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REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 3.25

STANDARD FORMAT AND CONTENT OF SAFETY ANALYSIS REPORTS FOR URANIUM ENRICHMENT FACILITIES

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1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust Review
10. General

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INTRODUCTION

The general requirements for uranium enrichment and other facility* license applications are contained in 10 CFR Part 50. A proposed Part 52 currently in preparation would contain requirements specifically for license applications for uranium enrichment plants. The regulation would specify in general terms the information to be supplied in the Safety Analysis Reports (SARs) that must be submitted with an application. This document indicates the level of detail needed in the review of applications and suggests a standard format for its presentation. In order to facilitate presentation of this Standard Format, it has been written as though the regulation in preparation were in effect. The SARs contain the principal technical information submitted by the applicant to the Commission concerning the nature of the facilities and the plans for their use and become part of the record for a particular license application.

It is recognized that not all of the topics in this Standard Format are applicable to every site and facility. Specific data should be developed on an individual basis. If an item does not apply to the specific site or facility, the applicant should state concisely why it is not applicable. Revisions will be made as future conditions warrant.

The regulations also require that an environmental report accompany each application. This report will include some information that is also required in the SARs. This information should be duplicated in the SARs in order to expedite review.

Each applicant should show that (1) site selection, (2) the structures, systems, and components to be used, (3) the quality assurance program adopted, (4) the use of licensed operators, and (5) the applicant's technical capability collectively provide reasonable assurance that the health and safety of the public will be protected. He should also present plans that assure that the common defense and security of the country is not compromised. The Final Safety Analysis Report (FSAR) must include, at a minimum, sufficient information to justify the selection of technical specifications as required in §52.42(d) of 10 CFR Part 52.

The SARs should reflect the most advanced state of design at the time of their submittal. If at the time of submission certain information is not yet available, the PSAR should include (1) the criteria and bases being used to develop the required information, (2) the concepts and alternatives under consideration, and (3) the schedule for completion of the design and submittal of this information. The PSAR should describe the proposed site and facilities

*As used in this Standard Format, the term "facility" includes all onsite structures, systems, and components designed for the safe processing of uranium compounds.

in sufficient detail to enable the Regulatory staff to evaluate whether the plant can be constructed and operated without undue risk to the health and safety of the public. Therefore, the status of the design should be sufficiently advanced to permit this evaluation. The PSAR should include narrative descriptions of the structures, systems, and components sufficiently comprehensive to enable the reader to understand their purpose and functions. Site and plot plans, floor plans, equipment layouts, special sections, electrical and instrument diagrams, isometrics, etc., as appropriate to ready understanding of plant features and operations, should be provided.

Functional flow diagrams showing equipment, piping, and instrumentation for process and process support systems should be provided. Material and activity balances should be shown, as appropriate. Functional specifications should be included for safety-related systems and components. The design bases and their relation to the principal design criteria should be clearly shown. A description of the quality assurance program, organization, and training program should also be included. Essentially, all of the design and safety criteria and the data necessary to develop these items should be presented in the PSAR. These data and related information should be shown to demonstrate that the applicant has performed analyses to define potential problems and has provided systems and equipment adequate to cope with these problems. An assessment of the safety margin designed into the structures systems and components should be developed. The applicant should include a preliminary plan for coping with emergencies.

The Final Safety Analysis Report (FSAR) must contain all technical information required by §52.42 of 10 CFR Part 52 and describe in detail the final plant design, current site information, and final safety analyses. Modifications of those criteria, bases, or designs included in the PSAR, as well as any new or modified criteria, bases, or designs, should be identified in the FSAR. The safety significance of each change should be evaluated. The detailed presentation on the conduct of operations including plans for preoperational testing, startup, and normal operation; emergency plans; organizational structure; personnel qualifications; records; decommissioning plans; and proposed technical specifications should be included. The FSAR should also contain a description of and plans for implementation of the operator requalification plans.

The Regulatory staff will make a preliminary review of each application for a construction permit (including the PSAR) or an operating license (including the FSAR) to determine whether sufficient information is included. If the application is deficient, formal review will not be initiated until the applicant corrects these deficiencies.

It is recommended that the applicant discuss his plans and programs, particularly his quality assurance staffing and program plans, with the Regulatory staff in advance of preparing his Safety Analysis Reports. This will enable the applicant to develop the pertinent information and depth of analysis required for the proposed plant.

This Standard Format and Content of Safety Analysis Reports for Uranium Enrichment Facilities has been prepared for use by the staff and applicants to identify the type of information needed. The Standard Format may be used for both the Preliminary Safety Analysis Report (PSAR) and the Final Safety Analysis Report (FSAR). Emphasis in various areas and depth of detail will differ in the two reports.

Because of the diversity of possibilities for the processes and design of enrichment facilities, the applicant may wish to include appendices to the SARs to provide detailed supplemental information not explicitly identified in this Standard Format. Examples are (1) a glossary of unusual terms or abbreviations used by the applicant, (2) supplementary information regarding assumed models, calculational methods or design alternatives used by the applicant or his agents, and (3) reports furnished by consultants. In addition, the applicant may want to provide, for selected plant features, detailed in-depth analyses. These may be presented in supplemental report(s) and incorporated into the SAR by reference.

Proprietary Information

Information which the applicant deems to be proprietary should be submitted separately and identified as such. This information should be accompanied by a full statement of the reasons for which it is claimed to be proprietary. This information will be handled as described in §2.790, 10 CFR Part 2.

Restricted Data

If the application contains "Restricted Data" or defense information, it should be prepared in such a manner that all restricted data and defense information are separated from the unclassified information. The restricted data should be handled in a manner prescribed in 10 CFR Part 95.

Use of the Standard Format

The SARs should follow the numbering systems of this Standard Format at least down to the level of third order sections.

Style and Composition

A table of contents should be included in each volume and for each chapter.

Where numerical values are stated, the number of significant figures given should reflect the accuracy or precision to which the number is known. Where possible, estimated limits of errors or uncertainties should be given.

Abbreviations should be consistent throughout the SAR, and should be consistent with generally accepted usage. Any abbreviations, symbols, or special terms not in general usage or which are unique to the proposed plant should be defined in each chapter of the SAR where they are used or in an appendix to the SAR.

Drawings, maps, diagrams, sketches, and tables should be employed where such means may be used to present the information more adequately or conveniently. Due concern should be taken to ensure that all information presented in drawings is legible, symbols are defined, and drawings are not reduced to the extent that they cannot be read by the unaided eye. These drawings, maps, etc., should be located with the section in which they are primarily referenced.

Physical Specifications

1. Paper size

Text pages: 8-1/2 x 11 inches

Drawings and graphics: 8-1/2 x 11 inches preferred; however, a larger size is acceptable provided the finished copy, when folded, does not exceed 8-1/2 x 11 inches.

2. Paper stock and ink

Suitable quality in substance, paper color, and ink density for handling and for reproduction by microfilming.

3. Page Margins

No less than one inch on the top, bottom, and binding side of all pages submitted.

4. Printing

Composition: text pages should be single spaced.

Type face and style: suitable for microfilming.

Reproduction: may be mechanically or photographically reproduced. All pages of the text should be printed on both sides with the image printed head to head.

5. Binding

Pages should be punched for looseleaf ring binding.

6. Page numbering

Insofar as possible, pages should be numbered by chapter and section and sequentially within the section. The entire report should not be numbered sequentially. For example, the first page of Section 3.1 should be numbered 3.1-1. All references to this Standard Format should be to chapters and sections.

Procedures for Updating or Revising Pages

The updating or revising of data and text should be on a replacement page basis.

Each changed or revised portion of a page should be highlighted by a vertical line. The line should be in the margin opposite the binding margin for each line changed or added. All pages submitted to update, revise, or add pages to the report should show the date of change. The transmittal letter should include an index page listing the pages to be inserted and the pages to be removed. Where major changes or additions are made, a revised table of contents should be provided.

STANDARD FORMAT AND CONTENT OF SAFETY ANALYSIS REPORTS
FOR URANIUM ENRICHMENT FACILITIES

CHAPTER 1 INTRODUCTION AND GENERAL DESCRIPTION OF THE FACILITIES

The applicant should provide information and state the purpose for, and the general description of, the facilities. The information should enable the reader to obtain a basic understanding of all facilities without having to delve into the subsequent chapters. Review of the detailed chapters which follow can then be accomplished with better perspective and with recognition of the relative importance of each individual item to the overall plant design.

1.1 Introduction

The principal aspects of the overall application should be described. The following should be included: (1) the activities for which a license is requested; (2) a brief description of the proposed location of the plant; (3) the nominal capacity of the enrichment plant; (4) the type, form, and quantities (possession limits) of source and special nuclear materials to be handled in each processing plant; (5) the services and products to be provided; (6) the corporate entities involved; and (7) the estimated time schedules for construction and operation.

1.2 Facilities Description

A summary description of the principal characteristics of the site and a concise description of the facilities should be included. The arrangement of all major structures and equipment should be indicated on plan and elevation drawings in sufficient detail to provide a reasonable understanding of the general layout of the plant. Any additional features of the plant likely to be of special interest because of their relationship to safety should be specifically identified.

1.3 Process Descriptions

The applicant should include a summary description (in nonclassified form) of all processes to be used at the facility. Sufficient detail in the discussion and accompanying charts and tables should be provided to enable the reader to understand the processes involved.

1.4 Identification of Agents and Contractors

The applicant should identify the prime agents or contractors for the design, construction, and operation of the facilities. All principal consultants and outside service organizations (including those providing audits of the quality assurance program) should be identified. The division of responsibility among the process designer, architect-engineer, constructor, and plant operator should be delineated.

1.5 Requirements for Further Technical Information

This section of the PSAR should itemize any aspects of the facilities or processes that will require additional information or development to support the design bases for that facility prior to or during construction. This information should be referenced to the appropriate sections in Chapters 5 and 6.

1.6 Comparison of Final and Preliminary Safety Analysis Reports

The FSAR should describe, with details, the changes adopted since submittal of the PSAR. The results obtained from Section 1.5 should be documented along with changes resulting from additional considerations and the reasons for those modifications.

CHAPTER 2 SUMMARY SAFETY ANALYSIS

A summary should be provided of all aspects the applicant considers necessary to protect the health and safety of operating personnel and the public.

2.1 Site Analysis

2.1.1 Natural Phenomena

From information presented in Chapter 3, the applicant should summarize the frequency and severity or magnitude of natural phenomena which characterize the site and influence design features and design criteria selected. The summary should include earthquakes, lightning, tornadic or hurricane-type winds, inundation by water from possible sources, loss of water supply, and snow load. Methods used to cope with the impact of those phenomena should be included in the summary.

2.1.2 Effect of Nearby Industrial, Transportation, and Military Activities

The applicant should summarize items that have been considered which may present a hazard to the facilities from activities within a 5-mile radius. Refer to the specific item as presented in Chapter 3. Typical considerations to be evaluated should be:

- The effects of explosion of chemicals or flammable gases.

- The effects of explosions of natural gas pipelines which cross the plant site.

- The effects of fires in adjacent industries, brush and forest fires, and fires caused by transportation accidents.

- The effects of accidental releases of toxic materials from onsite facilities, nearby industries, and/or transportation accidents.

- The effect of expected airborne pollutants and corrosives on important plant components.

- For sites within 5 miles of airports, the effects of aircraft impacts, taking into account aircraft size, velocities, weight, and fuel loading. A description of the relationship of the site location to aircraft flight patterns, as applicable, within a 15-mile radius should also be included.

