through buildings containing seismic Category I piping and cables, the failure of the non-seismic Category I components shall not result in the failure of the seismic Category I components as a result of a seismic event.

b. Where services to support recovery must tie into existing plant services, isolation provisions commensurate with the design requirements of the existing plant service shall be provided.

c. Where piping to be left in place when the unit is returned to service is routed through buildings containing safety-related equipment, the requirements for high energy line break and pipe whip specified in the TMI-2 FSAR shall be satisfied as applicable.

d. Where cables to be left in place when the unit is returned to service are routed through buildings containing safety-related equipment, the requirements for separation and fire protection specified in the TMI-2 FSAR and TMI-2 Fire Protection Reevaluation shall be satisfied as applicable.

3.2.4 Facilities constructed to support the recovery effort shall not have as part of their design basis the severe natural phenomena for which the plant was originally designed. Included under "severe natural phenomena" are:

a. Safe shutdown earthquake

b. Tornado and tornado missile

c. Maximum flood.

The facilities will be designed to ensure that there will be no loss of required function of existing adjacent safety-related structures, equipment, or systems should these events occur.

These facilities shall be designed for the more probable natural phenomena as called for by area building code requirements.

3.2.5 Facilities constructed to support the recovery shall not be designed for man-made events not resulting from recovery activities. Included under "man-made events not resulting from recovery activities" are:

a. Transportation accidents occurring offsite

b. Airplane crashes

c. Release of toxic chemicals.

The facilities will be designed to ensure that there will be no loss of required function of existing adjacent safety-related structures, equipment, or systems should these events occur.

3.2.6 Environmental analyses will be performed in accordance with the methodology permitted by the Three Mile Island Nuclear Generating Station Offsite Dose Calculation Manual (ODCM). The site meteorology 3
used for these analyses will be based on that contained in the ODCM.

3.2.7 For purposes of design evolution, the river characteristics specified in Chapter 2 of the TMI-2 FSAR shall be used. River water quality data is that specified in the Plant Design and Mechanical Design Criteria, 13587-2-M01-100.

3.3 DESIGN CONDITIONS

This section defines the spectra of operating conditions to which the activities required for the recovery shall be designed. Also provided are the general design requirements for these operating conditions.

3.3.1 Condition I - Normal Operation

Condition I occurrences are those that can reasonably be expected to occur during the recovery activities. Examples of Condition I occurrences are:

a. Those that are normally expected to occur during the recovery including contamination/decontamination resulting from routine activities.

b. Operations with equipment out of service or undergoing tests within operational limitations.

Condition I occurrences shall be accommodated with only routine action required to prevent an unplanned release of radioactive materials in effluents to unrestricted areas.

3.3.2 Condition II - Incidents of Moderate Frequency

Condition II occurrences are those any one of which may reasonably be expected to occur during a calendar year and which could result in a release of radioactive material requiring additional support personnel and/or equipment to control. Examples of Condition II occurrences are:

a. Loss of electrical power

b. Minor leakage from systems installed to support the recovery

c. Inadvertent actuation of a single active component in a system installed to support the recovery

d. Single error by an operator engaged in a recovery activity

e. Single active failure of a component (taken as the initiating event) in a system installed to support the recovery

Condition II occurrences shall be accommodated with, at most, a cessation of activities with the capability of resuming the activities after corrective action. Any release of radioactive materials in effluents to unrestricted areas shall be in conformance with Paragraph 20.1 of 10 CFR Part 20, "Standards for Protection Against Radiation."

3.3.3 Condition III - Infrequent Incidents

Condition III occurrences are those which are not expected to occur but are assumed to occur during the lifetime of the recovery effort and could result in a significant release of radioactive material. Examples of Condition III occurrences are:

a. Rupture of any tank utilized for the recovery effort

b. Pipe break in a system installed to support the recovery

c. Fire in an area where recovery activities occur

d. An operating basis earthquake (OBE).

e. Fuel handling accident in the reactor building (Note 2).

Condition III occurrences may result in damage to recovery facilities sufficient to preclude resumption of recovery activities for a considerable time. The release of radioactive material in effluents to unrestricted areas may exceed the guidelines of 10 CFR Part 20, "Standards for Protection Against Radiation," but shall not be sufficient to interrupt or restrict public use of those areas beyond the exclusion radius.

