NUREG–1200

Standard Review Plan
for the review of a license application for a Low-Level Radioactive Waste Disposal Facility

U.S. Nuclear Regulatory Commission

Office of Nuclear Material Safety and Safeguards

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Revision 2 to NUREG-1200

"Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility"

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NUREG–1200
Rev. 2

Standard Review Plan
for the review of a license application for a Low-Level Radioactive Waste Disposal Facility

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Office of Nuclear Material Safety and Safeguards
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PREFACE

The Standard Review Plan (SRP) provides guidance to staff reviewers in the Office of Nuclear Materials Safety and Safeguards (NMSS) on performing safety reviews of applications to construct and operate low-level waste disposal facilities and provides implicit guidance to licensees and applicants. Although this document is intended to be used by the NMSS staff in conducting its reviews, it can also be used by Agreement States and interested parties responsible for conducting their own licensing reviews or developing license applications. The principal purpose of the SRP is to ensure the quality and uniformity of staff reviews and to present a well-defined base from which to evaluate proposed changes in the scope and requirements of reviews. It is also a purpose of the SRP to make information about regulatory matters widely available and to improve the understanding of the staff review process by interested members of the public and the nuclear industry.

The safety review is primarily based on the information provided by an applicant in a Safety Analysis Report (SAR). Section 61.10 of Title 10 of the Code of Federal Regulations (10 CFR 61.10) requires that each application for a low-level waste disposal facility include an SAR. The SAR must be sufficiently detailed to permit the staff to independently verify that the facility can be built and operated without undue risk to the health and safety of the public. Before an SAR is submitted, an applicant should have designed and analyzed the facility in sufficient detail to conclude that it can be built and operated safely. The SAR is the principal document in which the applicant provides the information needed to understand the basis on which this conclusion has been reached.

10 CFR 61.11 specifies, in general terms, the information to be supplied in an SAR. The specific information that the staff needs in order to evaluate an SAR is identified in NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility." The individual SRPs are keyed to NUREG-1199 and are numbered according to the section numbers in that document.

The SRP is written to cover a variety of site conditions and facility designs. Each individual SRP provides the complete procedures and all acceptance criteria for all the areas of review pertinent to that SRP. However, for any given application, the staff reviewers may select and emphasize particular aspects of each SRP as is appropriate for the application. In some cases, a facility feature may be sufficiently similar to a feature previously reviewed so that a complete new review is not needed. For these and other similar reasons, the staff may not carry out in detail all of the review steps listed in each SRP.

Each individual SRP identifies who will perform the review, the matters to be reviewed, the basis for the review, how the review will be performed, and the conclusions that are sought. The safety review is performed by three branches in the Division of Low-Level Waste Management and Decommissioning: the Operations Branch Projects Branch (LLOB), which manages the license review for the

Division and ensures consistency and continuity of the review; the Technical Branch (LLTB), which reviews the engineering aspects of the SAR such as the disposal facility and package design and materials issues, as well as the geologic, hydrologic, and geochemical aspects of the SAR; and the Branch (LLRB), which reviews the financial assurance portions of the SAR and ensures that the entire review is consistent with NRC policy. Each SRP identifies the branch that has the primary responsibility for the review under that SRP. In some review areas, the branch with primary responsibility for the review may require support; the branches assigned supporting review responsibilities are also identified in the SRP. The SRP is one of the principal mechanisms that will allow the NRC staff to review a license application within 15 months.

Each SRP is organized into the following seven sections:

- 1. RESPONSIBILITY FOR REVIEW

  This section identifies the organization(s) responsible for evaluating the subject or functional area covered by the SRP. If more than one organization is to participate in the review, then the organizations are listed in descending order of responsibility

- 2. AREAS OF REVIEW

  This section describes the information that will be reviewed by the branch with primary review responsibility. It contains a description of the systems, components, analyses, data, or other information that will be reviewed as part of that particular section of the SAR. It may also discuss briefly the information needed or the review expected from other NRC branches to permit the primary review branch to complete its review.

- 3. REVIEW PROCEDURES

  This section discusses how the review will be performed. It generally includes step-by-step procedures that the reviewer will follow to reasonably verify that the applicable criteria have been met.

- 4. ACCEPTANCE CRITERIA

  This section contains a statement of the purpose of the review, applicable NRC regulatory requirements as well as related guidance, and the technical bases for determining the acceptability of the design or the programs within the scope of review of the SRP. The technical bases consist of specific criteria such as NRC regulatory guides, industry codes and standards, and branch technical positions.

  The technical bases for some sections are provided in branch technical positions or appendices, which are or will be included in the SRP. These documents typically set forth the solutions and approaches determined to be acceptable by the staff in dealing with a specific problem or design area. These solutions and approaches are codified in this form so that staff reviewers can take consistent positions on similar problems as they arise.

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LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 2.1.1
SITE LOCATION AND DESCRIPTION

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Operations Branch (LLOB)

1.2 Secondary - Technical Branch (LLTB)

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the location of the proposed near-surface disposal facility with respect to (1) latitude and longitude as well as the universal transverse mercator (UTM) coordinate system, (2) political subdivisions and nearby cities and towns, and (3) prominent man-made and natural features in the vicinity of the site. The description of the site will be reviewed with respect to (1) area, (2) land ownership and/or status of the site and any potential expansion areas, and (3) detailed topography of the disposal site.

The staff will use the information reviewed under SRP 1.2. The staff may also need information obtained from U.S. Geological Survey (USGS) topographic maps, aerial photography or remote sensing imagery, and local and regional planning agencies and by visiting the site.

3. REVIEW PROCEDURES

3.1 Acceptance Review

The staff will review for completeness the information on site location and description in the SAR in accordance with NUREG-1199 and this SRP.

3.2 Safety Evaluation

The staff will verify that the applicant's data on latitude and longitude, UTM coordinates, and relative location of cities, towns, and political subdivisions are complete and accurate. The staff should become familiar with the site environs, including man-made and natural features, by reviewing the applicant's data and, if necessary, by visiting the site. Accuracy of this information is essential to those sections of the SER that address potential releases of radioactivity and accident scenarios.

The staff also will verify the applicant's data on the site area and the legal status and/or ownership of this area as well as any potential expansion areas.

Topographic maps of the site and environs in an acceptable scale will be reviewed and included in the SER to augment a detailed description of site topography. The staff will review the applicant's data to ensure that sufficient information is contained to support a description of site topographic features such as elevation and relief, slope, and drainage.

Any omissions or clarifications of the applicant's submittal should be identified and communicated to the project manager as soon as possible so they can be resolved.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to this SRP are

(1) 10 CFR 61.11, "General Information," (c)(1), which requires a description of the location of the proposed disposal site

(2) 10 CFR 61.12, "Specific Technical Information," (a), which requires a description of the natural and demographic disposal site characteristics as determined by disposal site selection and characterization activities

4.2 Regulatory Guidance

There are no regulatory guides that apply to site location and description for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

The applicant's data will be considered acceptable if (1) they address the content and format guidelines of NUREG-1199 and (2) they are sufficient to meet the requirements for site description contained in 10 CFR 61.11(c)(1) and 61.12(a).