- The effect of damage to equipment or structures important to safety should a tall structure such as a water tower collapse.

2.2 Impact of Normal Operations

For the gaseous, liquid, and solid wastes, the following should be provided:

- A summary identifying each hazardous chemical waste.

- An estimate of the annual amount of these wastes generated.

- An estimate of the quantity and concentration of hazardous chemicals in each waste stream.

- The locations considered most impacted by hazardous chemical effluents beyond the restricted areas, as defined in 10 CFR Part 20, §20.3, and beyond the site boundary at 1-mile intervals, up to a radius of 5 miles.

- For effluent streams containing radioactive materials, the man-rem contribution of radiation dose to human occupants that could accrue under normal operational circumstances at the most impacted locations.

- In a discussion and sample calculations or by reference, the reliability of all estimated effluent values presented.

- For each effluent, the constraints imposed on process systems and equipment to ensure a safe operation.

- A discussion of how the "as low as practicable" requirement will be met. Also, the criteria used to justify this requirement.

2.3 Impact from Abnormal Operations

The applicant should show the capability of the plant to operate safely within the range of anticipated process variations, malfunctions of process equipment, and operator error. The information may be presented in tabular form, with the situations analyzed listed in one column, accompanied by other columns identifying:

- Estimated releases of hazardous chemicals.

- Method or means available for detecting the respective situations.

- Causes of the particular situation.

- The corrective actions.

- Effects and consequences.

2.4 Accidents

The applicant should provide a description to explain those credible situations which create demands beyond the capabilities of the processes and/or equipment, and should state the estimated health and safety consequences. A summary of the information presented in Chapter 9, with suitable reference to each applicable item, will be sufficient.

2.5 Conclusions

The applicant should provide summary conclusions with respect to the impact of the plant and its operation on the health and safety of the public and operating personnel.

CHAPTER 3 SITE CHARACTERISTICS

This chapter should provide information on the location of the plant and a description of the geographical, demographical, meteorological, hydrological, seismological, and geological characteristics of the site and surrounding vicinity. The objective is to indicate what site characteristics influence plant design and process selection. An evaluation of the site characteristics from a safety viewpoint should be developed, identifying any assumptions that should be applied in making the appraisal.

3.1 Geography and Demography of Site Selected

Information concerning the site, geography, population, and land usage should be provided to support the evaluation.

3.1.1 Site Location

The location of the site should be presented with sufficient clarity so that there is no ambiguity regarding the location of features discussed later in this chapter. All maps should include distance scale and compass north, as minimum data. A map showing the site location within the state and county should be provided.

A general location map, encompassing at least a 20-mile-radius area, should be provided. The site perimeter, applicant's property boundaries, nearby settlements, industrial plants, and transportation links (roads, waterways, airports, railroads) should be shown on this map.

The applicant should provide a map encompassing a 5-mile radius from the plant site center. Indicate on this map circles with radii of 1, 2, 3, 4, and 5 miles; divide each circle into 45° segments centered on 8 compass points (N, NE, E, etc.). The permanent and transient populations should be indicated within each sector.

Additional plot maps, contour maps, and aerial photographs should be provided to present details near the site and facilities to establish the orientation of buildings, streams, ponds, transmission lines, neighboring structures, etc. Details in this section may be referred to in subsequent chapters to avoid repetition.

3.1.2 Site Description

The topography of the site and vicinity should be described by suitable contour maps that indicate the character of surface drainage patterns and the potential impact of surface winds.

Vegetation cover and surface soil characteristics should be described sufficiently to indicate erosion potential and fire hazards.

Onsite traffic and transportation routes and transmission lines should be identified.

3.1.2.1 Site Boundary. The overall site limits should be clearly identified.

The applicant should clearly identify the location of any activity within the controlled area that is not related to the plant operation.

3.1.2.2 Boundaries for Establishing Effluent Release Limits. The applicant should identify the restricted areas as defined in 10 CFR Part 20, §20.3(a)(14), to show the boundary line that will be used to establish effluent release limits. Distances from plant effluent release points to the boundary line should be clearly presented.

3.1.3 Population, Distribution, and Trends

Population information should be based on the most recent available census data and should show the population distributions as a function of distance and direction. Tables and/or maps may be used and should locate, in each sector around the plant, the occupying population in each concentric ring bounded by radii at 1, 2, 3, 4, and 5 miles. Projected changes anticipated during the period of the license should be presented. The bases of these projections should be identified. Significant transient or seasonal population variations should be identified.

3.1.4 Uses of Nearby Land and Waters

Uses of lands and waters within a 5-mile radius should be described. Sufficient characterization of farming, dairy, industrial, residential, and recreation activities should be presented to permit estimations of potential health and safety impacts resulting from plant effluents. A localized population in schools and other institutions should be identified with respect to location and number of persons.

The applicant should identify the nature of activities, if any, conducted within the site boundaries other than those directly related to the operation of the facility. These activities may include manufacturing or processing systems. The interrelation of these activities to the plant should be explained.

3.2 Nearby Industrial, Transportation, and Military Activities

3.2.1 Nuclear

The applicant should provide the location and identification of other nuclear facilities within a 20-mile radius. As appropriate for each, a description of materials produced, stored, or transported should be provided. The effects of interfaces between the enrichment plant and other

plant(s) should be related. Interfaces should include the effects of effluents, transportation of special nuclear material, use of resources (such as water, electricity, etc.), and other related items.

3.2.2 Non-Nuclear

The applicant should identify industrial, utility, and military activities and installations within a 5-mile radius on a map which clearly shows their distance and relationship to the plant. As appropriate for each, provide a description of the activity or installation; the products or materials produced, stored, or transported; and the maximum quantities for each.

3.3 Meteorology

This section should provide a description of the site meteorology. Meteorological conditions which influence the design and operation of the facility should be identified. Sufficient information should be included to permit an independent evaluation by the Regulatory staff of aeolian dilution in all directions. The sources of information and data supplied should be stated.

3.3.1 Regional Climatology

The applicant should describe the climate of the region, pointing out characteristics attributable to the terrain. He should indicate seasonal weather conditions, including temperature, precipitation, relative humidity, and prevalent wind direction. The following information should also be provided:

- Data which can be applied to the analysis of hydrological problems.
- Historical summary of the intensity and frequency of severe cold and acute thaws.
- Historical summary of intensity and frequency of drought conditions.
- Occurrence of heavy rain, snow, and ice storms.
- Thunderstorms and lightning strikes.
- Strong winds and tornadoes.

Data should be reported in sufficient detail to permit impacts on plant design and operation to be evaluated.

3.3.2 Local Meteorology

3.3.2.1 Data Sources. The applicant should qualify onsite and/or nearby weather data summaries, identifying the methods and frequencies of collection and pointing out data collection undertaken specifically for this application.

3.3.2.2 Aeolian Parameters. The applicant should describe wind characteristics for the site in terms of the joint frequency distribution of speeds, direction, and variance or stability patterns throughout a year. Data for 8 cardinal compass points should be provided. The annual average concentration time integral to source ratio, ψ/Q, in each of eight compass sectors at the site boundary and at the radii where ψ/Q is maximum should be estimated. Frequency and duration probability of fumigation and inversion conditions should be evaluated. Also, short-term diffusion models for use in accident evaluations should be provided.

3.3.2.3 Local Meteorological Measurement Program. The applicant should describe the meteorological measurement program which will be conducted to develop additional data, if necessary, for better site characterization prior to operating the facility. Also, programs which will be used during operations to estimate offsite concentrations of monitored effluents should be described.

3.4 Surface Hydrology

The applicant should provide sufficient information to allow an independent review to be made of all hydrologically related design bases, performance requirements, and operating procedures important to safety. He should describe the characterizing features relating to hydrology of the region, area, and site. The sources of the hydrological information, the types of data collected, and the methods and frequency of collection should be identified.

3.4.1 Drainage Basin and Watercourse Flow

The applicant should describe the drainage basin and the watercourse flow in terms of the size and flow frequency distribution of nearby streams, rivers, lakes, and reservoirs. Watercourse flow data should be provided in terms of log probability plots indicating minimum and maximum historical observations. The applicant should identify and characterize by size and location those population groups that use surficial water (for potable water, irrigation, or stock watering) which could be affected by plant effluents.

The applicant should include a drainage plot of the site and adjacent areas as they may relate to water supply for the plant. The topographic map(s) provided in Section 3.1.2 should be referred to, and the location of

the plant and other planned features such as water supply ponds, cooling towers, and retention basins should be identified. If applicable, the applicant should include the location and description of upstream and downstream flow control structures and should explain the criteria governing their operation.

3.4.2 Floods

The applicant should provide frequency, intensity, and cause for past flooding and other water inundation occurrences, such as tidal or wind-blown waters which may or may not be coincident with one another.

3.4.3 Probable Maximum Flood (PMF) on Streams and Rivers

The applicant should describe the PMF using hypothetical flood characteristics of peak discharge, volume, and hydrographical shape. All factors contributing to a maximum flood runoff should be considered. All locations and associated water levels for which PMF determinations have been made should be summarized.

3.4.3.1 Probable Maximum Precipitation (PMP). The PMP is the theoretically greatest precipitation over the applicable drainage area that would produce flood flows that have virtually no chance of being exceeded. Estimates of PMPs involve detailed analyses of actual flood-producing storms in the general region of the drainage basin under study, and certain modifications and extrapolations of historical data to reflect more severe rainfall-runoff relations than actually recorded, insofar as these are deemed "reasonably possible" of occurrence on the basis of hydrometeorological reasoning. The applicant should discuss considerations of storm configuration (orientation of areal distribution), maximized precipitation amounts (including a description of maximization procedures and/or studies available in the area. such as reference to National Weather Service and Corps of Engineers determinations), time distributions, orographic effects, storm centering, seasonal effects, antecedent storm sequences, antecedent snowpack (depth, moisture content, areal distribution), and any snowmelt model. The selected maximized storm precipitation distribution (time and space) should be presented.

3.4.3.2 Precipitation Losses. The applicant should describe the absorption capability of the basin, including consideration of initial losses, infiltration rates, and antecedent precipitation. Verification of these assumptions should be provided by reference to regional studies or by presenting detailed local storm-runoff studies.

3.4.3.3 Runoff Model. The applicant should describe the hydrologic response characteristics of the watershed to precipitation (such as unit hydrographs). The applicant should verify these responses from historic floods or synthetic procedures and should provide a description of subbasin drainage areas (including a map), their sizes, and topographic features. A

tabulation of all drainage areas and runoff, reservoir, and channel routing coefficients should be included.

3.4.3.4 Probable Maximum Flood Flow (PMF). The applicant should present the PMF runoff hydrograph resulting from the probable maximum precipitation (and snowmelt, if pertinent) which considers the hydrologic characteristics of the potential influence of existing and proposed upstream dams and river structures for regulating or increasing the water level. If such dams or structures are designed to withstand a PMF, their influence on the regulation of water flow and levels should be considered; if they are not designed or constructed to withstand the PMF (or inflow from an upstream dam failure), the maximum water flows and resulting static and dynamic effects from their failure by breaching should be included in the PMF estimate (refer to Section 3.4.4.2). The applicant should discuss the PMF stream-course response model and its ability to compute floods of various magnitudes up to the severity of a PMF. Any reservoir and channel routing assumptions should be presented with appropriate discussions of initial conditions, outlet works (both uncontrolled and controlled), spillways (both uncontrolled and controlled), the ability of any dams to withstand coincident reservoir wind wave action (including discussions of setup, the significant wave height, the maximum wave height, and runup), the wave protection afforded, and the reservoir design capacity (i.e., the capacity for PMF and coincident wind wave action). Finally, the applicant should provide the estimated PMF discharge hydrograph at the site and, when available, provide a similar hydrograph without upstream reservoir effects to allow evaluation of reservoir effects and a regional comparison of the PMF estimate to be made.