Note 2: The source term for the postulated occurrence is based on assuming the assembly with the peak inventory of radioactive material in the TMI-2 core is intact. The burnup is based on exact power history. Credit is taken for a decay period of two years or more. |1

3.4 REGULATORY REQUIREMENTS

3.4.1 Code of Federal Regulations

The facilities and activities associated with the recovery shall satisfy the following:

a. 10 CFR Part 20, Paragraph 20.103, Exposure of Individuals to Concentrations of Radioactive Materials in Air in Restricted Areas

b. 10 CFR Part 20, Paragraph 20.105, Permissible Levels of Radiation in Unrestricted Areas

c. 10 CFR Part 20, Paragraph 20.106, Radioactivity in Effluents to Unrestricted Areas

d. 10 CFR Part 50, Paragraph 50.34a, Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents - Nuclear Power Reactors

e. 10 CFR Part 50, Paragraph 50.36a, Technical Specifications on Effluents from Nuclear Power Reactors

f. 10 CFR Part 50, Appendix A, General Design Criteria for Nuclear Power Plants

g. 10 CFR Part 50, Appendix I, Numerical Guides for Design Objectives and Limiting Conditions for Operations to Meet the Criterion "As Low As Is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, as specified by Appendix R of the Final Programmatic Environmental Impact Statement and incorporated into the TMI-2 operating license by Amendment No. 16

h. 10 CFR Part 100, Reactor Site Criteria

i. 29 CFR Part 1910, Occupational Safety and Health Standards (Department of Labor Regulations)

j. 40 CFR Part 190, Uranium Fuel Cycle Standard (Environmental Protection Agency Regulations)

k. 49 CFR Part 173, Shippers-General Requirements for Shipments and Packagings (Department of Transportation Regulations)

l. Deleted 3

m. 40 CFR Parts 260 through 265, Hazardous Waste Regulations (Environmental Protection Agency Regulations)

3.4.2 Regulatory Guides

Table 1 lists many of the regulatory guides which may be applicable to individual facility or system design. This table and other regulatory guides shall be reviewed and any regulatory guides to be implemented shall be included as part of the specific design criteria for the associated facility or system.

3.4.3 Standard Review Plans (SRPs)

The following SRPs and Branch Technical Positions shall be reviewed and the guidance provided used as applicable in designing the facilities and activities to support the recovery.

a. SRP 11.2, Liquid Waste Management Systems, Rev. 1

b. SRP 11.3, Gaseous Waste Management Systems, Rev. 1

c. SRP 11.4, Solid Waste Management Systems, Rev. 1

d. SRP 15.7.3, Postulated Radioactive Releases Due to Liquid Containing Tank Failures, Rev. 1

e. Appendix A to Branch Technical Position APCSB 9.5-1, Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976 (August 23, 1976) 3

f. Branch Technical Position ETSB 11-3, Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Plants, Rev. 1

3.4.4 State Regulations

The facilities and activities associated with the recovery shall satisfy the following: . .

Title 25, Environmental Resources; Chapter 75, Solid Waste Management (Pennsylvania Department of Environmental Resources Regulations)

3.5 INDUSTRY CODES AND STANDARDS

Applicable industry codes and standards are identified in the individual discipline design criteria.

3.6 SAFETY ASSESSMENT

A safety assessment will be performed for each facility and activity to be provided. This assessment shall include a review of the final design to ensure that the safety criteria have been satisfied. When the assessment reveals that the final design does not satisfy the safety criteria, design changes shall be made or administrative controls imposed.

4.0 ALARA DESIGN CRITERIA AND CONSIDERATIONS

The items listed in Table 2 form the basis for the TMI-2 Recovery Project ALARA program. During the design process, the applicable items shall be considered and incorporated into the design as appropriate.

2

TABLE 1

REGULATORY GUIDES

1. Reg. Guide 1.21 - Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquids and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants (Rev. 1, June 1974)

Discussion

This guide is applicable to the design of radiation monitoring systems in liquid and gaseous effluent paths and in the design of means for determining the total curie quantity and radionuclide composition of solid wastes shipped offsite with the following clarification.

(1) (Ref: Appendix A, Paragraph C) To preclude unnecessary radiation exposure to personnel, the curie and radionuclide determinations for solid radioactive waste shipped offsite will be performed to the extent and level required by Department of Transportation Regulations and 10 CFR Part 71, "Packaging of Radioactive Material." Additional sampling and analysis is not required.

2. Reg. Guide 1.25 - Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors (Rev. 0, March 1972)

Discussion

The assumptions of the guide may be used with the following exceptions or clarifications, in the analysis of the potential radiological consequences of a fuel handling accident.

(1) [Ref: Paragraph C.3.b(2)] Whole-body gamma doses and beta-skin doses are presented separately, as the dose from beta radiation of the whole body is negligible. The total dose to the skin is the sum of the beta-skin dose and the whole-body gamma dose.

(2) [Ref: Paragraph C.3.b(3)] Dose conversion factors are taken from Reg. Guide 1.109.

(3) (Ref: Paragraph C.1) The source term for the postulated fuel handling accident is based on assuming the assembly with the peak inventory of radiaoctive material in the TMI-2 core is intact. The burnup is based on exact power history. Credit is taken for a decay period of two years or more.