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

In addition to making the findings specified in Sections 3.1 and 3.2 of this SRP, the staff will prepare summary descriptions of the site location, the site itself, and transportation routes on or near the site for inclusion in the SER. Any deficiencies of site parameters with respect to the proposed facility will be noted.

The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the site location and description for [name of facility] low level waste disposal facility according to Standard Review Plan 2.1.1.

The applicant's data are acceptable because they address the content and format guidelines of NUREG-1199 and because they are sufficient to meet the requirements for site description in 10 CFR 61.11(c)(1) and 10 CFR 61.12(a).

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of a license application for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

Energy - 1968" (Slade, 1968) and decide whether the standard regulatory atmospheric diffusion models are appropriate for this site.

The staff will review for completeness and authenticity the general climatic description of the region in which the site is located. Climatic parameters such as air masses, general air flow, pressure patterns, frontal systems, and temperature and humidity conditions reported by the applicant will be checked against standard references (Thom, 1968; U.S. Department of Commerce, 1968) for appropriateness with respect to location and period of record.

The staff will verify the applicant's description of the role of synoptic-scale atmospheric processes on local (site) meteorological conditions against the descriptions provided in "Climatic Atlas of the United States" and "Local Climatological Data - Annual Summary With Comparative Data" (both published by the U.S. Department of Commerce).

Because meteorological averages and extremes can only be obtained from stations in the region of the site that have long record retention periods and the stations are not usually very close to the site, the staff will first determine the representativeness of the data to site conditions and then ascertain the adequacy of the stations and their data.

The staff will verify (1) recorded meteorological averages and extremes using standard publications such as "Storm Data" (published by the U.S. Department of Commerce), (2) other averages and extremes using "State Climatological Summary and "Storm Data" (published by the U.S. Department of Commerce), (3) the potential for high air pollution, (4) extreme winds and their distribution using RG 1.23 and "Meteorology and Atomic Energy - 1968" (Slade, 1968) and (5) gust factors using RG 1.23.

The staff will make independent determinations and comparisons regarding

(1) terrain modifications that will occur as a result of facility construction, such as removal of trees and leveling of ground, and relating this information to local meteorological conditions

(2) air quality conditions used for design and operating basis considerations

The staff will provide the findings on meteorological parameters to other branches as necessary to implement their review of the adequacy of the design of structures, systems, and components important to safety.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

There currently are no prescriptive regulations that specifically address meteorology and climatology for low-level waste disposal sites. The following will be used as a basis for interim criteria:

10 CFR 61.12, "Specific Technical Information," (a), with respect to meteorological and climatological effects on 10 CFR 61.12(b), (d), (g), (k), and (l)

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in the following:

(1) 10 CFR 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," with respect to information on severe regional weather phenomena that have historically been reported for the region and that are reflected in the design bases for structures, systems, and components important to safety

(2) Regulatory Guide 1.23, "Onsite Meteorological Programs (Safety Guide 23)," as it relates to reporting onsite meteorological data

4.3 Regulatory Evaluation Criteria

The applicant should present and substantiate the information in accordance with acceptable practice and data as promulgated by NOAA, industry standards, and regulatory guides.

(1) The description of the general climate of the region should be based on standard climatic summaries compiled by NOAA and published annually by the U.S. Department of Commerce. Consideration of the relationships between regional synoptic-scale atmospheric processes and local (site) meteorological conditions should be based on appropriate meteorological data published by the U.S. Department of Commerce ("Climatic Atlas of the United States," "Local Climatological Data - Annual Summary With Comparative Data," and "State Climatological Summary").

(2) Data on severe weather phenomena should be based on standard meteorological records from nearby representative National Weather Service (NWS), military, or other stations recognized as standard installations that have long record retention periods.

(3) Local summaries of meteorological data based on onsite measurements in accordance with RG 1.23 and NWS station summaries ("Local Climatological Data") should be provided.

(4) A discussion and evaluation of the influence of the facility on local meteorological and air quality conditions, if any, should be provided.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information,

the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed available information on the regional meteorological conditions important to the safe design and siting of the [name of facility] low-level waste disposal facility. The staff concludes that the identification and consideration of the meteorological characteristics at the site and in the surrounding area are acceptable and meet 10 CFR 61.12(a) with respect to determining the acceptability of the site. This conclusion is based on the presentation and substantiation of the meteorological information in accordance with acceptable standard practice as promulgated by the National Oceanic and Atmospheric Administration (NOAA) and industry standards identified in [provide appropriate references].

The staff concludes that the identification and consideration by the applicant of the severe regional weather phenomena at the site and the surrounding area are acceptable with respect to establishing the design bases for structures, systems, and components important to safety. This conclusion is based on the presentation and substantiation of severe regional weather phenomena in accordance with acceptable standard practice as promulgated by NOAA and in industry standards identified in [provide appropriate references].

The staff concludes that the identification and consideration of meteorology and climatology are sufficient to meet the general requirements in 10 CFR 61.12.

The staff has reviewed available information relative to local meteorological and air quality conditions that are of importance to the safe design and siting of this facility. The staff concludes that the identification and consideration of the meteorological, air quality, and topographical characteristics at the site and in the surrounding area are acceptable.

The staff also concludes that the identification and consideration by the applicant of the severe local weather phenomena at the site and in the surrounding area are acceptable.

These conclusions are based on the following:

(1) The applicant has provided and substantiated information on local meteorological and air quality conditions and characteristics, including severe weather phenomena, in accordance with standard practice as promulgated by NOAA.

(2) The applicant has satisfactorily addressed the regulatory guidance in RG 1.23 with respect to reporting the onsite meteorological data.

[These statements will be preceded by a summary of local and regional meteorological and air quality parameters appropriate for the site.]

LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 2.3.2
SEISMIC INVESTIGATION

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Technical Branch (LLTB)

1.2 Secondary - None

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the seismological and geophysical investigations required to ensure that a low-level waste disposal site operates safely and meets the performance objectives. These investigations should concentrate on the evaluation of the maximum earthquake potential taking into consideration the regional and local geology of the area.

The staff will review the following areas that are subject to the primary investigations that should be carried out by the applicant: seismicity, tectonic characteristics of the site and region, correlation of earthquake activity with geologic structures or tectonic provinces, maximum earthquake potential, seismic wave transmission characteristics of the site, design earthquake, settlement and liquefaction potential, and geophysical methods.

This section of the SAR should include, but not necessarily be limited to, the information mentioned above.

3. REVIEW PROCEDURES

3.1 Acceptance Review

The staff will review for completeness the information on seismic investigation in the SAR in accordance with NUREG-1199 and this SRP.

3.2 Safety Evaluations

After the license application is accepted and docketed, the staff will conduct its review as follows:

(1) The staff will evaluate the seismological and geophysical information to determine if it is acceptable and in accordance with the criteria given

in Section 4 of this SRP. The staff will meet with the applicant if the information has to be clarified.

(2) The staff will visit the site (a) to clarify and confirm some of the geophysical and seismological information in the SAR; (b) to inspect the geological structures around the site; and (c) to evaluate core borings, exploratory trenches, and geophysical data.

(3) On the basis of the information supplied by the applicant and obtained from the site visit and literature sources, the staff will prepare a request for additional information if needed and formulate positions that may agree or disagree with those of the applicant.