3.4.3.5 Water Level Determinations. The applicant should describe the translation of the estimated peak PMF discharge to elevation, using (when applicable) cross-sectional and profile data, reconstitution of historic floods (with consideration of high water marks and discharge estimates), standard step methods, roughness coefficients, bridge and other losses, verification, extrapolation of coefficients for the PMF, estimates of PMF water surface profiles, and flood outlines.

3.4.3.6 Coincident Wind Wave Activity. The applicant should discuss the runup, wave heights, and resultant static and dynamic effects of wave action on each safety-related system or component from wind-generated activity which may occur coincidently with the peak PMF water level.

3.4.4 Potential Dam Failures (Seismically Induced)

The applicant should evaluate the effects of potential seismically induced dam failures on the upper limit of flood capability for sites along streams and rivers. The potential influence of upstream dams and river structures for regulating or increasing the water level should be considered. The maximum water flow and level resulting from failure of a

dam or dams by seismically induced breaching under the most severe probable modes of failure should be taken into account, The possibility of domino-type failures due to flood waves should be included.

3.4.4.1 Reservoir Description. A description of the locations of existing or proposed dams that influence conditions at the site should be included. The applicant should tabulate drainage areas above reservoirs; provide descriptions of types of structures, all appurtenances, ownership, seismic design criteria, and spillway design criteria; provide the elevation-storage relationships for pertinent reservoirs; and tabulate short- and long-term storage allocations.

3.4.4.2 Dam Failure Permutations. The applicant should identify the locations of dams (both upstream and downstream), discuss potential modes of failure, and discuss results of seismically induced and other types of dam failures that could cause the most critical conditions with respect to the site for such an event. Consideration should be given to possible landslides, antecedent reservoir levels, and river flows at the coincident flood peak. The applicant should present the determination of the peak flow rate at the site for the worst possible dam failure, and should summarize an analysis to show that the presented condition is the worst permutation. The description of all coefficients and methods used should be included.

3.4.4.3 Unsteady Flow Analysis of Potential Dam Failures. In the determination of the effect of dam failures at the site, the analytical methods presented should be applicable to artificially large floods with appropriately acceptable coefficients and should also consider floodwaves through reservoirs downstream of failures. Domino-type failures due to floodwaves should be considered where applicable. Estimates of antecedent flow and static and dynamic floodwave effects which are included to attenuate the dam failure floodwave downstream should be discussed.

3.4.4.4 Water Level at Plant Site. The applicant should describe the backwater, unsteady flow, or other computation leading to the water elevation estimate for the most critical upstream dam failure, and should discuss its reliability. The applicant should superimpose wind wave conditions that may occur simultaneously, in a manner similar to that described in Section 3.4.3.6.

3.4.5 Probable Maximum Surge and Seiche Flooding

3.4.5.1 Probable Maximum Winds and Associated Meteorological Parameters. Probable maximum wind is defined as a hypothetical cyclonic windstorm that might result from the most severe combination of meteorological parameters considered reasonable for the region, provided further that this storm moves along a critical path at optimum velocity. The demonstration of probable maximum winds involves consideration of detailed analyses of actual historical storm events and certain modifications and extrapolations

of these data to reflect the most severe wind system deemed "reasonably possible" of occurring in the region involved. The probable maximum conditions are the most severe combinations of hydrometeorological parameters that would produce a surge or seiche which has virtually no chance of being exceeded. The hypothetical event should be postulated along a critical path at optimum storm velocity from correlation of storm parameters of record.

3.4.5.2 Surge and Seiche History. The applicant should discuss the proximity of the site to large bodies of water for which surge or seiche type flooding can reach safety-related systems or components. The probable maximum water level (surges) for shore areas adjacent to large water bodies is the peak of the hypothetical surge or seiche stage hydrograph and coincident wave effects. A description of the surge and/or seiche history in the site region should be provided.

3.4.5.3 Surge and Seiche Sources. The applicant should discuss considerations of hurricanes, frontal type windstorms, moving squall lines, and surge mechanisms which may be applicable to the site. Discussion should include (1) the antecedent water level (with reference to the spring tide for coastal locations, the average monthly recorded high water for lakes, and a forerunner water level where applicable); (2) determination of the controlling storm surge or seiche (include the probable maximum meteorological parameters such as the storm track, wind fields, the fetch or direction of approach, bottom effects, and verification with historic events); and (3) methods used and results of the computation of the probable maximum surge hydrograph (graphical presentation).

3.4.5.4 Wave Action. The applicant should discuss the wind-generated activity which can occur coincidentally with or independent of a surge or seich. Estimates of the wave period, the significant wave height and elevation, and the maximum wave height and elevations, with the coincident water-level hydrograph, should be presented. Specific data should be presented on the largest breaking wave height, setup, and runup that can reach any safety-related system or component.

3.4.5.5 Resonance. The applicant should discuss the possibility of oscillations of waves at natural periodicity, such as lake reflection and harbor resonance phenomena, and any resulting effects at the site.

3.4.5.6 Runup. The applicant should provide estimates of wave runup on the plant facilities. A discussion of the water levels on each affected facility and the protection to be provided against static effects, dynamic effects, and splash should be included. For breaking waves, Section 3.4.5.4 should be cross-referenced.

3.4.6 Probable Maximum Tsunami Flooding

For sites adjacent to coastal areas, the applicant should discuss historical tsunami, either recorded or translated and inferred, which

provide information for use in determining the probable maximum water levels, and the geoseismic generating mechanisms available.

3.4.6.1 Probable Maximum Tsunami. This event is defined as the most severe tsunami at the site which has virtually no chance of being exceeded. Consideration should be given to the most reasonably severe geoseismic activity possible in determining the limiting tsunami-producing mechanism. The analysis should present such considerations as the orientation of the site relative to the earthquake epicenter or generating mechanism, shape of the coastline, offshore land areas, hydrography, and stability of the coastal area.

3.4.6.2 Historical Tsunami Record. Local and regional historical tsunami information should be provided.

3.4.6.3 Source Tsunami Wave Height. The applicant should provide estimates of the maximum tsunami wave height possible at each major local generating source considered and the maximum offshore deepwater tsunami height from distant generators. The controlling generators for both locally and distantly generated tsunami should be discussed.

3.4.6.4 Tsunami Height Offshore. The applicant should provide estimates of the tsunami height in deep water adjacent to the site, or before bottom effects appreciably alter wave configuration, for each major generator.

3.4.6.5 Hydrography and Harbor or Breakwater Influences on Tsunami. The applicant should present the routing of the controlling tsunami, including breaking wave formation, bore formation, and any resonance effects (natural frequencies and successive wave effects), that result in the estimate of the maximum tsunami runup on each pertinent safety-related system or component. A discussion of the analysis used to translate tsunami waves from offshore generator locations, or in deep water, to the site, and antecedent conditions should be included. Where possible, verification of the techniques and coefficients used by reconstituting tsunami of record should be provided.

3.4.7 Ice Flooding

The applicant should present criteria for protection of safety-related systems or components from the most severe ice jam flood, wind-driven ice ridges, or ice-produced forces that are reasonably possible from adjacent rivers, streams, lakes, etc. The regional ice and ice jam formation history should be described.

3.4.8 Low Water Considerations

3.4.8.1 Low Flow in Rivers and Streams. The applicant should estimate the probable minimum flow rate and level resulting from the most severe drought considered reasonably possible in the region.

3.4.8.2 Historical Low Water. The applicant should discuss historical low groundwater levels, low water controls, minimum stream flows, or minimum surges and elevations. The discussion should include the 7-day low water flow within the last 10 years. The applicant should discuss probabilities (unadjusted for historical controls and adjusted for future controls and uses) when statistical methods are used to extrapolate flows and/or levels to probable minimum conditions.

3.4.8.3 Future Control. The applicant should provide the estimated flow rate, durations, and levels for probable minimum flow and groundwater level conditions, considering future uses. Any provisions for flow augmentation available for plant use should be substantiated.

3.4.9 Chemical and Biological Composition of Adjacent Watercourses

The applicant should provide details of the prevailing chemical and biological composition of watercourses which may be affected by the location of the plant. This information, together with other hydrological data, will be used to ensure that no safety problems will be created by the plant operation.

3.5 Subsurface Hydrology

3.5.1 Regional and Area Characteristics

The applicant should describe the groundwater aquifers, formations, and sinks in relation to the site location. A survey of uses, users, location of wells and springs, and details of factors affecting flow should be provided.

3.5.2 Site Characteristics

The applicant should provide data on groundwater levels, flow, and gradients at the site, as well as chemical analysis of the groundwater. The proposed sources and usage anticipated by the plant facility should also be stated. A map showing the location of any monitoring wells used to evaluate possible outleakage from the plant should be provided.

3.5.3 Contaminant Transport Analysis

By use of the hydrological gradients, permeability, ion exchange, and channeling characteristics at the site, the applicant should develop a model which will allow evaluation of the extent to which contamination from the plant operation could migrate in groundwater.

3.6 Geology and Seismology

The applicant should provide the geologic and seismic characteristics of the area and site, the nature of investigations performed, results of

investigations, conclusions, and identification of information sources. The written description should be supplemented with tables and legible graphics, as appropriate.

3.6.1 Basic Geologic and Seismic Information

The applicant should present the basic geologic and seismic information for the region and the site. Information obtained from published reports, maps, private communications, or other sources should be referenced. Information from surveys, geophysical investigations, borings, trenches, or other investigations, should be adequately documented by descriptions of techniques, graphic logs, photographs, laboratory results, identification of principal investigators, and other data.

3.6.1.1 Regional Geology. The applicant should characterize the topographic and subsurface features of the region and site area. A description of the lithologic, stratigraphic, and structural geologic conditions in relation to tectonic features and the geologic history should be included. The applicant should present the details of seismic, subsidence, or lifting activity known to have occurred in the past. Maps and cross sections to show all pertinent features should be included.

3.6.1.2 Site Geology. The applicant should describe the site physical geography and physiography, discussing the relationship between the region and the site. The discussion should reference and relate the previously presented topographic maps. A detailed discussion of the structural and mineralogical geology of the site should be presented and related to the surrounding characteristics. The applicant should include historical geology as appropriate to be more specific than the regional discussion and also a local geologic stratigraphic column. The applicant should relate both the topography and underground geological formation to the principal features of the plant.

3.6.1.3 Geotechnical Exploration. As necessary for detailed analysis of the site geology, the applicant should provide the detailed data developed by air photogrammetry, core borings (including ion exchange, permeability, and porosity measurements), seismic refraction mapping, and other geophysical measurements.

3.6.2 Analysis of Geologic Stability

3.6.2.1 Seismic History of Region and Vicinity. From analysis of historic epicenter intensity and resultant geologic changes, the applicant should assess the factors pertinent to development of plant design criteria and bases.

3.6.2.2 Vibratory Ground Motion. The applicant should determine, to the extent possible by consideration of available information, the vertical and horizontal components of seismic movement which could occur at the site location. The location of tectonic structures underlying the site and the region surrounding the site should be described.

3.6.2.3 Surface Faulting. The applicant should analyze available data on faults to determine whether plant structural design should include accommodation of possible surface faulting.