 2

TABLE 1 (Continued)

3. Deleted 2

4. Deleted

5. Reg. Guide 1.60 - Design Response Spectra for Seismic Design of Nuclear Power Plants (Rev. 1, December 1973)

Discussion

This guide is applicable to facilities housing radioactive waste management systems and subject to and as invoked by Reg. Guide 1.143.

6. Reg. Guide 1.61 - Damping Values for Seismic Design of Nuclear Power Plants (Rev. 0, October 1973)

Discussion

This guide is applicable to facilities housing radioactive waste management systems and subject to and as invoked by Reg. Guide 1.143.

7. Deleted |2

8. Reg. Guide 1.92 - Combining Modal Responses and Spatial Components in Seismic Response Analysis (Rev. 1, February 1976)

Discussion

This guide is applicable to facilities housing radioactive waste management systems and subject to and as invoked by Reg. Guide 1.143.

9. Reg. Guide 1.109 - Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I (Rev. 1, October 1977)

Discussion

The assumptions of Regulatory Guide 1.109 are followed in the analysis of annual doses to man from routine releases. |2

10. Deleted |2

11. Reg. Guide 1.112 - Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors (Rev. 0, April 1976)

Discussion

The applicable methods described in this guide may be used in calculating estimated releases from liquid waste processing systems.

TABLE 1 (Continued)

12. Reg. Guide 1.113 - Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I (Rev. 1, April 1977)

Discussion

The applicable methods described in this guide may be used in estimating aquatic dispersion of effluents.

13. Reg. Guide 1.132 - Site Investigations for Foundations of Nuclear Power Plants (Rev. 1, March 1979)

Discussion

Recognizing the site-sensitive aspects, the guidance provided by this guide may be used in the development of site investigation studies for foundations of facilities to be provided.

14. Reg. Guide 1.138 - Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants (Rev. 0, April 1976)

Discussion

Recognizing the site-sensitive aspects, the guidance provided by this guide may be used in the laboratory investigations of soils required by Reg. Guide 1.132.

15. Reg. Guide 1.140 - Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants (Rev. 1, October 1979)

Discussion

The detailed project position is under development. However, this guide is applicable to atmosphere cleanup systems and, in general, the guidance provided may be followed.

16. Reg. Guide 1.143 - Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants (Rev. 1, October 1979)

 2

TABLE 1 (Continued)

Discussion

This guide is applicable to systems and facilities that are associated with the control and management of liquid, gaseous, and solid radioactive waste. (Note: radioactive waste means those liquids, gases, or solids containing radioactive materials that by design or operating practice will be processed prior to final disposition.) 2

17. Reg. Guide 8.8 - Information Relevant to Ensuring That Occupational Radiation Exposure at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable (Rev. 3, June 1978)

Discussion

The design considerations, personnel qualifications, and plans and procedures for ensuring that occupational radiation exposures will be as low as is reasonably achievable are in accordance with Regulatory Guide 8.8 subject to the following clarifications or exceptions:

(1) (Ref: Paragraph C.2) The design features discussed in this paragraph are described in general terms which may permit several acceptable alternative designs for a particular application, e.g., different types or amounts of shielding.

(2) (Ref: Paragraph C.2.g) Airborne monitoring equipment will be provided in areas to which personnel normally have access and in which there is a potential for airborne radioactivity. In addition, area radiation monitors will be provided in areas to which personnel normally have access and where there is a potential for personnel unknowingly receiving high levels of radiation exposure (e.g., in excess of 10 CFR 20 limits) in a short period of time because of system failure or improper personnel action.

Note: For guidance on the following Regulatory Guides, consult the Bechtel Nuclear Quality Assurance Manual (NQAM).

1.26 QA Classifications and Standards for Water Stream and Radioactive Waste Containing Components of Nuclear Power Plants, Rev. 3, February 1976

1.29 Seismic Design Classification, Rev. 3, September 1978. 2

1.30 QA Requirements for the Installation, Inspection and Testing of Instrumentation and Electrical Equipment, August 11, 1972.

1.31 Control of Ferrite Content in Stainless Steel Weld Metal, Rev. 3, April 1978.

TABLE 1 (Continued)

1.37	QA Requirements for Cleaning of Fluid Systems and Associated Components of Water Cooled Nuclear Power Plants, March 16, 1973.
1.38	QA Requirements for Packaging, Shipping, Receiving, Storage and Handling of Items for Water Cooled Nuclear Power Plants, Rev. 2, May 1977.
1.39	Housekeeping Requirements for Water Cooled Nuclear Power Plants, Rev. 2, September 1977.
1.54	QA Requirements for Protective Coatings Applied to Water Cooled Nuclear Power Plants, June 1973. 2
1.63	Electric Penetration Assemblies in Containment Structure for Light Water Cooled Nuclear Power Plants, Rev. 2, July 1978.
1.94	QA Requirements for Installation, Inspection and Testing of Structural Steel and Concrete during the Construction Phase of Nuclear Power Plants, Rev. 1, April 1976.
1.116	QA Requirements for Installation, Inspection and Testing of Mechanical Equipment and Systems, Rev. 0-R, May 1977.