(4) The staff will evaluate the response(s) to the request for additional information for adequacy and completeness and then write a Safety Evaluation Report (SER), in which it will include any open issues that may require further investigation. These open issues should be addressed in a supplement to the SER.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.41, "Protection of the General Population From Releases of Radioactivity," as it relates to concentrations of radioactive material that may be released to the general environment

(2) 10 CFR 61.42, "Protection of Individuals From Inadvertent Intrusion," as it relates to the protection of an individual inadvertently intruding into the disposal site

(3) 10 CFR 61.43, "Protection of Individuals During Operations," as it relates to maintaining radiation exposures as low as is reasonably achievable

(4) 10 CFR 61.44, "Stability of the Disposal Site After Closure," as it relates to achieving long-term stability of the site and to eliminating the need for ongoing active maintenance after site closure

(5) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," as it relates to near-surface disposal of waste

The above information should be documented by appropriate references to all relevant published and unpublished data and materials and personal communications. Illustrations should include tectonic, geologic, geomorphologic, topographic, and structural maps; stratigraphic sections; boring logs; electrical logs; and aerial photographs. When applicable, certain sites will require maps showing oil or gas wells, faults, karst features, and seismic reflection profiles.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

If the staff's evaluation confirms that the SAR meets the requirements and guidelines described in the acceptance criteria, the conclusion in the SER will state that the information in the SAR adequately supports the applicant's conclusions. Any unresolved issues or reservations about any significant deficiency in the SAR will be clearly stated in the SER to define precisely the nature of the concern. If no outstanding issues or concerns remain, the staff will conclude that the site is acceptable from a geologic standpoint and meets 10 CFR 61.

5.2 Sample Evaluation Findings

The staff has reviewed the geologic site characterization for [name of facility] low-level waste disposal facility according to Standard Review Plan 2.3.1.

The geology and seismology of the proposed site have been adequately characterized, modeled, and analyzed to ensure that the long-term performance objectives of Subpart C of 10 CFR 61 are met as required in 10 CFR 61.50(a)(2).

The tectonic and geologic processes and seismic activity do not occur with such frequency and to such an extent that they significantly affect the ability of the disposal site to meet Subpart C of 10 CFR 61 as required in 10 CFR 61.50(a)(9) and (10).

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-0902, "Site Suitability, Selection, and Characterization," April 1982.

---, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in the following documents:

(1) NUREG-0902, "Site Suitability, Selection and Characterization," as it relates to characterizing the regional framework including stratigraphy, tectonics, structure, and seismic and volcanic risk at the disposal site and vicinity, and which provides guidance and recommendation for site-specific investigations

(2) "Standard Review Plan for UMTRCA Title 1 Mill Tailing Remedial Action Plans," Low-Level Waste Management and Decommissioning, as it relates to characterizing the seismic and tectonic hazards at the disposal site and vicinity, and which provides guidance and recommendations for site-specific investigations

(3) 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants," as it relates to the design of any safety-related portions of the structures important to safety to withstand the effects of earthquakes

(4) 10 CFR 100, Appendix A, "Seismic and Geologic Criteria for Nuclear Power Plants," as it relates to the investigations required to obtain the seismic data necessary to determine site suitability and as it identifies geologic and seismic factors that have to be taken into account in the siting of the low-level waste disposal facility

4.3 Regulatory Evaluation Criteria

Evaluation criteria pertaining to the areas of review in this SRP are given in the following sections.

4.3.1 Seismicity

The applicant should evaluate all available historical data and list all available parameters for earthquakes within 200 miles of the site having a modified Mercalli intensity (MMI) greater than or equal to IV or a magnitude greater than or equal to 3.0. The applicant should provide an epicentral map showing the distribution of these earthquakes and large-scale maps showing earthquakes within 50 and 5 miles of the site and areas of high seismicity. The listing should include origin time, focal depth, epicenter coordinates, highest intensity, magnitude, and distance from the site. The magnitude designations such as m_b, M_L, and M_S should be identified, and the sources of this information should be indicated. Any other relevant information related to the occurrence of the earthquake such as information on landsliding, fracturing, and liquefaction should be mentioned.

4.3.2 Tectonic Characteristics of Site and Region

The applicant should identify accurately all the geologic structures and the tectonic activity within the region that are important in determining the

earthquake potential. On the basis of the geologic structure and the distribution of earthquakes in the area, the applicant should identify, with documentation, the tectonic provinces in the vicinity of the site. Tectonic provinces are regions of uniform earthquake potential. The tectonic provinces may be identified on the basis of seismicity study, differences in geologic history, and differences in the current tectonic regime. In addition, when capable faults are identified in the vicinity of the site, a regional map should be provided showing the tectonic provinces, the location of the earthquakes with respect to these faults, and the location of geologic structures associated with these faults.

4.3.3 Correlation of Earthquake Activity With Geologic Structures or Tectonic Provinces

Whenever the SAR demonstrates the association of earthquakes with either geologic structures or tectonic provinces, the applicant should provide the rationale for the association taking into consideration the characteristics of the geologic structures and the regional tectonic model and the historical seismicity of the area. The coordinates of the earthquake location and its focal depth should be provided, and the methods used to locate it should be identified. The presentation should be augmented by regional maps showing the tectonic provinces, the earthquake epicenters, the location of geologic structures, and measurements used to define tectonic provinces. All the maps should be of the same scale.

4.3.4 Maximum Earthquake Potential

The applicant should examine the literature to identify the maximum credible earthquake associated with each geologic structure or maximum historical earthquake associated with each tectonic province. The maximum credible earthquake is the largest earthquake that can be reasonably expected to occur on a geologic structure in the tectonic regime.

When new geological or seismological evidence becomes available that may warrant the determination of an earthquake larger than the maximum historical earthquake, a discussion should be provided and the magnitude of such an earthquake should be estimated. When an earthquake is associated with geologic structure, the maximum earthquake that could occur on that structure should be estimated taking into consideration the earthquake rupture length and type of faulting (normal, reverse, etc.). Also, the frequency content of the earthquake should be discussed, when possible. For the maximum historical earthquakes associated with tectonic provinces within a 200-mile radius of the site, isoseismal maps should be presented for the earthquakes having a magnitude greater than or equal to 3. The ground motion at the site should be estimated using appropriate attenuation models for the area. In the estimation of ground motion, the maximum earthquakes associated with these tectonic provinces should be placed where the tectonic province is closest to the site.

For the floating earthquake within the same tectonic province of the site, the earthquake should be placed at an appropriate distance from the site and the acceleration should be estimated.

4.3.5 Seismic Wave Transmission Characteristics of the Site

To estimate the ground motion at the site, a knowledge of the seismic wave transmission from the sources to the site is essential. In addition, material overlying the bedrock at the site should be described because this material will amplify or deamplify the upcoming seismic waves. Information on the compressional and shear wave velocities, bulk densities, and shear moduli should be addressed under SRP 6.3 for this overlying material and the bedrock. The methods used to calculate the values should be discussed.