3.6.2.4 Subsurface Stability. The applicant should present an analysis of the subsurface characteristics which influence the selection of structural design bases. Analysis should include not only the engineering properties of the materials underlying the site, but also a consideration of areas of potential subsidence and zonal deformation or alteration.

3.6.2.5 Slope Stability. As applicable to the site location, the applicant should determine the stability of topographical slopes in the vicinity. These slopes should also be analyzed to determine induced flooding potential.

3.7 Site Suitability Summary

The applicant should summarize all factors developed in this chapter that are deemed significant to the selection of site and design bases for the plant and associated facilities.

CHAPTER 4 PRINCIPAL DESIGN CRITERIA

The contents of this chapter should partially fulfill the requirements of 10 CFR Part 52, Subpart F, "General Design and Siting Criteria." Principal design criteria should be established by the applicant in the PSAR. They should conform to the appropriate general criteria specified in 10 CFR Part 52. The remaining criteria should be established in the respective chapters discussing them. To determine the adequacy of the plant design criteria, an analysis will be made by the AEC Regulatory staff before construction approval may be granted. The criteria selected should encompass considerations for alternatives that the applicant considered to fulfill these requirements.

4.1 Purpose of Facilities

The applicant should describe in general terms the plant, its functions and operation, process capacities, type of feeds, and products.

4.1.1 Plant Feeds

4.1.1.1 Enrichment Plant Feed. A detailed description of and specifications for the physical, chemical, and radioactive characteristics of the SNM feed materials to be processed in the plant should be provided. An estimate of quantities also should be given. Presentation of radioactive characteristics should include fission product and transuranic content, if the uranium to be used is from reactor fuel reprocessing.

4.1.1.2 Other Uranium Processing Plant Feed. The applicant should provide the same type of data as in Section 4.1.1.1 for feed to other than enrichment processing systems (such as decontamination and recovery). If the only source of uranium for these processes is from the enrichment plant, the applicant should so state.

4.1.2 Plant Products

4.1.2.1 Enrichment Plant Products. The applicant should identify the SNM products (tops, tails, feed, etc.) which will be withdrawn from the enrichment plant. Maximum and minimum uranium-235 isotopic content (as weight percent of uranium), characteristics, estimated quantities, specifications, and onsite storage and transportation facilities for these products should be included.

4.1.2.2 Other Uranium Processing Plant Products. The applicant should provide a description of and specifications for the physical and chemical characteristics and estimated quantities of the SNM products from processes indicated in Section 4.1.1.2. The disposition of these products and the handling facilities to be provided should be included.

4.1.3 General Plant Utilities

The applicant should include design parameters related to the overall functions of each of the systems and components, on the plant site, that contribute to the safe operation of the enrichment plant. Typical processes to be described should be: chemical cleaning, maintenance, laboratory, security, transportation and storage, waste handling, utilities, and wastes processing systems.

4.2 Structural and Mechanical Design Criteria

Based on the site selected, the applicant should identify and quantify the environmental and geologic features which are used as design criteria. Design criteria may be presented based on data developed in Chapter 3 to meet criteria established in 10 CFR Part 52, §52.98.

4.2.1 Wind Loadings

The applicant should provide design parameters for wind velocity, including the vertical wind velocity and gust factor, and a determination of applied forces which are used for structural design.

4.2.2 Cyclonic Windstorms (Tornado, Hurricane, etc.)

The applicant should provide the design parameters such as translational and rotational velocity, pressure differential, and associated time interval, together with the methods used to translate those data into forces exerted on the plant structures, systems, or components.

4.2.3 Water Level (Flood)

The applicant should provide design parameters for load from forces developed by the maximum probable flood, including water height, and dynamic phenomena such as velocity.

4.2.4 Projectile Protection

Design parameters with respect to internal and external projectile protection should be provided. The applicant should give details on the assumed projectile, velocities, and forces involved.

4.2.5 Seismic Loadings

The applicant should provide design parameters to be used in construction of the plant and associated equipment with respect to earthquake shocks. Sufficient detail should be presented to permit an independent evaluation of the criteria selected.

4.2.6 Snow Loadings

The applicant should provide parameters used to assure that a maximum snow load can be accommodated.

4.2.7 Process and Equipment-Derived Loadings

The applicant should provide design parameters to accommodate the load contributed by process equipment and materials contained therein.

4.2.8 Combined Loadings

The applicant should provide design parameters for credible combined loads and the criteria selected to provide mechanical and structural integrity.

4.3 Facilities Design Criteria

4.3.1 Process Facilities

The applicant should provide a summary of the principal design parameters used for the enrichment plant and any other onsite SNM processing facilities. This summary may be presented in narrative and/or tabular form and should contain such information as component, function, design and operating criteria, safety considerations, etc. Each item should be referenced to a process flow sheet and, as applicable, related to details presented in Chapters 5 and 6.

4.3.2 Auxiliary Activities

The applicant should provide a summary of the criteria used for selection of the auxiliary activities, such as maintenance, laboratory, steam, air, water, etc. The applicant should relate the function of each, as applicable, to the operation of the onsite processing facilities.

4.3.3 Materials Handling and Storage

4.3.3.1 Uranium Handling. The applicant should describe the criteria used to determine safe containment during process, storage, and transportation of uranium compounds used at the facility.

4.3.3.2 Hazardous Chemical Waste Treatment and Storage. The applicant should provide design parameters to be used for treatment and storage of radioactive and/or hazardous chemical wastes, including (1) reduction in volume, (2) minimizing release during treatment and MPC values in effluent streams, (3) suitable forms for storage and/or shipment to a disposal site, (4) safe confinement and monitoring during onsite storage, and (5) final decontamination and disposal of waste for decommissioning.

4.4 Protection Systems

4.4.1 General

The primary confinement barrier for all hazardous chemicals is assumed to be the process equipment. Additional confinement barriers may be necessary to meet requirements specified in 10 CFR Part 20 and 10 CFR Part 52. Items requiring special consideration in design because of site selection, process selection, or release prevention should be identified.

4.4.2 Hazardous Chemical Confinement Barriers and Systems

4.4.2.1 General. The applicant should discuss each method of confinement which will be used to protect against uncontrolled release of uranium and other hazardous materials to the environment. Included for each method should be:

- Criteria for protection against any postulated internal accident or external natural phenomena.

- Design criteria selected for vessels, piping, effluent systems, and secondary confinement.

- Indication of how the criteria selected satisfy the requirements of 10 CFR Part 20, 10 CFR Part 52, maximum permissible concentrations (MPC), and/or threshold value limit (TVL) for fluorides and other hazardous chemicals. The source criteria for MPC or TVL limits should be referenced.

- Demonstration of how the criteria selected satisfy the requirements for achieving the lowest practicable level of releases from the operation of that process or facility.

Where limits selected are consistent with proven practices or standards, a referenced statement to that effect will suffice. Where the limits extend beyond present practices, an evaluation based on development work and/or analyses should be provided. These criteria may be expressed numerically or as general conditions.

4.4.2.2 Ventilation. For all safety-related structures, systems, and components, the applicant should provide parameters used to select suitable ventilation for normal, abnormal, and accident operation. Typical conditions considered should be air flow patterns and velocities with respect to contamination control. Where applicable, the applicant should provide filter system performance parameters with respect to particulate removal efficiency, testing, and maximum pressure drop, and performance of dampers and instrumented controls. The margin of safety should be evaluated for each condition.

4.4.2.3 Process (Off-Gas) Vents. The applicant should provide design parameters selected to contain, remove, or control all hazardous chemicals from process gas vents. Typical conditions considered should be minimum negative pressures at key points in the system required to maintain proper flow control, chemical and mechanical interaction of "off-gas" with removal components, and performance of control devices. The margin of safety should be evaluated for accident conditions for each process vent containing hazardous chemicals.

4.4.2.4 Liquid Effluents. The applicant should provide design parameters selected to contain, remove, or control all hazardous chemicals from liquid waste effluents. Typical conditions considered should be stream flow rates, chemical concentrations, holding pond capacities, and retention and control devices. The margin of safety should be evaluated for accident conditions.

4.4.3 Radiological Protection

A portion of radiological design criteria has been discussed in Section 4.4.2, since hazardous chemicals may include some radioactivity. In addition, parameters should be presented in this section to show compliance with specific regulations.

4.4.3.1 Access Control. The applicant should provide parameters selected to provide "Restricted Areas" as defined in 10 CFR Part 20, §20.3.

4.4.3.2 Radioactive Effluents to Unrestricted Areas. The applicant should provide the parameters selected to meet the requirements specified in 10 CFR Part 20, §20.106. The margin of safety designed into the process parameters for each system on the plant site should be evaluated.

4.4.3.3 Radiation Alarm Systems. The applicant should describe the criteria used to determine action levels from radiation alarm systems. The description should include radiation control systems installed for contamination control, safeguard purposes, and criticality detection.

4.4.4 Fire and Explosion Protection

The design parameters selected to ensure that all safety functions will successfully withstand credible fire and explosion conditions should be provided.

4.5 Nuclear Criticality Safety

All pertinent criteria relating to assurance that appropriate safety margins are provided to insure a subcritical situation should be included.

4.5.1 Control Methods for Prevention of Criticality

The applicant should present the methods to be used to ensure subcritical situations in all plant process operations under the worst credible conditions.

4.5.2 Error Contingency Criteria

The applicant should define the error contingency criteria selected to support the information in Section 4.5.1.

4.5.3 Verification Analyses

The applicant should present the criteria for establishing verification of nuclear criticality safety.

4.6 Summary of Structures, Components, and Systems Criteria

A summary of the structures, components, and systems selected for the design should be provided in tabular form according to the (1) safety function they perform, (2) natural phenomena protection considerations required, and (3) quality of the item with respect to its function and performance. As appropriate, this classification should relate to details presented in Chapters 5 and 6.

The criteria used for selection should be included.

4.7 Decommissioning

Arrangements for safe decommissioning of the facilities should be included. This section should provide the design criteria incorporated in the plant for fulfilling this requirement. The plans and policies regarding the expected environmental consequences should be presented. Also, the actions to be taken at the end of the useful life of the plant should be presented. Suitable reference to the appropriate part of Section 11.8 may be used to facilitate presentation of these criteria.

CHAPTER 5 FACILITY DESIGN

In support of the PSAR evaluation, the applicant should provide information on the buildings and other installed features for the plant and their locations on the site. Illustrative aids such as drawings and maps may be used as appropriate. The applicant should describe and evaluate each part of the facility with emphasis on those features which serve a safety-related function, and should describe and evaluate special design features employed to withstand environmental forces and accident forces. The design bases and use of industrial codes should be related to the design criteria presented in Chapter 4. Those features which require inclusion in the Quality Assurance Program should be referenced. For the FSAR, the applicant should identify areas which have been changed or added to the facility as described in the PSAR, the reasons for those changes, and the safety implications of those changes. The results of research and development activities which are related to the construction and/or operating criteria should be presented.

5.1 Site Description

5.1.1 Location and Facility Layout

The applicant should identify the location of the buildings and other structures of the plant on a map or drawing (to scale). This presentation should also include roadways, railroad lines, security, utility, and water service locations.

5.1.2 Principal Features

5.1.2.1 Site Boundary. The boundary which encompasses the area owned and/or leased by the applicant should be shown.

5.1.2.2 Exclusion Area. The boundary within which the applicant has authority to determine all activities, including exclusion or removal of personnel and property, should be shown.