1 ↓

TABLE 2

ALARA ITEMS

Item No.	Description	Responsibilities	Note
Sec. A	FACILITY ARRANGEMENT		
1.0	Facility Layout		
1.1	Check that equipment with contact radiation levels of Zone III (see Table 4) or greater is separated from Zone II and lower areas by shielding or distance plus access barriers.	N	*
1.2	Check that major equipment which by design accumulates or concentrates radioactivity with Zone III or greater contact radiation levels is shielded or separated from adjacent active and passive equipment to meet the applicable radiation shielding criteria for adjacent areas.	N	*
1.3	Check that equipment compartments are arranged such that radiation zone differences between adjacent areas are minimized.	N	*
1.4	Check that personnel access control and traffic patterns are considered to minimize spread of contamination during all facility operating modes.	A, N, PD	*
1.5	Check that active components in clean (nonradioactive) services are not located in Radiation Zone III or greater.	N	*
1.6	Check that equipment subject to removal or replacement has adequate aisles or area access and built-in provisions (such as monorails, jib cranes, etc.) for removal.	PD	*
1.7	Check that access to components requiring frequent maintenance, in-service inspection, adjustment, etc. is from the lowest practicable radiation zone and not via a Zone V.	PD	*

1 ↓

TABLE 2 (Continued)

Item No.	Description	Responsibilities	Note
1.8	Check that adequate space and facilities are provided for clothing change stations outside contaminated areas.	A	
1.9	Check that all corridors and normal traffic areas are Zone I or II.	N, A	*
2.0	Equipment Location		
2.1	Check that adequate space is provided around equipment to allow ease of maintenance.	PD, CS	
2.2	Check that equipment maintenance envelopes include estimated size of rigging requirements and temporary shielding, if required.	PD	
2.3	Check that laydown area requirements for equipment are available.	PD	*
2.4	Check that equipment which requires routine maintenance, service, testing, or inspection, such as instruments, sample stations, or rotating components, are located to provide maximum direct access.	PD, CS	*
2.5	Check that the clear space for doorways is a minimum of 3 feet by 7 feet and that there is adequate access for personnel, tools, and component removal.	A, PD	*
2.6	Check that equipment manways are readily accessible.	PD	
2.7	Check that high radiation equipment is located such that interconnecting high radiation piping is minimized.	PD	
3.0	Specific Component Layout		
3.1	Filters		
	Check that adequate space is provided for semi-remote	PD	*

1 ↓

TABLE 2 (Continued)

Item No.	Description	Responsibilities	Note
	removal, cask loading, and transporting spent radioactive filter cartridges to the solid radwaste area.		
3.2	Pumps		
3.2.1	Check that small pumps are oriented in a manner that allows easy removal from the area.	PD	
3.2.2	Check that adequate access is provided for pump seal replacement.	PD	
3.3	Tanks		
3.3.1	Check that direct access and removal space is provided for motors of tank agitators.	PD	*
3.3.2	Check that direct access to active components or manways is provided into the upper levels of tank rooms as well as the lower elevations.	PD	*
3.3.3	Check that adequate space is provided for tank internals cleaning operations.	PD	
3.4	Evaporators		
3.4.1	Check that concentrates and distillate components are adequately separated.	PD	
3.4.2	Check that components which accumulate radioactivity or crud, such as heating tubes, are separated from active components such as valves.	PD, N	
3.4.3	Check that adequate space is provided to allow uncomplicated removal of heating tube bundles.	PD	
3.5	Sample Stations		
3.5.1	Check that sample stations for routine sampling of process fluids are separated by shielding or distance from other radioactive components to Zone II.	PD, N, CS	

1 ↓

TABLE 2 (Continued)

Item No.	Description	Responsibilities	Note
3.5.2	Check that local ventilation (e.g., a hood) is provided at sample stations containing radioactive materials.	PD, N, CS	
3.6	Ventilation System Components		
3.6.1	Check that ventilation fans and filters are provided with adequate access space to permit servicing.	PD	
3.6.2	Check that outside air supply and building exhaust system components are in areas no greater than Zone II.	PD	
3.6.3	Check that general ventilation flow is from areas of potential (or actual) low contamination to areas of potential (or actual) high contamination.	PD	
3.7	Instruments		
3.7.1	Check that instruments which require periodic attention are located in Zone II (or lower) areas whenever possible.	CS	
3.7.2	If instruments must be located in Zone III or greater, check that they are mounted so that they are readily accessible for maintenance and calibration and are easily removable to a lower radiation zone for extended servicing or calibration.	PD, CS	
3.7.3	If control valves must be located in Zone IV or greater, check that appurtenances such as E/P converters, airsets, and solenoid valves are not mounted on the control valve but are located in a lower radiation zone.	PD, CS	
3.8	Sumps		
	Check that sumps capable of accumulating radioactive wastes are located in zones compatible with radiation levels due to the contained activity.	PD	