4.3.6 Design Earthquake

The applicant should describe the vibratory ground motion resulting from the maximum earthquake at the free surface and at the depth of concern for the location of the facility. For this earthquake, the peak horizontal and vertical accelerations at the site should be estimated by using applicable attenuation relationships. Attenuation equations that may be applicable to the site are listed in NUREG/CR-3756, Appendix C.A. The potential for amplification of vibratory ground motion in the overburden should be addressed. In some instances site-specific response spectra may have to be compared with the design spectra of the structures.

If possible, probabilistic seismic hazard estimates should be provided. The assumptions and uncertainties associated with these estimates should be documented. The results from the probabilistic seismic hazard study should highlight which seismic sources are of significance to the site.

4.3.7 Settlement and Liquefaction Potential

Deformation and differential settlement of subsurface and fill materials under both static and seismic conditions, analysis for liquefaction potential, and consequences of liquefaction of subsurface soil affecting the stability of the cover materials should be analyzed and addressed under SRPs 5.1.2 and 6.3.

4.3.8 Geophysical Methods

The applicant should provide adequate information about the geophysical methods used to support the geological suitability of the site. The applicant should explain the capabilities of the geophysical methods used and the methods of obtaining, processing, and interpreting geophysical data. The applicant should integrate all the geophysical data and present a coherent section of the geological structure in the area with the rationale used to arrive at this interpretation.

A few of the geophysical survey methods that can be useful in the study of most of the subsurface geologic problems are the electrical, reflection, refraction, gravity, and magnetic methods. Borehole data will also support the interpretation generated from the use of the above-mentioned geophysical methods.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

The staff's evaluation in the SER will address issues such as tectonic provinces, capabilities of faults in the region, maximum credible or historical earthquake, estimated ground acceleration at the site, settlement and liquefaction, and suitability of the site for licensing.

If the evaluation by the staff confirms that the applicant has met all the requirements for a license, the staff will state in the SER that the information provided by the applicant adequately supports the applicant's conclusion regarding the seismic integrity of the site.

In addition, the SER should include any concern the staff may have and state in sufficient detail any open issues that may require further discussion.

5.2 Sample Evaluation Findings

The staff has reviewed the information on seismic investigation for [name of facility] low-level waste disposal facility according to Standard Review Plan 2.3.2.

As a result of this review, the staff concludes the following:

(1) The seismologic information provided by the applicant is adequate, and no capable faults exist at the site that would adversely affect the safety of the site.

(2) The design-basis earthquake is adequately defined, and the potential for amplification is addressed.

(3) Adequate geophysical investigations have been carried out to characterize the site.

(4) The applicant has met performance objectives in 10 CFR 61.41 through 61.44 and the technical requirements for land disposal facilities in 10 CFR 61.50(a)(9) and (a)(10).

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a)(5), as it relates to siting in frequently flooded areas and showing compliance with Executive Order 11988, "Floodplain Management Guidelines"

(2) 10 CFR 61.50(a)(6), as it relates to minimizing upstream drainage areas, where possible

(3) 10 CFR 61.50(a)(10), as it relates to avoiding areas where active erosion is occurring

4.2 Regulatory Guidance

No specific regulatory guidance is currently available on acceptable procedures for implementing the regulations in Section 4.1 of this SRP.

4.3 Regulatory Evaluation Criteria

Acceptance of the information in the SAR will be based in part on a qualitative evaluation of the completeness and adequacy of the information and of maps. Descriptions and evaluations of structures, facilities, and erosion protection designs are adequate if they are sufficiently complete to allow independent evaluations of the effects of flooding and intense rainfall. Site topographic maps are acceptable if they are of good quality and of sufficient scale to allow independent analysis of pre- and post-construction drainage patterns.

The information presented forms the basis for subsequent hydrologic engineering analysis. Therefore, completeness and clarity of data are very important. Maps are adequate if they are legible and adequate in coverage to substantiate applicable data and analyses. The descriptions of the hydrologic characteristics of surface water features and water use are acceptable if they are detailed and generally correspond to those of the U.S. Geologic Survey (USGS), National Oceanographic and Atmospheric Administration, Soil Conservation Service, Corps of Engineers, or appropriate State and river basin agencies. Adequate descriptions of existing or proposed reservoirs and dams that could influence conditions at the site may be obtained from reports of the USGS, U.S. Bureau of Reclamation, Corps of Engineers, and others; these descriptions normally include tabulations of drainage areas, types of structures, appurtenances, ownership, seismic and spillway design criteria, elevation-storage relationships, and short- and long-term storage allocations.

The information and analyses presented are acceptable if the staff determines that the data clearly indicate that the following site suitability requirements have been met:

(1) The site is not located in an area subject to frequent flooding (10 CFR 61.50(a)(5)), and the requirements of Executive Order 11988, "Floodplain Management Guidelines," are met.

(2) Upstream drainage areas are minimized (10 CFR 61.50(a)(6)).

(3) Active erosion is not occurring in the site area to the extent that the site cannot be protected from the potential effects of erosion (10 CFR 61.50(a)(10)).

Acceptance criteria for flood analyses presented by the applicant are given in SRP 6.3.1.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

Findings will consist of a brief general description of the site with respect to the general hydrosphere, a determination of the nearby users of surface water, and a determination of the suitability of the site as given in 10 CFR 61.50.

5.2 Sample Evaluation Findings

The staff has reviewed the surface water hydrology for [name of facility] low-level waste disposal facility according to Standard Review Plan 2.4.1.

The site is located in Waste City, Pennsylvania, along the right bank (looking downstream) of XYZ Creek. XYZ Creek has a drainage area of approximately 91.0 mi^2 at the site. The stream flows in a northeasterly direction with an average channel slope of about 0.0012. The XYZ Creek watershed is heavily vegetated and consists largely of agricultural and wooded lands surrounding the residential and industrial areas [supply reference].

Flooding data for XYZ Creek have been recorded since the 1880s. The flood of record occurred in September 1912; other major floods occurred in August 1956, April 1961, March 1963, and February 1966.

Streamflow data for low flows in XYZ Creek have also been recorded since 1907. The lowest flow of record (8.7 ft^3/sec) occurred in October 1936. The 7-day 10-year flow rate has been estimated to be approximately 16.7 ft^3/sec [supply reference].

Surface-water quality monitoring has been performed by the U.S. Geological Survey (USGS) at two gauging stations located on XYZ Creek from about 1950 to

3.2.2 Numerical Analysis

The staff will evaluate the numerical analyses of groundwater data collected by the applicant for the disposal site and vicinity. This will normally involve analytical or numerical modeling. The staff will verify that the model type chosen for analysis is properly documented, verified, and calibrated and adequately simulates the physical system of the site and vicinity.

The staff's review of the numerical analysis of the saturated zones begins with the modeling strategy used by the applicant. Whether the applicant chooses to perform analytical or numerical techniques, the chosen technique should be explained. The staff will review this modeling strategy and determine whether it is logical and defensible.

The staff will review the adequacy of the model input data generation and reduction techniques. Modifications of input data, required for calibration, will be reviewed to ensure that the new values are realistic and defensible.