5.1.2.3 Restricted Area. The restricted area(s), as defined in 10 CFR Part 20, §20.3, should be shown.

5.1.2.4 Site Utility Facilities. The applicant should identify all utility components, supplies, and systems. For the purpose of this chapter, a utility is any auxiliary system deemed necessary or desirable for the operation of the enrichment plant. The locations of these components, supplies, and systems should be shown. As appropriate, single line diagrams or drawings should be provided to show distribution as described in this section. Safety-related load and stress characteristics should be provided in applicable sections. Such items as water, steam, cooling towers, warehouses, etc. should be included.

5.1.2.5 Storage Facilities. The locations of holding ponds, process chemical storage, gas storage vessels, and other tankage not located in a building should be shown.

5.1.2.6 Effluents and Stacks. The locations of sewage and hazardous chemical effluent streams and process vents should be shown.

5.2 Enrichment Process Buildings and Components

The design bases for process buildings should be provided. The applicant should include (1) analysis and design procedures where appropriate for tornado, earthquake, projectile, fire, and explosion effects; (2) the general analysis and design procedures for normal, abnormal, and load combinations; (3) allowable foundation loads; (4) deflections and deformation stresses for structures and component supports; and (5) provisions and methods for making connections between the existing plant and future plant modification and additions. It is recognized that some auxiliary systems may be constructed in process buildings. The components of these systems should be discussed in the appropriate section.

5.2.1 Structural Specifications

The bases and engineering design required should be established for each building and its components. Where applicable, the applicant should identify nationally recognized codes and standards and the materials of construction, fabrication and inspection to be used and should itemize in tabular form features which will be used in the Quality Assurance program discussed in Chapter 10. The specifications and design details to meet the required information discussed in Section 5.2 above should be shown. The consideration given to combination stress loadings should be included.

5.2.2 Building Layout

5.2.2.1 Building and Component Plans. Using engineering type drawings, the applicant should show the layout of the functional features of each building. Plans and elevations should be provided in sufficient detail to identify all features, including operational and control areas to be discussed. Spatial and equipment identification data should be included directly on layouts or (with suitable designations) in tabular listings. The applicant should discuss the components in the area under consideration. The applicant should use individual equipment sketches and layout locations as necessary to identify components that must be relied upon (and limits that may be imposed) to achieve the margin of safety required by the design base.

5.2.2.2 Confinement Features. The applicant should identify and discuss those general criteria which have been included in the design of each building to assure confinement of hazardous materials. This should be a general discussion of details presented in Chapter 6 and may be suitably referenced to the appropriate section.

5.3 Auxiliary Building and Components

Auxiliary buildings (decontamination/recovery, maintenance, laboratory, pump houses, steam plant, etc.) will be constructed to house ancillary uranium processes, utilities, and other services for the enrichment systems. The design bases for these buildings and components should be presented in a similar manner to that in Section 5.2. Where the design criteria differ, the applicant should so state. A brief explanation should be given.

5.3.1 Structural Specifications

Presentation of these data should be similar to that in Section 5.2.1. The bases and engineering design should be developed separately for each auxiliary building and its components.

5.3.2 Building Layout

5.3.2.1 Building and Components Plans. By use of engineering type drawings, the layout of the functional features of each building should be presented. Where more than one process is contained in a building, the applicant should clearly identify each and discuss system components separately.

5.3.2.2 Confinement Features. Presentation of data in this section should be developed similarly to Section 5.2.2.2. Where hazardous chemical confinement is not involved, the applicant should so state.

5.4 Items Requiring Further Development

This section of the PSAR should identify, describe, and discuss those safety features for components which will require further technical information in support of the issuance of a construction permit, but which has not been supplied in the PSAR. This section of the PSAR should:

- Identify and distinguish between those technical information development programs that will be required to determine the adequacy of a new design and those that will be used to demonstrate the margin of safety of a proven design.

- Characterize the specific technical information that must be obtained to demonstrate acceptable resolution of the problems.

- Outline the program in sufficient detail to show how the information will be obtained.

- Provide a schedule of completion of the program as related to the projected startup date of the proposed plant.

Discuss the design alternatives or operational restrictions available in the event that the results of the program do not demonstrate acceptable resolution of the problems.

The applicant should provide the necessary information to support the contention that there is either reasonable assurance of successful completion of the program or that the alternatives considered will be an acceptable substitute.

5.5 Changes from the PSAR

This section will appear only in the FSAR. The applicant should describe the results of the development work identified in the PSAR, present an evaluation of the results, the application made of them, and identify and justify the changes made. Each item should be cross-referenced to the appropriate section in the FSAR that describes the changes and the reasons for them. The applicant should include a resumé of special technical information development programs undertaken to establish the final design and/or to demonstrate the conservatism of the design, and a discussion of any programs that will be conducted during operation in order to demonstrate the acceptability of contemplated future changes in design or modes of operation.

CHAPTER 6 SYSTEMS AND COMPONENT DESIGN

6.1 General

6.1.1 Requirements

6.1.1.1 Preliminary Safety Analysis Report. In this chapter, the applicant should provide a detailed description of the enrichment system and all other systems considered desirable for its operation in compliance with 10 CFR Part 52. The applicant should show clearly that all system and component design bases will provide adequate margin of safety for normal and transient operations. The applicant should analyze and evaluate each system and its components for prevention or mitigation of all credible accidents.

The selection of variables which will be probable subjects of technical specifications should be identified and justified. The applicant should include the process steps, equipment, and instrumentation, their operating characteristics, and identification of potential hazards. Those items which will require Quality Assurance program attention should be clearly indicated. The considerations used to assure "as low as practicable levels" of hazardous chemicals in the plant effluents and to ensure subcritical conditions at all times should be described for each applicable system.

6.1.1.2 Final Safety Analysis Report. The applicant should describe and analyze systems and components, with emphasis on performance and technical justification to show that safety-related functions will be accomplished. All current information derived from development programs and environmental and meteorological monitoring programs should be evaluated. Such items as chemical and physical processes to be performed, instrumentation and control systems, ventilation, hazardous chemical effluent control, and electrical, auxiliary, and emergency systems should be discussed. The applicant should evaluate the kinds and quantities of radioactive materials and the means of control to limit exposures in compliance with 10 CFR Part 20.

6.1.2 Narrative Description

The applicant should describe the proposed processes in narrative form and should relate them to the equipment and associated controls. Ancillary activities pertinent to the use by the main process should be included in this discussion--for example, heat removal systems, decontamination-recovery, utility generation and supply, off-gas handling, and volume reduction of wastes. In the description, the applicant should identify the interfaces between systems and should discuss the safety aspects of the interfaces. Descriptions should include specific reference to components and control items shown on the applicable flowsheet(s) to promote understanding.

6.1.3 Flowsheets

In support of the description above, process flowsheets, materials and heat balance areas, and instrumentation tabulations should be supplied. Identification of the process and effluent streams should be provided in sufficient detail so that an independent review can be made to ensure a safe operation. They should include stream flow quantities, activities, compositions, properties, sample points, and identification of primary control points. The applicant should provide the flow input characteristics for effluent control equipment, as well as its output, to show the efficiencies obtained. Equipment descriptions with design operating temperatures and pressures, special design features, and process limitations should be included.

6.1.4 Identification of Items of Safety Analysis Concern

Safety analysis related areas or items should be identified. Identification should be made by reference to items discussed in Chapter 2. The applicant should discuss design and operating features for these components and systems.

6.2 Process Chemistry and Physical Principles

The process chemistry and/or physical data appropriate to characterize each system should be presented in detail. Where side reactions may occur, the applicant should present the chemistry and extent to which such reactions will be expected under normal and abnormal conditions.

6.3 Enrichment and Other Processing Systems

The process system description should be related to the appropriate flowsheet. As applicable, the applicant should identify the system as a source of the effluents and waste discussed in Chapter 7 or Chapter 8. Reference to operational and control areas should be made to physical layout presentations found in Chapter 5. Subsections should be used to present the information. The applicant should name the process system and identify each sequentially, e.g., Sections 6.3.1, 6.3.2, 6.3.3, etc.

6.3.1, 2, 3, etc. Process Identification

6.3.X.1 Functional Description. The applicant should describe the process, or part thereof, and its function and interface function(s) as applicable. The applicant should present the design codes used, design base, and additional specifications as necessary to show that a sufficient margin of safety between normal and accident conditions exists so that a single error or failure will not result in the release of significant amounts of hazardous materials. Features included to assure "as low as practicable" exposure and compliance with environmental and industrial safety criteria should be described.

6.3.X.2 Major Components. If more than one component is included in a particular system, the applicant should explain the interrelationship of the individual components and the means by which they are combined within the system.

6.3.X.3 Design Description. The applicant should discuss the design bases as applied to materials of construction, pressure limits, temperature limits, and detailed dimensions, especially as related to criticality consideration. If not discussed elsewhere, corrosion allowances and standards or codes used should be specified. Material and equipment fabrication specifications pertaining to the system should be itemized in sufficient detail to relate to the Quality Assurance program to be discussed in Chapter 10. The applicant should itemize design bases in sufficient detail to relate to criteria developed in Chapter 4. With suitable cross reference, it may not be necessary to duplicate this information.

6.3.X.4 Safety Criteria and Assurance. From the parameters discussed in the preceding sections, the applicant should summarize the safety criteria and the means of assuring a safe system as constructed, operated, and maintained. Those limits selected for control by action and the level required for action should be clearly identified. The applicant should identify those items which can be characterized as being engineered safety features and which are considered to be necessary in addition to normal process operation and control.

6.3.X.5 Operating Limits. Limits, conditions, and performance requirements should be shown in sufficient detail to permit an evaluation of the necessity for development of technical specifications. The interface relations within the system and with other systems should be clearly described.

6.3.X.6 Component Spares. The applicant should describe in detail design features, such as installation of spare or alternative equipment, to provide continuity under normal and abnormal conditions. The bases for inspection, preventive maintenance, and testing programs to assure continued safe functioning should also be described.

6.3.X.7 Instrumentation. By reference to flowsheets and the particular process, the applicant should discuss the instrumentation and control features of each system. The discussion should include process control, process monitors, and alarms. The applicant should explain the relationships between control systems and operator response for normal and abnormal conditions.

6.4 Utility and Support Systems

Certain support systems, essential to processing operations, are not ordinarily classified as process systems. This classification includes such systems as building ventilation, electrical, compressed air, steam supply,

water supply, process heat exchange, communications and alarms, sewage treatment, and fire protection systems. Information on these systems should be provided. The applicant should emphasize the capacities, redundancy, and other provisions for coping with normal and accident conditions that mitigate unsafe conditions. Suitable reference can be made to Chapter 5 to identify component location without duplication of information.

6.4.1 Building Ventilation

As applicable, the applicant should provide design bases and features of various process building ventilation systems. Where ventilation systems are specifically designed to mitigate hazardous materials release, justification of the design bases should be provided.

6.4.2 Electrical

6.4.2.1 Major Components and Operating Characteristics. The applicant should discuss the source, load requirements, and characteristics of the electrical system providing power to the plant. As applicable to each processing system, the power distribution and supply should be described.

6.4.2.2 Safety Considerations. The applicant should describe redundant provisions for power to processing systems. Also, emergency power provisions for essential process system control and lighting should be described. The applicant should itemize the mechanism, sequence, and timing of events which will occur from loss of normal power.

6.4.3 Compressed Air

6.4.3.1 Major Components and Operating Characteristics. The design bases for supplying the compressed air needs of the plant should be provided. The applicant should include the components and their location and operating characteristics. The applicant should also include a description of the compressors, receivers and dryers, air quality testing, and distribution systems.