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TABLE 2 (Continued)

Item No.	Description	Responsibilities	Note
Sec. B	SHIELDING		
1.0	Bulk Shielding		
1.1	Check that shielding or separation is provided between radiation zone areas to meet the radiation level criteria for adjacent areas.	N	*
1.2	Check that shielding design is based on conservative or measured radiation source term, component design, and plant layout assumptions.	N	
1.3	Check that poured concrete density specifications are consistent with shielding design basis minimum densities.	N, C	
1.4	Check that concrete block density specifications are consistent with shielding design basis minimum densities.	N, A	
1.5	Check that concrete block wall designs meet or exceed the minimum shielding requirements.	N, A	
1.6	Check that removable or temporary shielding is designed consistent with applicable radiation shielding criteria for adjacent areas.	N	
2.0	Penetration and Discontinuity Shielding		
2.1	Check that penetrations, such as H&V ducts and piping, are either located with an offset between radiation sources and accessible areas or are appropriately shielded.	N, PD, E, CS	
2.2	Check that penetrations are located as far as possible above the accessible floor elevation.	N, PD, E, CS	
2.3	Check that penetration shielding is provided as necessary to meet the radiation shielding criteria in adjacent accessible areas.	N	

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TABLE 2 (Continued)

Item No.	Description	Responsibilities	Note
2.4	Check that seismic gap shielding is provided to maintain radiation levels in adjacent accessible areas within radiation shielding criteria limits.	N, C	
3.0	Entryway Shielding		
3.1	Check that there is no direct or near direct shine out of shielded cells.	N	*
3.2	Check that adequately shielded labyrinths or hatches are provided to limit direct and scattered radiation out of shielded areas.	N	*
Sec. C	SYSTEM DESIGN		
1.0	Decontamination Provisions		
1.1	Check that radioactive systems with Zone V component radiation levels have provisions to flush the entire system. Flushing capability should be available even if the system pump is inoperable.	M, PD	
1.2	Check that major components of the primary coolant purification system where crud can collect up to Zone V radiation levels, such as filters, heat exchangers, etc. have provisions for chemical decontamination, including low point drains. Check that means are available to take the decon solution to chemical waste area.	M, PD	
1.3	Check that seal flush water is provided to pumps with chemical or slurry wastes.	M, PD	
1.4	Check that all serviceable components have isolating and draining capability.	M, PD, CS	
1.5	Check that provisions are available to flush potentially contaminated instrument lines.	M, PD, CS	

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TABLE 2 (Continued)

Item No.	Description	Responsibilities	Note
1.6	Check that flush connections are located downstream of the component isolation valve on the inlet line and upstream of the isolation valve on the outlet line, and as close as possible to the inlet and outlet connections of the component.	M, PD	
1.7	Check that isolation valves are provided on the flush connections and are located as close as possible to the main pipe.	M, PD	
1.8	Check that all flush connections are equipped with quick connect/disconnect fittings.	M, PD	
2.0	Remote Operation and Instrumentation		
2.1	Check that adequate process instrumentation and controls are available to allow system and component operation from a low radiation zone.	CS	
2.2	Check that filters which accumulate high radioactivity are designed with the means either to backflush the filter remotely or to perform cartridge replacement with semi-remote tools.	PD	
2.3	Check that probe type instruments are used on highly radioactive tanks containing two-phase materials.	CS	
3.0	Leakage Provisions		
3.1	Check that tank overflow lines are directed to the waste collection system.	PD	
3.2	Check that sludge tanks and air mixing tanks which contain radioactive materials are vented to the respective building ventilation system or the vent collection system.	PD	
3.3	Check that strainers are included in vent lines from tanks containing spent resins or sludge.	PD	

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TABLE 2 (Continued)

Item No.	Description	Responsibilities	Note
4.0	Demineralizers		
4.1	Check that demineralizers in radioactive systems and associated piping are designed with provisions for being flushed with demineralized water.	PD	
4.2	Check that strainers are located immediately downstream of ion exchangers.	PD	
4.3	Check that drains and downstream strainers are designed for full system pressure drop.	M, PD	
4.4	Check that strainers are included in vent lines from the demineralizer vessel.	PD	
4.5	Check that flush connections are provided at all critical locations (such as elbows, ties, valves) to clear potential plugs.	PD	
4.6	Check that flow in piping is turbulent enough to maintain suspension of fines.	M	
5.0	Floor Drains		
5.1	Check that equipment drains are piped directly to a drainage collection system.	PD	
5.2	Check that provisions are made to remove plugging should it occur in drain lines.	PD	
5.3	Check that radioactive and potentially radioactive drains are separated from nonradioactive drains.	PD	
Sec. D	PIPING AND VALVE DESIGN		
1.0	Pipe Routing		
1.1	Check that piping containing radioactive materials is routed through suitably zoned, controlled access areas in accordance with piping	PD	