Following its review of this information, the staff will determine whether the applicant's conclusions are adequately conservative or realistic so that the applicable requirements of 10 CFR 61.50(a)(2), (7), and (8) are met. However, if the staff considers that the applicant's results are based on inadequate analysis, the staff will communicate its concerns to the applicant. Alternatively, the staff may decide to conduct an independent analysis. If the staff conducts an independent analysis, it will compare the results with those derived by the applicant to determine if the applicant's results are adequately conservative or defensible.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (a), as it relates to the description of the hydrologic features of the disposal site and vicinity

(2) 10 CFR 61.12(j), as it relates to a description of the quality control program for the determination of natural disposal site characteristics

(3) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a)(2), as it relates to the capability of the disposal site to be monitored, characterized, and modeled

(4) 10 CFR 61.50(a)(7), as it relates to a sufficient depth of the water table so that it will not rise into the waste

(5) 10 CFR 61.50(a)(8), as it relates to the onsite discharge of groundwater from the hydrogeologic unit used for disposal

(6) 10 CFR 61.53, "Environmental Monitoring," (a), as it relates to the collection of hydrogeologic information on the disposal site for at least 1 year for those characteristics subject to seasonal variation

4.2 Regulatory Guidance

NUREG-0902, as it relates to characterizing the groundwater flow regime at the disposal site and vicinity, provides information, recommendations, and guidance and in general describes a basis acceptable to the staff for implementing the requirements of 10 CFR 61. Other useful information is contained in NUREG/CR-2700, NUREG/CR-2917, NUREG/CR-3038, NUREG/CR-3164, and NUREG/CR-4369.

4.3 Regulatory Evaluation Criteria

To adequately evaluate the groundwater characterization section of the SAR, the staff must have at least 1 year of characterization monitoring data for both the saturated and unsaturated zones. Data pertinent to saturated zone evaluation include, but are not limited to, location of all monitor wells (in coordinate system), well drilling and construction information, water quality and water levels, hydrologic test data and results, storativity, transmissivity, and possible surface recharge or discharge features.

Data pertinent to unsaturated zone evaluation include, but are not limited to, sample locations, moisture content measurements, laboratory analyses techniques and results for obtaining the characteristic curves for soil cores, and results of infiltration, percolation, and saturated hydraulic conductivity tests.

Information pertinent to modeling both the saturated and unsaturated zones include, but are not limited to, a description of the conceptual model, equations, and computer code; verification and calibration procedures; descriptions of all data inputs and model outputs; and conclusions pertaining to compliance with relevant sections of 10 CFR 61.50(a)(2), (7), and (8).

To adequately review this section of the SAR, the staff will refer to information supplied in sections of the SAR reviewed under the following SRPs:

(1) SRP 2.2, "Meteorology and Climatology," referring to information on annual precipitation, design-basis rainfall events, and evapotranspiration rates required for the groundwater flow model

(2) SRP 2.3, "Geology and Seismology," referring to the stratigraphy of the affected environment, grain sizes, thicknesses, and regional and local structural features for both aquifers and aquicludes

5. EVALUATION FINDINGS

5.1 Introduction

As part of the review, the staff will document its conclusions and the basis for the conclusions in a Safety Evaluation Report. This report will also contain a description of the site hydrogeology (as background for the reader and justification for the conclusions reached). This report will also contain a description of any model used by the staff to conduct an independent analysis along with the results and conclusions reached from it. If the groundwater

3.2.4 Borrow Materials

The staff will review the fill borrow material exploration program to determine if an adequate number of borings, probes, test pits, etc., were carried out to establish with reasonable confidence the quantity and type of material available for fill borrow. Results of the tests performed to establish the properties of the borrow material and selection of the recommended design parameters for the borrow material will be reviewed in order to assess its suitability for its intended use.

3.2.5 Stratigraphy and Design Parameters

The staff will review location plans for completed subsurface investigations, cross-sections, and profiles showing subsurface soil and rock layering at the site and compare them with exploratory records to ascertain that all the data collected, particularly data on zones of soft/loose conditions encountered in the explorations, have been used and that the uncertainties normally associated with the estimation of the thickness and extent of various materials occurring at the site have been conservatively considered in developing the soil and rock layering. The staff will review the soil and rock test data to determine that strength tests have been performed on undisturbed samples and that there are sufficient relevant test data to support the selection of the design parameters. The review will also consider whether soil and rock characteristics derived from the investigations have been completely and conservatively interpreted to develop design parameters. If clearly unconservative soil and rock properties and subsurface stratigraphy have been used, a request will be made for additional data to verify the applicant's recommendations.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (a), which requires that one of the specific technical information areas needed to demonstrate that the performance objectives of 10 CFR 61, Subpart C, and the applicable technical requirements of 10 CFR 61, Subpart D, will be met involves a description of the geotechnical characteristics and features of the disposal site and vicinity

(2) 10 CFR 61.23, "Standards for Issuance of a License," (f), which requires that the applicant demonstrate with reasonable assurance that the disposal site meets the applicable technical requirements of 10 CFR 61, Subpart D

(3) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a), which lists the site suitability requirements that must be met by a near-surface disposal facility (information on the geotechnical characteristics of the site is needed to demonstrate compliance with these technical requirements)

4.2 Regulatory Guidance

There are no regulatory guides that apply to the geotechnical engineering aspects for a low-level waste disposal facility. However, the following guides provide recommendations and guidance generally applicable to a geotechnical review of this type, although the required level of detail and the extent of investigation and analyses would vary on a case-by-case basis:

(1) Regulatory Guide 1.132, "Site Investigations for Foundations of Nuclear Power Plants," which describes programs of geotechnical engineering site investigations that would normally meet the needs for evaluating the performance of earthworks under anticipated static and dynamic loading conditions and provides general guidance and recommendations for developing site-specific investigation programs as well as specific guidance on conducting subsurface investigations, the spacing and depth of borings, and sampling

(2) Regulatory Guide 1.138, "Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants," which describes laboratory investigations and testing practices acceptable for determining soil and rock properties and characteristics needed for geotechnical engineering analysis and design

4.3 Regulatory Evaluation Criteria

Evaluation criteria pertaining to the areas of review listed in Section 2 of this SRP are given in the following sections.

4.3.1 Field Investigations

(1) Geological, Geochemical, and Seismological Investigations

The investigations in these areas should be adequate in scope and technique to provide the following data necessary for the LLTB staff's review of the geotechnical characteristics of the site. The section defining geologic features is acceptable if the discussions, geologic maps, profiles of the site stratigraphy, structural geology, geologic history, and engineering geology are complete and are supported by investigations sufficiently detailed to obtain an unambiguous representation of the site geology. The section presenting the geochemical aspects of the site is acceptable if it discusses the geochemical effects of the environment (weather and rain water) on the physical and strength characteristics of the soil and rock at the disposal site (particularly if there is potential for geochemical weathering and leaching of soils and rocks at the disposal site). The section presenting the seismological aspects of the site is acceptable if it includes discussions on the method used to determine the design-basis seismic event. The information on the design-basis seismic event should include the magnitude of the earthquake, the elevation or location at which the design-basis earthquake is defined, the maximum value of the horizontal component of acceleration, maximum velocity, duration of the earthquake, and the potential for amplification of ground motion caused by the soil conditions at the site.

The staff would refer to SRPs 2.3 and 2.6 for details on the LLTB staff's acceptance criteria for information submitted on the above areas of review.