6.4.3.2 Safety Considerations. The applicant should discuss in detail the backup provisions for the process instrument air, essential purge, and other systems.

6.4.4 Steam Supply and Distribution

6.4.4.1 Major Components and Operating Characteristics. The applicant should present the design for supplying steam to the systems, including a discussion of the source, distribution; reliability of supply and onsite storage capacity for fuel.

6.4.4.2 Safety Considerations. The applicant should discuss features of the steam supply system in relation to continuity of operations. Also, plans for alternative supply during annual inspection outage, maintenance, etc. should be described.

6.4.5 Water Supply

6.4.5.1 Major Components and Operating Characteristics. The applicant should discuss the primary source of the water supply, alternative sources, storage facilities, treatment, and plant supply loops. The distribution and quantities should be itemized by service (potable, process, and fire).

6.4.5.2 Safety Considerations and Controls. If necessary for plant safety, the applicant should show that water can be provided for essential services under abnormal and accident conditions. The effects of loss of water supply, such as pump failure, major piping failure, and power failures, should be discussed.

6.4.6 Process Heat Exchange

6.4.6.1 Major Components and Operating Characteristics. The design bases for lubrication, heating, or cooling requirements to process systems should be provided. The applicant should describe components and controls, cooling towers, mass balance data, etc.

6.4.6.2 Safety Considerations. The applicant should discuss redundancy of system components, ramification and operator response to coolant leaks into the process, and loss of power, lubrication, coolant, or components.

6.4.7 Sewage Treatment

6.4.7.1 Sanitary Sewage. The applicant should describe the sanitary sewage handling system sufficiently to show that hazardous chemicals will not occur in this effluent.

6.4.7.2 Chemical Sewage. The applicant should provide bases for any system used to handle hazardous chemicals. System components, controls, and monitoring facilities should be described.

6.4.8 Communications and Alarms

6.4.8.1 Major Components and Operating Characteristics. The applicant should discuss the system(s) to be utilized for internal and external communications with particular emphasis on the networks to be used under emergency conditions.

6.4.8.2 Safety Considerations and Controls. The applicant should describe the functioning of the communication systems and alarms in response to normal and abnormal operations and under accident conditions. Also, the applicant should describe emergency power supply for systems considered essential.

6.4.9 Fire Protection

6.4.9.1 Major Components and Operating Characteristics. The applicant should describe the fire protection systems provided. Suitable reference to Chapter 5 may be used to show the location of the fire water supply, storage and loop system, detection and alarms, and fire walls and doors. The functions of the various systems should be explained.

6.4.9.2 Safety Considerations and Controls. The applicant should identify the features of the fire protection systems designed to mitigate the results of a fire to ensure against uncontrolled release of hazardous materials. The applicant should show that the capacity of the system is sufficient to meet any credible requirement and that the system is compatible with process conditions.

6.5 Sampling and Analyses

In addition to process and monitoring instrumentation described earlier, the applicant should discuss provisions for obtaining samples for chemical and physical analyses necessary to insure that operations are within prescribed limits. The facilities which will be available to perform the analyses in a timely and accurate manner should be described.

6.6 Items Requiring Further Development

As described in Section 5.4, the applicant should present in the PSAR the details for each item requiring the development of additional information or data. The applicant should identify the item, what is needed, and how and when the information will be obtained.

6.7 Changes from the PSAR

In the FSAR, the applicant should describe with details the results of the development work identified in the PSAR. The applicant should present an evaluation of the results and the application made of them. These changes should be identified and justified.

CHAPTER 7 WASTE CONFINEMENT AND MANAGEMENT

The applicant should provide the primary design bases and supporting analyses for demonstrating that all radioactive and/or hazardous chemical waste materials will be confined over the life of the plant. The considerations for offsite disposal of solid waste material and contaminated equipment should be included. Where contaminated equipment involves secret Restricted Data material, considerations should include requirements to comply with 10 CFR Part 95. The actual operation of the system and its minimum expected performance should be discussed in Chapter 6. A summary with suitable reference may suffice in this chapter.

7.1 Radiological Waste

The applicant should identify all hazardous chemical waste containing radioactive material as to source and chemical and radiological composition. The possibility, probability, and effects of processing uranium recycled from reactor fuel should be discussed in this section.

7.1.1 Ventilation and Off-Gas Treatment

All hazardous chemical wastes accummulated by process gas (off-gas) cleaning systems should be identified. Such items as filters, absorbers, scrubbers, etc., which collect wastes, should be discussed to indicate the destination of wastes upon regeneration or replacement. If these wastes enter other waste treatment systems, the applicant should indicate how the transfer is made and possible effects of the transfer.

7.1.2 Liquid Waste Treatment

The applicant should identify how all hazardous chemical liquid wastes are generated and enter the treatment or disposal systems. A discussion of the inventory levels, provisions for storage, and volume reduction should be part of the design bases.

7.1.3 Solid Waste Treatment

The applicant should identify how all solid wastes are generated and the means for handling, packaging, shipping, and disposing of them. If solid wastes are retained on site, the containment methods, including corrosion aspects and monitoring of the containment should be explained. The applicant should show how decommissioning retrievability requirements can be met.

7.2 Nonradiological Waste

The applicant should identify waste, including thermal, laboratory waste, fluorides, etc., other than those containing radioactive materials. The sources and chemical composition, including reaction products, should be discussed. This information should include a demonstration of the probability of inadvertent additions of radiological waste.

CHAPTER 8 RADIATION PROTECTION

8.1 Radiation Protection Objectives

In 10 CFR Part 20, "Standards for Protection Against Radiation," the Commission's regulations for radiation protection are presented. Of particular importance is §20.1(c), which provides that:

"(c) In accordance with recommendations of the Federal Radiation Council, approved by the President, persons engaged in activities under licenses issued by the Atomic Energy Commission pursuant to the Atomic Energy Act of 1954, as amended, should, in addition to complying with the requirements set forth in this part, make every reasonable effort to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as far below the limits specified in this part as practicable. The term 'as far below the limits specified in this part as practicable' means as low as is practicably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety and in relation to the utilization of atomic energy in the public interest."

The purpose of the information that should be provided in this chapter is to permit a determination of whether radiation exposures to persons in unrestricted areas and to plant personnel from plant operation, including anticipated operational occurrences, and from postulated accidents will be kept as low as practicable and within applicable limits. It is recognized that as used throughout the Standard Format, the term "hazardous chemicals or hazardous materials" includes radioactive and chemical content. For the purposes of this chapter, only the radioactive constituents will be considered.

In the PSAR, the applicant should discuss the design considerations and the methods for contamination and radiation control to be used in achieving these requirements. In addition, based on the source terms developed in previous chapters, the applicant should estimate radiation dose rates to operating personnel and to the public. A description of the instrumentation, surveillance procedures, and action levels selected to assure continued low exposure should also be provided.

The FSAR should present the kinds and quantities of radioactive materials expected to result during operation. It should also present a discussion of methods used for control of these materials in the effluents. Any changes from the PSAR presentation should be discussed and justified.

8.2 Onsite Contamination Control

The design and safety basis for each contamination control zone should be identified. The applicant should include a discussion of contamination control

performance limits for normal and abnormal conditions. Engineering drawings showing locations, layout of equipment, or other functional features should be presented.

8.2.1 Zones

The zones within the plant and on the site which may be classified as contamination and/or radiation zones should be identified. The applicant should provide a clear description of the location of the interfaces between zones and the type of controls which will prevent spread of contamination.

8.2.2 Access and Egress Control

The applicant should discuss the methods to be used for control of access and egress to and from contaminated zones. The applicant should include the methods to be established for maintaining radiation protection awareness on the part of personnel, such as placarding, boundary marking, etc., and for confinement of contamination, such as protective equipment, personnel monitoring, and change-room design arrangement.

8.2.3 Contamination and Radiation Control

The applicant should provide the design bases, objectives, and estimated radiation dose rates to show that exposure of operating personnel will be "as low as practicable." The FSAR should discuss the procedures and instrumentation used for surveillance of radiation and contamination levels, the levels selected above which action will be required, and the actions that will be taken.

8.2.4 Maintenance Areas and Procedures

The applicant should describe the functional arrangement and procedures for conducting maintenance work in contaminated areas or on equipment which may be contaminated. Radiation exposure limits and expected exposure levels should be discussed.

8.2.5 Decontamination Provisions

The applicant should present the bases to assure that provisions have been included to decontaminate equipment and plant areas during the operating life of the plant.

The applicant should discuss the arrangements and plans for final decontamination and decommissioning of the plant.

8.3 Effluent Radioactivity Control

The applicant should summarize the previous discussions on building ventilation, liquid waste, and off-gas treatment in Chapters 5 and 6 to show that the designs selected will achieve the "as low as practicable" limits required by 10 CFR Part 20.

8.3.1 Building Ventilation

8.3.1.1 Design Base Validation. The applicant should refer to the discussion on building ventilation in Section 4.4.2.2 and to appropriate equipment and process flow drawings to further discuss the interrelation of component parts and controls to:

- Prevent spread of radioactivity in normal plant operations.
- Minimize spread of radioactivity during abnormal operations or under accident conditions.
- Control contamination between areas.
- Control contamination when maintenance activities are being performed.
- Demonstrate that provisions are incorporated to adequately monitor performance.

8.3.1.2 Operating Characteristics. The applicant should describe the function and performance objectives of each ventilation system installed for radioactive particulate removal. For each system, the applicant should discuss the areas and equipment serviced and the criteria for providing adequate service. The description should include, with reference to drawings, the interface considerations between components of the system. A discussion of the design limits selected for operation and the performance limits that should be met for safety should be included. The program to determine the efficiency of each component during the operating life of the plant should be discussed.

8.3.2 Process Vents (Off-Gas)

8.3.2.1 Design Base Validation. The applicant should refer to the discussions on off-gas treatment in Section 4.4.2.3 and to process flow drawings to show for each off-gas system that:

- "As low as practicable" radioactive releases will be achieved.
- Design is capable of confining radioactivity to acceptable levels during abnormal operations or under postulated accident conditions.
- Provisions are incorporated to adequately monitor performance.
- A detailed plan for air sampling is presented.
- Satisfactory design features are incorporated to interface with other effluent and ventilation systems.

8.3.2.2 Operating Characteristics. The applicant should describe the function and performance objectives of each off-gas treatment system, and should present a discussion of the principles upon which each performs. The applicant should include a discussion of the design limits selected for operation and the performance limits that must be met for safety. The applicant should also discuss the program to determine the efficiency of each treatment component during the operating life of the plant, including the composition of the feed to the treatment system and the discharge from it.

8.3.3 Liquid Streams

8.3.3.1 Design Base Validation. The applicant should refer to the discussion on liquid waste treatment in Section 4.4.2.4 and to appropriate equipment and process flow drawings to show for each stream that:

- "As low as practicable" radioactive and/or hazardous chemical releases will be achieved.

- Provisions are incorporated to adequately monitor input streams and performance of each system.

8.3.3.2 Operating Characteristics. The applicant should describe the function and performance objectives of each liquid effluent treatment system. For each system, applicant should describe the areas and equipment serviced and the criteria for providing adequate service. A discussion of the design limits selected for operation and the performance limits that must be met for safety should be included. Also, the program to determine the efficiency of each system during the life of the plant should be discussed.