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TABLE 2 (Continued)

Item No.		Responsibilities	Note
	radiation classification as shown in Table 3.		
1.2	Check that equipment compartments contain radioactive piping associated only with equipment within the compartment or that nonassociated piping is adequately separated.	PD	
1.3	Check that where it is necessary for radioactive piping to be routed through corridors or other radiation zone areas, shielded pipeways are provided to meet area radiation level requirements.	PD, N	
1.4	Check that long runs of exposed radioactive piping are minimized, particularly in active component areas such as valve galleries or pump cells.	PD	
1.5	Check that radioactive piping is routed to take credit for shielding effects of equipment or structures.	N, PD	
2.0	Valve Location		
2.1	Check that valves are separated from components which accumulate or contain radioactivity by shielding or distance to meet the applicable radiation shielding criteria levels.	N, PD	
2.2	Check that valves are readily accessible from floors or permanent platforms.	PD, CS	
2.3	Check that sufficient space is provided to facilitate valve and valve operator maintenance, operations, and testing.	PD, CS	
2.4	Check that valves are not located in radioactive pipeways.	PD, CS	
2.5	Check that vent and drain isolation and instrument root isolation valves are located as close as practical to process piping or components.	PD, CS	

TABLE 2 (Continued)

Item No.		Responsibilities	Note
2.6	Check that process valves are not located at low points in piping.	PD	
2.7	Check that reach rods or remote manipulators are provided for manually operated valves that are required in potentially high radiation areas (Zone V or greater).	PD, N	
3.0	<u>Pipe Design</u>		
3.1	Check that branch lines having little or no flow during normal operation are connected above the horizontal midplane of the main pipe.	PD	
3.2	Check that thermal expansion loops in radioactive systems are raised rather than dropped.	PD	
3.3	Check that orifices are located on vertical piping runs if possible. If located in horizontal piping runs, use eccentric design of the orifice.	PD, CS	
3.4	Check that reducers are installed not to form a stagnant pocket, i.e., use eccentric design with bottom flat, except at pumps.	PD	
3.5	Check that orifices located in horizontal runs use an eccentric design only if suspended solids are present in the process fluid.	PD, CS	2
3.6	Check that lengths of radioactive pipe runs and number of bends are minimized.	PD	
3.7	Check that low points and dead legs in radioactive piping are minimized and are capable of being flushed	PD	
3.8	Check that instrument and sensing line connections are located in such a way as to avoid corrosion product and radioactive gas buildup.	PD, CS	

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TABLE 2 (Continued)

Item No.		Responsibilities	Note
3.9	Check that welded joints are used whenever possible to minimize crud traps in the mechanical joints.	PD, CS	
4.0	<u>Valve and Valve Operator Selection</u>		
4.1	Check that full ported valves are used in systems expected to handle spent resins or slurries with radiation levels of 25 mr/hr or greater at contact with the surface of the pipe. (See Table 3)	M, PD, CS	
4.2	Check that valves 2-½ inches and larger (except butterfly valves and plug valves) in lines carrying radioactive fluids with radiation levels of 25 mr/hr or greater (contact dose rate) are diaphragm, packless, or have a double set of packing with lantern ring.	M, PD, CS	
4.3	Check that all globe valves in drain lines (excluding instrument valves) 2 inches and smaller are Y-pattern globe valves to facilitate rodding if plugging should occur.	M, PD	
4.4	Check that remote operators or handwheels on reach rods are provided for all valves, which must be accessible during operation, in lines processing evaporator bottoms or spent resins.	M, PD, CS	
4.5	Check that pressure relief valves have flange connections to facilitate removal for set pressure verification and calibration.	M, PD	
4.6	Check that valve operators are properly selected and meet the criteria in Table 3.	M, PD	
4.7	Check that valve types are properly selected for their intended service and environment.	M, PD	

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TABLE 2 (Continued)

Item No.		Responsibilities	Note
4.8	Check that plug valves or equal are used on systems transporting resins and sludge, and on radwaste systems.	M, PD	
5.0	Spent Resin and Sludge Piping		
5.1	Check that resin lines are continuously sloped in the direction of flow to avoid potential stagnant pockets.	PD	
5.2	Check that valves are located as close as possible to the spent resin tank room to minimize the length of the dead leg.	PD	
5.3	Check that flow control valves and orifices are not used in resin lines.	M, CS	
5.4	Check that long radius (1.5 times the pipe diameter or greater) bends and elbows are used at direction changes.	PD	
5.5	Check that directional changes in resin piping runs are minimized.	PD	
5.6	Check that fluid velocity is high enough to keep resins in suspension.	PD	
5.7	Check that system design permits flow to be continuous until resins are flushed from piping, or provision is made for flushing at a velocity high enough to pick up resins that have settled out during flow interruption.	PD	
Sec. E	COMPONENT DESIGN (For components containing radioactive fluids or located in high radiation areas)		
1.0	Specifications		
1.1	Check that material requisitions specify the radiation environmental requirements for the intended material application.	M, CS	
1.2	Check that equipment design features as presented in the remainder of this section are included in the appropriate equipment specification.	M, CS	