(2) Geotechnical and Geophysical Investigations

A complete field investigation and sampling program should be performed to define the occurrence and properties of the soil and rock materials underlying the proposed site and in borrow areas proposed for an LLWDF. Regulatory Guide 1.132 describes the geotechnical and geophysical investigations required for a nuclear power plant. However, it can be used as a general guide, since the scope of the field investigations depends on the complexity of the LLWDF and subsurface conditions at the site. The scope of the program should be adequate to establish with a high degree of confidence the geotechnical characteristics of the disposal site. The investigation program is acceptable if it includes the following:

(a) plot plan(s) clearly showing the outline of the LLWDF and the locations of all borings, probes, pits, trenches, seismic lines, piezometers, observation wells, and geologic profiles

(b) profiles and an adequate number of cross-sections of the site showing the subsoil and rock layering and illustrating in appropriate detail the relationship of the proposed LLWDF to the subsurface materials

(c) logs of borings, probes, pits, trenches, and geophysical investigations in sufficient detail as described in Regulatory Guide 1.132

4.3.2 Field and Laboratory Testing and Engineering Properties

The applicant should provide a detailed and quantitative discussion of the criteria used to determine that the samples were taken in accordance with Regulatory Guide 1.132 and tested in sufficient number to define all the soil and rock parameters needed for characterizing the site and borrow areas in accordance with the general guidance of Regulatory Guide 1.138.

In keeping with the regulatory positions of Regulatory Guides 1.132 and 1.138, the description of and test results for the properties of materials underlying the site and borrow areas are considered acceptable if the methods and procedures currently accepted in the geotechnical engineering profession are used to determine their engineering properties. Widely accepted index and engineering properties tests for soils are

Soil classification	Freeze-thaw
Water content	Dispersivity
Unit weights	Diffusion characteristics
Void ratio	Permeability (hydraulic conductivity)
Porosity	Consolidation
Saturation	Direct shear test

Atterberg limits	Triaxial compression tests
Specific gravity	Unconfined compression tests
Gradation analysis	Relative density
Compaction	Special tests (cyclic strength, shear modulus, damping, etc.) as required
Shrinkage-swelling	

Acceptable test methods and procedures are described, for example, in the Annual Book of ASTM Standards and special technical publications published by the American Society for Testing and Materials; in Engineering Manual EM 1110-2-1906 published by the U.S. Army Corps of Engineers; in Geotechnique published by the Institution of Civil Engineers; in various research reports prepared by universities such as the University of California, Earthquake Engineering Research Center; and in other publications mentioned in the reference section.

A detailed discussion of field and laboratory sample preparation for testing should be given when applicable. For strength tests conducted in the laboratory, full details should be given; for example, how saturation of the sample was determined and maintained during testing and how the pore pressures changed. For sites that are underlaid by saturated cohesionless soils and sensitive clays, the applicant should show that all zones that could become unstable because of liquefaction or strain-softening phenomena have been sampled and tested to evaluate their liquefaction potential. The applicant should also show that the static and dynamic engineering properties of the soils, such as unconfined compressive strength, shear strength parameters for total and effective stress conditions, dynamic modulus values, and dynamic strength parameters from cyclic triaxial tests, were properly determined and that reasonable and conservative values were used in the design. This demonstration should explain how the developed data were used in design analyses, how the test data were enveloped for design, and why the design envelope is conservative. A table indicating the values of the parameters used in design should be provided and should be supported by field and laboratory test records.

4.3.3 Groundwater Conditions

The acceptance criteria for information on groundwater conditions at the site are given in SRP 2.4. In the review of the geotechnical characteristics of the LLWDF site, the information identified in Section 3.2.3 of this SRP is reviewed for adequacy and acceptability for use as input into the geotechnical engineering evaluation of backfilling of the disposal excavations and for slope stability, settlement/subsidence, and site closure considerations.

4.3.4 Borrow Materials

Information on the proposed fill borrow material is acceptable if it (1) includes a plan showing the limits, grades, and slopes of the area proposed for fill borrow material and the location of borings drilled and test pits dug to determine the quantity and type of material available and (2) shows that the properties of the borrow material are based on adequate testing. The data on the engineering properties of borrow materials should be based on laboratory

tests performed on representative samples of borrow material compacted to the same range of density and moisture contents as that to be specified for the corstruction of the LLWDF.

4.3.5 Stratigraphy and Design Parameters

Information on the stratigraphy of the disposal site is acceptable if it includes plot plans and an adequate number of cross-sections and profiles showing subsurface soil and rock layering at the site in relationship to features of the LLWDF. The cross-sections should show the location of the borings and the data from the boring logs that are used in developing the soil and rock layering. The layering should be developed using all the data collected particularly data on zones of soft/loose conditions encountered in the explorations. The recommended design parameters should be based on a reasonable and conservative interpretation of the soil and rock layering and test data on soil and rock materials encountered at the site. There should be a sufficient number of relevant tests to support the selection of the design parameters. The recommended design parameters may be presented in tabular form and also in graphical form, where appropriate, to demonstrate the conservatism of the recommended design parameters.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the geotechnical characteristics of the [name of facility] low-level waste disposal facility according to Standard Review Plan (SRP) 2.5. The objectives of the review were to ensure that (1) the scope of the geotechnical and geophysical field investigations and laboratory and field testing are adequate; (2) the interpretations of the data to develop typical soil and rock layering, typical cross-sections, and design parameters used in the design are reasonable and conservative; and (3) the geotechnical characterization of the site meets the guidance and acceptance criteria in SRP 2.5.

In its review, the staff determined the following:

(1) The geologic characterization of the site addresses the potential for surface or subsurface subsidence at the site, unrelieved stresses in the bed rock, the instability of rock or soil because of mineralogy, and the history of deposition and erosion of soil deposits.

(2) The design-basis seismic event is adequately defined by parameters such as magnitude, acceleration, velocity, duration, and potential for site amplification.

(3) The geotechnical and geophysical investigations conducted to characterize the site and borrow materials are adequate in scope.

(4) The static and dynamic engineering properties of various materials used in the analysis and design of the facility are based on adequate field and laboratory testing and a reasonable and conservative interpretation of the test data.

(5) The groundwater conditions such as the position of the groundwater table, the extent of its fluctuation, and the presence of artesian conditions have been defined on the basis of adequate investigation.

(6) The selection of the properties of fill borrow material was based on an adequate exploration and testing program.

(7) Site stratigraphy and design parameters used in the design are a reasonable and conservative interpretation of the data.

The staff concludes that the geotechnical site characterizations in the SAR provide the basic data needed to determine if the disposal facility meets the performance objectives stipulated in the regulations, thereby satisfying the requirements of 10 CFR 61.12(a), 10 CFR 61.23(f), and 10 CFR 61.50(a).

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

American Society for Testing and Materials, Annual Book of ASTM Standards, Philadelphia, PA, revised annually.

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

Shannon & Wilson, Inc., and Agbabian-Jacobsen Associates, "Soil Behavior Under Earthquake Loading Conditions - State-of-the-Art Evaluation of Characteristics for Seismic Responses Analyses," U.S. Atomic Energy Commission Contract W-7405-eng-26, January 1972.

Terzaghi, K., and R. B. Peck, Soil Mechanics in Engineering Practice, 2nd edition, John Wiley & Sons, New York, 1967.

for a minimum of 1 year to determine seasonal variations. Data interpretations should be reasonable and consistent with geological, chemical, and hydrological data.