8.4 Area Surveillance

8.4.1 Area Radiation Monitors

The applicant should show the location of area radiation monitors and describe the type of detection and alarm response. The FSAR should discuss the mechanism and procedures for assuring safety.

8.4.2 Criticality Monitors

The applicant should show the location of radiation detectors used to monitor for criticality incidents and describe the type of detection and alarm response. The FSAR should discuss the plan, mechanisms, and procedures used to ascertain correct response.

8.5 Estimated Man-Rem Offsite Exposures

The applicant should describe the program and the analytical approach taken to monitor the radioactivity content of the effluent streams of the plant. The applicant should relate the monitoring program to process flow diagrams and the discussions presented in Chapters 6 and 7. The contribution by the plant to the offsite radioactivity level should be estimated. The applicant should show that the radioactivity levels will be as low as practicable and should show that, in any case, these levels will comply with 10 CFR Part 20, §§20.105 and 20.106.

8.5.1 Effluent and Environmental Monitoring Program

The program for monitoring and estimating the contribution of radioactivity to the environment should be described in the PSAR. The applicant should present the details of the approach and results obtained for determining the background levels and the estimate of subsequent contribution of the plant.

8.5.1.1 Gas Effluent Monitoring. The features of the sampling systems to be used, their locations, and the items to be monitored should be described in the PSAR. For each system, the applicant should show the expected reliability and Ci-sec-m^{-3} sensitivity in double the instrument response time and in one week. The sensitivity of detection relative to the limits specified in 10 CFR Part 20, §20.106, should be discussed. The frequency and methods of sampling, the limits for which action is required, and procedures to be used to maintain continued integrity should be discussed in PSAR and specified in the FSAR.

8.5.1.2 Liquid Effluent Monitoring. As with gas effluent monitoring, the applicant should describe the features of the liquid sampling systems to be used, their locations, and the items to be monitored. If in-line monitors are used, the applicant should show for each the expected reliability and the sensitivity in Ci-sec-m^{-3} in double the instrument response time and in one week. Where holding tanks and on-line or in-tank sampling followed by laboratory analysis are used for monitoring of radioactive contaminants, the applicant should discuss the sensitivity of detection relative to limits specified in 10 CFR Part 20, §20.106. The applicant should discuss the frequency and methods of sampling, the limits for which action is required, and procedures to be used to maintain continued integrity of analyses.

8.5.1.3 Solid Waste Monitoring. The applicant should describe the procedures, equipment, and instrumentation used to monitor all solid waste containing radioactivity and should describe the methods of sampling, analysis, and instrument calibration.

8.5.1.4 Environmental Monitoring. The applicant should describe in detail the program which will monitor possible contribution of radiation to the site and environs. The applicant should identify the samples of atmosphere, soil, flora, and fauna which will be taken, the frequency the samples are obtained, the analyses to be performed, instrumentation and calibration, and the method of reporting. This section should include the program for continuing meteorological data collection and evaluation to supplement the estimates previously developed.

8.5.2 Analysis of Multiple Contribution

The applicant should present an analysis of the incremental and accumulated annual population exposure for the proposed facilities effluents plus effluents from any other nuclear plant within a 5-mile radius. Presentation may be by a table summarizing radiation dose contribution to regional population from the proposed plant and other nuclear facilities. Calculations should include water and airborne pathways, allowing for deposition and lithological characteristics.

8.5.3 Estimated Exposures

The applicant should present the man-rem annual exposures for whole body and appropriate critical organs estimated to be attributable to plant effluents in each of 8 compass sectors about the plant between each of the arcs having radii of 1, 2, 3, 4, and 5 miles. The applicant should provide details of assumptions and give sample calculations with emphasis on critical pathways to man. These should be related to the meteorological data presented in Chapter 3 and the radioactivity release rates in Chapter 7.

CHAPTER 9 ACCIDENT ANALYSIS

The evaluation of the safety of uranium enrichment facilities is accomplished in part by analysis of the responses to postulated accident events in terms of (1) minimizing the causes of such events, (2) the quantitative identification and mitigation of the consequences, and (3) the ability to cope with each situation should it occur. These analyses are an important part of the reviews made by the Commission prior to issuing a construction permit or an operating license.

The PSAR should present an in-depth discussion of accident analysis to the extent the technology and design are known or determined at the time of its submittal. The FSAR should present additional details which have been revised or developed since the PSAR submittal because of additional information.

In previous chapters, features important to safety have been identified and discussed. It is the purpose of this chapter to identify and analyze a range of credible abnormal operations and accident occurrences, their causes, and consequences. Reference should be made to the appropriate chapter and section describing the considerations to prevent, or to mitigate the consequences of, the accident.

9.1 Abnormal Operations

In this section, the applicant should present events which could occur from malfunctions of components or systems or because of operator error. It is expected that the magnitude of the events discussed in this section would require notification to USAEC Regulatory Operations pursuant to 10 CFR Part 20, §20.403. The following format should be used for the purpose of presenting the desired detail.

9.1.1, 2, 3, etc. Event

The occurrence should be identified, including thy location of event, type of failure or maloperation, and systems involved.

9.1.X.1 Postulated Cause of the Event. The applicant should describe the sequence of occurrences that could initiate the event under consideration and the bases upon which the probability of each occurrence in the sequence is determined.

The following should be provided:

- Starting conditions and assumptions.
- A step-by-step sequence of the course of each accident.
- Identification of any operator actions necessary.

The discussion should show the extent to which protective systems must function, the effect of failure of protective functions, the credit taken for designed-in safety features, and the performance of backup protective systems during the entire course of the event analyzed. The discussion should also include evaluation of the effect on the function of other systems and the consequences of their failure.

The analysis given should permit an independent evaluation of the adequacy of the protection system(s) as related to the event under study. The analysis should explain which functions, systems, interlocks, and controls are safety related and what actions are required by the operator under anticipated operational occurrence and accident conditions.

9.1.X.2 Detection of the Event. The applicant should discuss the means or methods provided to detect the abnormal operation, using visual or audible alarms or routine inspections performed on a stated frequency. For each, the applicant should provide an assessment of response time required to avoid or alleviate the postulated event.

9.1.X.3 Effects and Consequences. The applicant should analyze the effects and particularly any health and safety consequences of the event. The analysis should:

- Show the methods, assumptions, and conditions used in estimating the course of events and the consequences.

- Identify the source terms applicable to each accident analysis. This may be presented in tabular form. The data should include (1) chemicals used in the process, (2) physical form and compound, (3) the maximum inventory available, and (4) the properties important to dispersion (reactions, particle size, solubility, etc.).

- A description of the margin of protection provided by whatever system is depended upon to limit the extent or magnitude of the consequences.

9.1.X.4 Corrective Actions. For each event, the applicant should give the corrective actions necessary to return to a normal situation.

9.2 Accidents

This section should provide analyses of credible accident situations which could occur and result in uncontrolled release of radioactive or other hazardous materials. It is expected that the magnitude of accidents discussed in this section would require notification to USAEC Regulatory Operations pursuant to 10 CFR Part 20, §20.403.

The following format should be used for the purpose of presenting the desired detail.

9.2.1, 2, 3, etc. Accident Analyzed

The applicant should identify the accident, the location or portion of the facility involved, and the type of accident. On-site transportation accident involving hazardous chemicals should be included. Discuss each accident sequentially, e.g., 9.2.2, 9.2.3....

9.2.X.1 Cause of the Accident. For each accident analyzed, the applicant should describe and list the sequence of events leading to the initiation of the accident. The applicant should identify the accident cause, i.e., natural phenomena, human error, equipment malfunction, or equipment failure. An estimate of the probability of occurrence and a description of how this estimate was determined should be included.

9.2.X.2 Accident Analysis. The applicant should analyze the effects of the accident, with emphasis on consequences of hazardous material release. As with the abnormal event analysis, the methods, assumptions, and conditions used in estimating the consequences should be shown. The recovery from the consequences and steps used to mitigate the accident should be discussed. The possible consequence of the accident to persons and property offsite should be assessed.

The results and consequences derived from the analysis should be discussed. The applicant should show the margin of protection provided by whatever system is depended upon to prevent or mitigate the consequences.

CHAPTER 10 QUALITY ASSURANCE PROGRAM

The regulations for a quality assurance (QA) program to be established and executed by the applicant are specified in 10 CFR Part 52, §52.121 through 52.123. The QA program should be established at the earliest practical time and will be effective throughout the design, construction, and operation of the facilities. The PSAR should describe that part of the QA program to be used during the design and construction phases. The FSAR should specify that part of the QA program to be used during preoperational testing, startup, and operation of the facilities.

Where some portions of the quality assurance program have not yet been established at the time the PSAR is prepared, the description should include a schedule for implementation.

Where a portion of the quality assurance program to be implemented will conform to a particular quality assurance standard, such as those adopted by the American National Standards Institute (ANSI), the description of the program, to the extent described in the standard, may consist of a statement that the particular standard will be followed.

10.1 PSAR Quality Assurance Program

10.1.1 Organization and QA Plan

The applicable structures, systems, and components of the QA program should be identified by the applicant. All activities affecting safety-related functions should be included. The QA program should be established at the earliest practical time consistent with the activity to be accomplished.

The working relationship and organizational interfaces among the applicant, the architect-engineer, contractors, and suppliers should be described. Any arrangements with Federal, State, or local governments should be presented.

Organizational charts for the construction project should be provided that denote the lines and areas of responsibility, authority, and intercommunication among the applicant, architect-engineer, fabricators, and construction company. In addition, the applicant should supply a discussion of the responsibility and authority of each. The location of, freedom of, and authority of each individual or group for checking, auditing, inspecting, or otherwise verifying that an activity has been correctly performed should be indicated. The charts and discussions should indicate the degree of involvement on the part of the applicant in the verification of the QA programs to be implemented by the applicant's contractors and suppliers. These data should cover those cases where the applicant has delegated to other organizations the work of establishing and implementing the project QA program or any part thereof.

The written policies, procedures, or instructions which implement the QA program should be described.

10.1.2 Design Control

A description of the design control measures should be provided. The description should include (1) measures to assure that appropriate quality standards are specified in design documents and that deviations from such standards are controlled, (2) measures for the selection and review of suitability of materials, parts, and equipment, (3) measures for the identification and control of design coordination among participating organizations, and (4) measures for verifying or checking adequacy of design, such as by design reviews or suitable testing programs. Measures should also be described to assure that design changes, including field changes, will be subject to design control review commensurate with that applied to the original design.

The measures for identifying, controlling, and coordinating design interfaces should be described.

10.1.3 Procurement Document Control

A description of the procurement document control measures should be included. These measures should show that (1) suppliers are required to have and implement QA programs and (2) applicable Regulatory requirements and design base criteria are included or referenced.

10.1.4 Instructions, Procedures, and Drawings

The measures to ensure that activities affecting process systems quality are specified in documented instructions, procedures, and/or drawings should be described. The measures to ensure that these activities will be conducted according to these specifications should also be included.

10.1.5 Document Control

The measures established to control the issuance of documents for items specified in Section 10.1.4 should be described. The description should include (1) the review and approval procedures, (2) the measures to establish and update a master document listing, and (3) the method to ensure that any changes to these documents are reviewed and approved.

10.1.6 Control and Identification of Purchased Material and Services

The measures for the control of critical purchased material, equipment, and services should be described. Provisions for inspection at the supplier source and for adequate shipping protection should be explained. The applicant should describe facilities and procedures for examination and proper storage of these products upon delivery. The measures taken to ensure that

the applicable material and equipment conform to the procurement requirements should be described. Evidence of conformance, for critical components, should be available at the plant site prior to installation or use of such material or equipment.