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TABLE 2 (Continued)

Item No.		Responsibilities	Note
2.0	Heat Exchangers		
2.1	Check that corrosion-resistant tubes of stainless steel or other suitable material with welded tube-to-tube sheet joints are provided to minimize leakage.	M	
2.2	Check that impact baffles are provided with tube side and shell side velocities limited to minimize erosive effects.	M	
2.3	Check that drains are provided on the lowest portion to ensure removal of contaminated fluids.	M, PD	
2.4	Check that where practical the contaminated side of the heat exchanger operates at a lower pressure than the clean side.	M	
2.5	Check that the more radioactive stream is on the tube side.	M	
3.0	Evaporators		
	Check that chemical addition connections are provided to allow use of chemicals for descaling operations.	M	
4.0	Pumps (Small)		
4.1	Check that pump casings are provided with drain connections.	M	
4.2	Check that pumps in radiation areas (Zone III or higher) are purchased with mechanical seals to reduce seal servicing time and leakage.	M	
4.3	Check that pumps in radioactive systems are provided with flanged connections for ease in removal.	M	
4.4	Check that electrical quick disconnects are provided on pumps in high radiation zones (V or higher).	M, E	
4.5	Check that painted surfaces of the pump (if any) are painted with a radiation-resistant and decontaminable coating.	M, A	

TABLE 2 (Continued)

Item No.		Responsibilities	Note
4.6	Check that the pump has long-lived bearings and that lubrication is the permanent type.	M	
4.7	Check that the pump selection has considered the use of low RPM designs.	M	
5.0	Tanks		
5.1	Check that tanks in radioactive service are provided with sloped bottoms (min. 1 inch per foot of tank diameter) and bottom outlet connections. Conical or dished bottom tanks with bottom connections are acceptable.	M, C	
5.2	Check that adequate tank mixing is provided to prevent crud settling.	M	
5.3	Check that each tank requiring a manway is top fitted with one of at least a 2-foot diameter. (If a manway is located on the side of a tank, it should be clearly demonstrated that it is necessary.)	M, C	
5.4	Check that side manways have eccentrically hinged covers designed to easily clear fastening studs.	M, C	
5.5	Check that outlet pipes have backflushing capability into the tank to break up sediment. Backflush capability should include air.	M, PD	
5.6	Check that tank linings (if any) are suitable for the expected service.	M, C, A	
5.7	Check that overflow lines are lower than vent lines to prevent fluid from contaminating vent lines.	M, PD, C	2
5.8	Check that a permanent connection is provided for insertion of a hydrolaser unit for decontamination of tanks in Zone V areas.	M, PD, C	

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TABLE 2 (Continued)

Item No.		Responsibilities	Note
5.9	Check that lap joints were not used in tank construction.	M, C	
5.10	Check that no backing strips were used on tank welds.	M, C	
5.11	Check that backing rings were not used on nozzle welds.	M, C	
5.12	Check that siphoning of liquid waste from tanks cannot occur.	PD	
5.13	Check that in-line filters with backflushing capability are provided for tanks with a sludge buildup potential.	PD	
5.14	Check to ensure that tanks with a potentially hazardous leakage consequence are located over catch pans or within curbs with drain lines leading to radioactive liquid waste storage tanks or to sumps capable of handling a potential spill.	M, PD	
6.0	<u>Instruments</u>		
6.1	Check that chemical seals are provided on sensing lines on process piping that may contain high amounts of solids.	CS	
6.2	Check that primary instruments which, for functional reasons, are located in high radiation zones (V and greater) are designed for easy removal to a radiation Zone II or lower for calibration.	CS	
6.3	Check that instruments are selected which contain minimal quantities of contaminated working fluids; e.g., pressure transducers rather than bellows-type pressure gauges.	CS	

TABLE 2 (Continued)

Item No.		Responsibilities	Note
7.0	Tools		
7.1	Check that tool design has minimized cracks and crevices.	M	
7.2	Check that corrosion-resistant materials have been used for tool construction (where applicable) and that the materials and surface finishes are conducive to decontamination.	M	
7.3	Check that tool design allows for flushing of potentially contaminated surfaces (inside and out).	M	
7.4	Check the design to ensure that tools can be easily assembled/disassembled with simple hand tools and that the design incorporates features to either minimized installation time or provide for remote installation.	M	
7.5	Check that all flush connections (if applicable) have quick connect/disconnect fittings.	M	
7.6	Check that tool hangers and storage areas are accessible and serviceable.	M	
Sec. F	MISCELLANEOUS FACILITY DESIGN		
1.0	Lighting		
1.1	Check that multiple electric lights are provided for each cell or room containing highly radioactive components (Zone V and greater) so that burnout of a single lamp will not require entry.	E	
1.2	Check that lighting in high radiation areas (Zone V and greater) is actuated from outside the area in the lowest practical radiation zone.	E	