4.3.2 Geochemistry of Soils and Rock Units

The information on the geochemistry of soils and rock units is acceptable if discussions of the classification, mineralogical identification, and chemical characterization and chemical stability of the soils and rock units are complete, compare well with studies conducted by others in the same area, and a supported by detailed investigations performed by the applicant. The sampling, preservation, storage, analytical, and experimental techniques should be acceptable to the technical community, and adequate quality assurance and quality control procedures should be performed. Solubility, ion exchange, sorption experiments should be carried out by methods such as those suggest in NUREG-0902 and should represent a range of chemical and physical conditi in order to bound the results. Presentation of the experimental results should include a discussion of uncertainties and limitations of the proced Data interpretations should be reasonable and consistent with geological, chemical, and hydrological data.

4.3.3 Geochemical Modeling

The information on geochemical modeling is acceptable if the discussions geochemical modeling are complete and consistent with the detailed invest tions performed by the applicant. The conceptual chemical models used sh be designed to adequately represent the system being studied, and codes to make predictions based on the conceptual chemical models should be pr verified and validated as defined in NUREG-0856. Any data used in the c but not collected by the applicant should be consistent with established up-to-date data compilations. Input data and interpretations of the res should be consistent with data collected in field and/or laboratory inve tions. The applicant should not draw conclusions based on modeling res that exceed the capabilities of the models and codes, and there should discussion of model and code uncertainties and limitations.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been in the SAR to satisfy the 10 CFR Part 61 requirements and that the in is consistent with the guidance in this SRP. On the basis of this in the staff should be able to conclude that this evaluation is complete staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the geochemical studies submitted by the appl [name of facility] low-level waste disposal facility according to S view Plan 2.6. The staff considered in its review information obta (1) data gathered from onsite and near-site borings and water wells

4.3 Regulatory Evaluation Criteria

The applicant must identify all known geologic resources and their t
location, and extent, as requested in NUREG-1199, to satisfy 10 CFR

Pursuant to 10 CFR 61.50(a)(4), the applicant must also analyze the
for resource exploitation. The applicant should base the analysis
values and current and projected demand for the resources in questi
gether with this analysis, the location of the resources, and the n
extraction, the applicant must provide reasonable assurance that th
ance objectives of 10 CFR Part 61 will be met for the proposed fac

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has
in the SAR to satisfy the 10 CFR Part 61 requirements and that th
is consistent with the guidance in this SRP. On the basis of thi
the staff should be able to conclude that this evaluation is co
staff can document its review as follows.

The staff should report in a Safety Evaluation Report (SER) its
discuss the extent to which the acceptance criteria of the SRP
and the reasons for the acceptance or rejection of the applicat
acceptance criterion has not been met. The SER should contain
of the review and include topics such as (1) aspects of the rev
emphasized, modified by the applicant, require additional infor
resolved in the future, or remain unresolved; (2) aspects of th
programs that deviate from the criteria in the SRP; and (3) a
deviations from the SRP or exemptions from regulations.

5.2 Sample Evaluation Findings

Geologic resource data are likely to be very site specific fo
level waste disposal facility. Therefore, the staff's findin
resource specific, taking into account different types of res
potential for different types of effects on the performance
proposed facility. For example, the staff may find that exp
particular resource does not create a concern regarding 10 C
objectives, and find that exploitation of another resource d
performance objectives of the proposed facility.

The staff's review, for example, must support the following
ing statements:

(1) The staff concludes that the identification of known
in the SAR for a low-level waste facility license is
priate. The applicant has shown, and the staff agree
geologic resources occur in the proposed disposal are
attempts at future resource exploitation are unlikely

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for a minimum of 1 year to determine seasonal variations. Data interpretations should be reasonable and consistent with geological, chemical, and hydrological data.

4.3.2 Geochemistry of Soils and Rock Units

The information on the geochemistry of soils and rock units is acceptable if discussions of the classification, mineralogical identification, and chemical characterization and chemical stability of the soils and rock units are complete, compare well with studies conducted by others in the same area, and are supported by detailed investigations performed by the applicant. The sampling, preservation, storage, analytical, and experimental techniques should be acceptable to the technical community, and adequate quality assurance and quality control procedures should be performed. Solubility, ion exchange, and sorption experiments should be carried out by methods such as those suggested in NUREG-0902 and should represent a range of chemical and physical conditions in order to bound the results. Presentation of the experimental results should include a discussion of uncertainties and limitations of the procedures. Data interpretations should be reasonable and consistent with geological, chemical, and hydrological data.

4.3.3 Geochemical Modeling

The information on geochemical modeling is acceptable if the discussions of geochemical modeling are complete and consistent with the detailed investigations performed by the applicant. The conceptual chemical models used should be designed to adequately represent the system being studied, and codes used to make predictions based on the conceptual chemical models should be properly verified and validated as defined in NUREG-0856. Any data used in the codes but not collected by the applicant should be consistent with established and up-to-date data compilations. Input data and interpretations of the results should be consistent with data collected in field and/or laboratory investigations. The applicant should not draw conclusions based on modeling results that exceed the capabilities of the models and codes, and there should be a discussion of model and code uncertainties and limitations.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the geochemical studies submitted by the applicant for [name of facility] low-level waste disposal facility according to Standard Review Plan 2.6. The staff considered in its review information obtained from (1) data gathered from onsite and near-site borings and water wells and from

laboratory and field experiments, (2) discussions with individuals knowledgeable about the geochemistry of the site and region, (3) a review of the technical literature, and (4) the prelicensing monitoring program. Geochemical data are required for the characterization of the site (10 CFR 61.12(a) and 10 CFR 61.50) and as input into technical analyses (10 CFR 61.13(a)) to demonstrate protection of the public from radiation (10 CFR 61.41). The basis for the staff's acceptance of the geochemical studies is that, on the basis of the information collected, the public will be protected from releases of radioactivity. The collection and presentation of the data are consistent with the recommendations in NUREG-0902, "Site Suitability, Selection and Characterization."

The fundamental geochemical concerns addressed in this review to confirm the geochemical aspects of site adequacy are (1) chemical composition of groundwater, surface water, and precipitation as it would influence the concentrations of contaminants in the waters and site stability and (2) the ability of the rocks and soils at the site to prevent significant contaminant migration and contribute to site stability.

The applicant has provided information on water chemistry in support of site characterization. The information suggests that the current chemistry of ground and surface waters and any anticipated changes in the chemistry of these waters after emplacement of the proposed shallow land burial site will not increase (or have a detrimental effect on) the dissolved concentrations of radionuclides relative to the maximum concentration limits for radionuclides in the environment as prescribed by NRC guidelines or be detrimental to site stability. [Describe information on groundwater and surface water chemistry.]

The applicant has provided information on the soil and sediment geochemistry in support of site characterization. The information suggests that the current mineralogy and chemistry of the soils and rock units and the anticipated changes in mineralogy and chemistry after emplacement of the proposed shallow land burial site will not increase (or have a detrimental effect on) the dissolved concentrations of radionuclides relative to the maximum concentration limits for radionuclides in the environment as prescribed by NRC guidelines or have a detrimental effect on site stability. [Describe information on soil and rock geochemistry.]