10.1.7 Identification and Control of Materials, Parts, and Components

The measures established to identify, to control, and to prevent the use of incorrect or defective specified items should be described. These measures should include appropriate means of identification and should provide records traceable to the item.

10.1.8 Control of Special Processes

The applicant should provide a description of the measures established to control special processes such as heat treatment, welding, etc. The measures should include the means to ensure that these processes are adequate and are performed in a qualified manner.

10.1.9 Inspection, Surveillance, and Testing

The program for inspection and surveillance of activities, listing the specific items affecting quality, should be described. Mandatory hold points, where witnessing or inspection by the applicant is required, should be included.

Also included should be an organizational description of the individuals or groups performing inspections and their qualifications to perform the inspection. The independence of the inspection group from the group performing the activity being inspected should be indicated. The applicant should describe how the inspection and surveillance program for the organizations involved has been or will be established.

The applicant should describe the program to ensure that all testing, required to demonstrate that systems and components will perform satisfactorily in service, is performed and identified. Included should be an outline of the test program, procedures to be developed, means for documenting and evaluating test results of the item tested, and designation of the responsibility for performing the various phases of the program. Where a program is used to verify the adequacy of a specific design feature, a description of the qualification testing of a prototype unit should be included.

10.1.10 Control of Measuring and Test Equipment

Where applicable, the applicant should describe the program to ensure that tools, gages, and instruments used in quality-affecting test activities are properly controlled, calibrated, and adjusted.

10.1.11 Nonconforming Materials, Components, Fabrication, and Construction

The applicant should describe the measures to be taken to control nonconforming materials, parts, or components to prevent their inadvertent use or installation. Included should be the means for identification, documentation, segregation, disposition of nonconforming material, and notification to affected organizations. Also, the method for control of nonconforming construction practices as related to approved drawings and specifications should be included.

10.1.12 Corrective Actions

The applicant should describe the corrective action measures necessary to ensure that conditions adverse to acceptable quality are identified, corrected, and will not be repeated.

10.1.13 QA Records

The applicant should discuss the program for the maintenance of records to furnish evidence of activities affecting quality. Included should be the means for identifying the records, retention requirements for the records including duration, location and assigned responsibility, and means for retrieving the records when needed.

10.2 QA Program for Plant Operation

The applicant should provide in the FSAR a description of the proposed QA program that will govern the quality of all safety-related items during operation of the plant. Those activities include operating, maintaining, repairing, and modifying such items subsequent to the preoperational phase. Procedures and equipment used in repair, modification or replacement should be subject to the same approval procedure required for the original design. The format of Section 10.1 should be followed to provide this information.

CHAPTER 11 MANAGEMENT ORGANIZATION, TESTING, AND OPERATING PROGRAMS

The PSAR should include preliminary plans for the applicant's organization, preoperational testing, training programs, emergency plans, conduct of operations, and decommissioning. Sufficient detail should be provided to indicate how the applicant intends to maintain a technically competent staff for continued implementation of administrative and operating procedures necessary to plant safety. The application requires that the applicant will not permit access to "Restricted Data" until the Commission shall have determined that permitting such access will not endanger the common defense and security. A plan that meets the requirements of 10 CFR Parts 25 and 95 should be described.

The FSAR should include information concerning the applicant's organizational structure, allocations of responsibilities, and personnel qualifications for operating the facilities. It should also describe (1) plans for preoperational testing, (2) plans for operator training and qualifications, (3) plans for initial startup, and (4) the technical, managerial, and administrative controls to be used to assure safe operation of the facilities.

11.1 Organizational Structure

11.1.1 Corporate Financial Responsibilities

The corporate arrangement or organization related to the enrichment facilities should be described. If the corporation is made up of two or more existing entities, the applicant should explain the relationship and responsibilities among the groups. As required in 10 CFR Part 52, §52.36, sufficient information should be provided to demonstrate the financial capabilities for construction, operation, and decommission of the plant.

11.1.2 Corporate Functions, Responsibilities, and Authorities

The applicant should describe the corporate functions, responsibilities, and authorities with respect to plant engineering design, construction, QA program, testing, operation, and other applicable activities. The applicant's management and technical staffing assigned the responsibility for construction of the facilities should be described. Included should be a discussion of the responsibilities of this group for transition of the facilities to operational status. The extent of the dependence of this group on corporate or other personnel should be explained.

11.1.3 Operating Organization

This section should describe the structure, functions, and responsibilities of the proposed operating organization. The following information should be included in the FSAR.

11.1.3.1 Plant Organization. The organizational arrangement for assuring safe operation of the facilities should be presented. Included should be a comprehensive description of the plant organizational arrangement showing (1) the title of each position, (2) the flow of responsibility, and (3) the number of personnel in each unit. Also, the personnel assigned to the safety committee (by position), its mode of operation, and its responsibility should be specified.

11.1.3.2 Managerial Functions. The functions and authority of managerial positions with safety-related authority should be described. A discussion of succession in the event of absence, incapacitation, or other emergency should be presented.

11.1.4 Personnel Qualifications Requirements

In this subsection, the applicant should describe the proposed minimum requirements for safety-related onsite plant position. The PSAR should specify the minimum qualification requirements of plant manager, health and safety officer, first line supervision, and other safety-related positions. The FSAR should present any changes in required qualifications and the description of assigned onsite staff personnel.

11.1.4.1 Minimum Qualification. The PSAR should describe minimum qualification requirements for plant operating and other safety-related personnel.

11.1.4.2 Plant Personnel Qualifications. The qualifications of the individuals assigned to safety-related managerial and technical positions described should be presented in resumé form in the FSAR. The resumés should identify individuals by position title and, as a minimum, should describe the formal education, the training, and the experience of the individuals.

11.2 Preoperational Testing and Operation

The FSAR should describe the preoperational testing requirements and procedures. Operating startup plans should be presented. The applicant should emphasize those plans which demonstrate that the facility, equipment, and processes meet safety and design criteria discussed in previous chapters. Test plans should be presented to verify the integrity of the facility, equipment, and process. Results obtained from carrying out the plans should be available for operational referral.

11.2.1 Administrative Procedures for Test Programs

The applicant should describe the system used for preparing, reviewing, approving, and executing all test procedures and should also describe instructions for evaluating, documenting, and approving the test results.

The administrative procedures should be described for incorporating any needed system modifications or procedure changes based on the results of the tests (e.g., test procedure inadequacies or test results contrary to expected test results).

11.2.2 Test Programs Description

The applicant should describe the test objectives and the general methods for accomplishing these objectives, the acceptance criteria that will be used to evaluate the test results, and the general prerequisites for performing the tests. The following items should be summarized: items tested, type of test, response, and validation.

11.3 Training Programs

11.3.1 Program Descriptions

The FSAR should describe the proposed training program. Specific programs for licensed operators and other personnel should be described. Requirements for licensed operators are specified in 10 CFR Part 52, §§52.71 through 52.81. The scope of training in plant operations and design, instrumentation, and control, methods of dealing with process malfunctions, decontamination, procedures, health physics, and emergency procedures should be included. For health physics, the extent of training in subjects such as sources and nature of radiation, methods of controlling contamination, biological effects of radiation, use of monitoring equipment, and principles of criticality control should be described. The applicant should identify personnel classification with level of instruction.

11.3.2 Retraining Programs

The applicant should describe program(s) for continued training through presentation of additional materials, refresher instructions, and licensed operator requalification.

11.3.3 Administration and Records

The applicant should identify personnel in the organization responsible for the training programs and for maintaining up-to-date records on the status of trained personnel, training for new employees, and refresher or upgrade training of personnel.

11.4 Facility Operations

11.4.1 Plant Procedures

The PSAR should include a commitment to conduct safety-related operations by detailed written procedures. In addition, the FSAR should include a list of titles of procedures (that indicate clearly their purpose and applicability) and a description of the process for review, change, and approval for all operating, maintenance, laboratory, and testing procedures.

11.4.2 Plant Records

The FSAR should present a description of the management system used to maintain records. The methods used for storage, retrieval, and retention of all records should be described. Retention time should be specified for specific types of records. At a minimum, descriptions should be provided for plant history, operating records, and event records.

11.4.3 Review and Audit

This section should describe the applicant's program for ensuring independent review of the plant construction and operation. The intent of this plan should be to ascertain that the plant will be constructed and operated safely and according to the license conditions.

11.5 "Restricted Data" Security Program

The PSAR should include management plans for compliance with 10 CFR Part 25 as regards access to "Restricted Data" and a discussion of 10 CFR Part 95 as regards handling documents and materials classified as "Secret - Restricted Data." The FSAR should discuss specific plans, components, and systems for receiving, using, storing, and disposing of these classified items.

11.6 Emergency Plans and Procedures

11.6.1 Preliminary Plan

The PSAR should include a description of the applicant's plan to cope with emergencies. It should contain sufficient information to ensure compatibility with facility features. The contents should include a description of the organization delegated to handle the emergency and a means for notification of the persons assigned to this organization. The plan should (1) describe contracts and arrangements to be made with outside groups which have responsibility for coping with an emergency, (2) describe measures to be taken to protect the health and safety of offsite facilities and personnel, (3) describe emergency first aid, decontamination, and transportation facilities provided at the facility, (4) describe provisions to be made for emergency treatment at offsite facilities, (5) describe any training program for employees or other persons to provide services required to cope with the emergency, and (6) describe provisions to ensure safe evacuation and reentry. The content of the plan should be comprehensive enough to meet the requirements of 10 CFR Part 52, §§52.140 through 52.143.

11.6.2 Final Plan

The FSAR should contain emergency plans and details of implementation to the extent sufficient to demonstrate that it will provide reasonable assurance of the protection of public property, health, and safety.

11.7 Technical Specifications

The FSAR should contain proposed Technical Specifications. The Technical Specifications are derived from analysis of the plant and processes and include safety limits, condition limits, surveillance, and design features.

The conclusion that the health and safety of the public and of operating personnel will be protected during plant operation if all operations are performed within certain prescribed limits should be supported by the safety analyses. These limits should be defined and established in the Technical Specifications.

Each technical specification is composed of four parts as defined below:

Applicability The area of the plant or portion of the process to which the Technical Specification applies.

Objective The safety goal to be achieved.

Operating Control or Limit A precise statement of the operating control or limit.

Basis Information derived from the safety analysis which indicates:

a. the normal range of the variable,

b. the limit to abnormal operation,

c. the margin between the operating control or limit and the onset of unsafe conditions,

d. reference to supporting information.

The Technical Specifications should be proposed by the applicant and must be reviewed and issued by Licensing personnel. Regulatory Guide 3.6, "Content of Technical Specifications for Fuel Reprocessing Plants," presents an acceptable description of the requirements for and format for presentation of fuel reprocessing plant Technical Specifications. It is suggested that this guide be adapted for use in this section.

11.8 Decommissioning

11.8.1 Decommissioning Program

The PSAR should present the planned program for decommissioning the plant.

11.8.2 Decontamination

The applicant should discuss the procedures and arrangements to decontaminate the facility to the lowest practicable level. Plans to adequately handle Secret - Restricted Data material and documents should be described.

11.8.3 Agreements with Outside Organizations

The applicant should present any arrangements and agreements with other organizations for control of access in the event decommissioning does not permit unrestricted access.

11.8.4 Arrangements for Funding

The applicant should discuss the means for funding the decommissioning and for maintaining controlled access, if necessary.

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