2

TABLE 2 (Continued)

Item No.		Responsibilities	Note
1.3	Check that sufficient lighting is provided in areas that contain remote viewing devices to allow their efficient use.	E	
1.4	Check that plug-in, accessible, bracket hung, removable units are provided for easy removal and relamping outside high radiation areas. (Lightweight units are preferable for ease of handling.)	E	
1.5	Check that extension cord powered units stored on brackets and cord hangers outside the entrance are provided if permanent units are not practical, and the pre-placed brackets are provided within the high radiation area to facilitate installation.	E	
1.6	Check that long-life bulbs are provided in high radiation areas (Zone V).	E	
2.0	<u>Contamination Control and Coatings</u>		
2.1	Check the floor drains and properly sloped floors are provided for each room or cubicle containing serviceable components with radiation levels of a Zone III or higher.	M, PD, C	
2.2	Check that local gas traps or porous seals are not used on floor drains from radiation areas.	M, PD	
2.3	Check that gas traps are provided at the common sump or collection tank.	M, PD	
2.4	Check that concrete surfaces in areas of potential contamination are covered with a smooth-surfaced coating for the floor and wainscot, which will allow easy decontamination.	N, A	
2.5	Check that threshold curbs, cofferdams, or other means are provided to control radioactive leakage or spills.	PD, A, C	

 2

TABLE 2 (Continued)

Item No.		Responsibilities	Note
2.6	Check that protection from backflooding of floor drains is provided.	PD, C	
3.0	Access Platforms		
3.1	Check that equipment subject to routine maintenance (defined as at least once per year) has permanent access platforms.	PD, CS	
3.2	Check that direct access to active components is provided from any working platform.	PD, CS	
3.3	Check that ample space is provided on platforms for accommodating safe personnel movement during replacement of components (including the use of any necessary material handling equipment).	PD	
4.0	Remote Viewing Devices		
	Check that in high radiation areas (Zone V and greater) where routine visual surveillance inspections are required, remote viewing devices are provided.	M, PD, CS	
5.0	Temporary Shielding		
	Check that when shielding is required and permanent shielding is not feasible, sufficient space and supports for portable shielding are provided and the structure is capable of accepting the additional loading.	N, PD, C	
6.0	Insulation		
	Check that piping and components requiring frequent (once per year or greater) access for maintenance, inspection, etc. utilize quick removal insulation wherever practical.	PD	

 |2

TABLE 2 (Continued)

Item No.		Responsibilities	Note
7.0	Plant Services		
	Check that services such as electrical power, water, respirable air, and compressed air are available reasonably close to radiation work areas.	M, PD, E, N	

Legend

Symbol	Description
PD	Plant Design
CS	Control Systems
A	Architectural
E	Electrical
C	Civil
M	Mechanical
N	Nuclear/Licensing
*	Item to be completed prior to transmittal of general arrangement drawing to client for initial review.

TABLE 3

TYPICAL RADIOACTIVE PIPING CLASSIFICATION AND ROUTING

Exposure Rate at Contact with Pipe Surface (mR/hr)	Radioactivity Description	Acceptable Radiation Zone Routing*
---	Nonradioactive	I, II, III, IV, V
0.5	Slightly radioactive	I, II, III, IV, V
2.5	Low radioactivity	II, III, IV, V
25	Low to moderately radioactive	III, IV, V
100	Moderately radioactive	IV, V
>100	Highly radioactive	V, VI, VII

* Routing of nonradioactive or low radioactivity piping in high radiation zones should be minimized.

TABLE 4

RADIATION ZONES

Zone	Design Dose Rate (mrem per hour)	Access Description
I	≤0.5*	Uncontrolled, unlimited access
II	0.5 to 2.5	Controlled, limited access 40 hours per week
III	2.5 to 25	Controlled, limited access 4 to 40 hours per week
IV	25 to 100	Controlled, limited access 1 to 4 hours per week
V	100 to 1000	Normally inaccessible access during emergency
VI	1000 to 3000	Normally inaccessible access during emergency Locked barrier to zone
VII	≥3000	Normally inaccessible access during emergency Locked barrier to zone

* Design dose rates in office spaces and other Zone I areas which are continuously occupied 8 hours per day, 5 days per week or more shall be less than 0.25 mrem/hr. Corridors and other Zone I areas of a transient occupancy nature shall be below 0.5 mrem/hr.

2