The applicant has used thermodynamic calculations and computer codes to develop conceptual models and codes pertaining to geochemistry in support of site characterization. The modeling results are consistent with measured data and support the conclusion that geochemical conditions at the proposed shallow land burial site will not increase (or have a detrimental effect on) the dissolved concentrations of radionuclides relative to the maximum concentration limits for radionuclides in the environment as prescribed by NRC guidelines or be detrimental to site stability. [Describe information on geochemical modeling.]

exploitation of which could result in inadvertent intrusion into the low-level wastes after removal of active institutional control

(2) 10 CFR 61.23, "Standards for Issuance of a License," (c), which requires that the applicant's proposed disposal site,...disposal site closure, and postclosure institutional control are adequate to protect the public health and safety in that they will provide reasonable assurance that individual inadvertent intruders are protected in accordance with the performance objective in 10 CFR 61.42

(3) 10 CFR 61, Subpart C, "Performance Objectives," particularly

(a) 10 CFR 61.41, "Protection of the General Population From Releases of Radioactivity"

(b) 10 CFR 61.42, "Protection of Individuals From Inadvertent Intrusion"

(c) 10 CFR 61.44, "Stability of the Disposal Site After Closure"

(4) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a)(4), which requires that areas be avoided having known natural resources which, if exploited, would result in failure to meet the performance objectives of Subpart C, 10 CFR 61

(5) Resource recovery must not affect, directly or indirectly, the disposal site and result in failure to meet various technical requirements of Subpart D, 10 CFR 61, including but not restricted to

(a) 10 CFR 61.52, "Land Disposal Facility Operations and Disposal Site Closure," (a)(7), as it relates to maintenance of boundary and land survey markers

(b) 10 CFR 61.52(a)(8), as it relates to maintenance of a buffer zone around and beneath the waste

(c) 10 CFR 61.53, "Environmental Monitoring," (d), as it relates to maintenance of a postclosure environmental monitoring system

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in the following documents:

(1) NUREG-0902, "Site Suitability, Selection and Characterization"

(2) NUREG/CR-2700, "Parameters for Characterizing Sites for Disposal of Low-Level Radioactive Waste"

(3) NUREG/CR-3038, "Tests for Evaluating Sites for Disposal of Low-Level Radioactive Waste"

4.3 Regulatory Evaluation Criteria

The applicant must identify all known geologic resources and their types, location, and extent, as requested in NUREG-1199, to satisfy 10 CFR 61.12(h).

Pursuant to 10 CFR 61.50(a)(4), the applicant must also analyze the potential for resource exploitation. The applicant should base the analysis on market values and current and projected demand for the resources in question. Together with this analysis, the location of the resources, and the methods of extraction, the applicant must provide reasonable assurance that the performance objectives of 10 CFR Part 61 will be met for the proposed facility.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

The staff should report in a Safety Evaluation Report (SER) its findings and discuss the extent to which the acceptance criteria of the SRP have been met and the reasons for the acceptance or rejection of the application when an acceptance criterion has not been met. The SER should contain a description of the review and include topics such as (1) aspects of the review that were emphasized, modified by the applicant, require additional information, will be resolved in the future, or remain unresolved; (2) aspects of the applicant's programs that deviate from the criteria in the SRP; and (3) a basis for any deviations from the SRP or exemptions from regulations.

5.2 Sample Evaluation Findings

Geologic resource data are likely to be very site specific for a proposed low-level waste disposal facility. Therefore, the staff's findings should be resource specific, taking into account different types of resources and the potential for different types of effects on the performance objectives of the proposed facility. For example, the staff may find that exploitation of one particular resource does not create a concern regarding 10 CFR 61 performance objectives, and find that exploitation of another resource does threaten the performance objectives of the proposed facility.

The staff's review, for example, must support the following types of concluding statements:

(1) The staff concludes that the identification of known geologic resources in the SAR for a low-level waste facility license is adequate and appropriate. The applicant has shown, and the staff agrees, that no known geologic resources occur in the proposed disposal area or region and attempts at future resource exploitation are unlikely.

or

surface water, evaluated under SRP 2.1, "Geography, Demography, and Future Developments." Projected ground and surface water withdrawal scenarios should be analyzed with respect to location and rate of withdrawal of projected pumping schemes.

The staff will review and confirm that the applicant's analyses and conclusions regarding the effect of the exploitation of ground and surface water on the performance objectives in 10 CFR 61, Subpart C, are adequately conservative or defensible. The staff should anticipate that the analyses might be located in other sections of the SAR. In this case, relevant findings and conclusions derived from these sections should be referenced as part of the review process.

If the staff concludes that the applicant's results are inadequate, it will communicate its concerns to the applicant. Alternatively, if it is decided that an independent analysis needs to be performed by the NRC staff, the analysis may include, but not be limited to, an analytical or numerical simulation of the flow system. The model results will be incorporated into dose calculations performed by a health physicist at NRC. The staff then will determine whether the applicant's results were adequately conservative or defensible and whether the performance objectives were met with reasonable assurance.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (h), as it relates to the description of known water resources at the disposal site that, if exploited, would affect waste isolation

(2) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a)(4), as it relates to avoiding disposal areas with known water resources that, if exploited, would result in failure to meet the performance objectives of Subpart C

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in NUREG-0902, "Site Suitability, Selection and Characterization," as it relates to the identification of water resources.

4.3 Regulatory Evaluation Criteria

To adequately evaluate the assessment of water resources presented in the SAR and perform independent analyses if necessary, the staff will review information pertaining to

(1) the description of the current uses of water resources (including locations of discharge points and withdrawal rates), which include

residential, industrial, and municipal withdrawal for drinking purposes, irrigation, livestock watering, and recreational uses

(2) the description of conceptual and numerical models used in the applicant's evaluation, including documentation, verification, calibration, and results

The staff will also review information reviewed under the following SRPs:

(1) SRP 2.1, "Geography, Demography, and Future Development," referring to the projected use of all water resources in the vicinity of the proposed facility

(2) SRP 2.4.1, "Surface Water Hydrology," referring to the description of surface water features, including location, volumes of water, and hydrologic characteristics of the features

(3) SRP 2.4.2, "Groundwater Characterization," referring to the description of the groundwater flow regime, including the extent, thickness, and physical parameters of all potential aquifer systems, and data and results of the numerical simulation used to calibrate the physical system

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows. As part of the review, the staff will document its conclusions and the basis for the conclusions in a Safety Evaluation Report. The report will also contain a description of water resources and justification for the conclusions reached along with a description of any model used by the staff to conduct an independent analysis and the results and conclusions reached from it. However, if the staff concludes that the description and analyses of water use are inadequate, it will document the inadequacies, specify the technical basis for the comments, and describe alternative approaches to resolve the inadequacies.

5.2 Sample Evaluation Findings

The staff has reviewed the water resources for [name of facility] low-level waste disposal facility according to Standard Review Plan 2.7.2. The staff concludes that no water resources exist at the site that, if exploited, would result in failure to meet the performance objectives of Subpart C of 10 CFR 61.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In

important to the performance of the facility. The reviews of this and other sections dealing with terrestrial and aquatic ecology will be closely coordinated with the review of the applicant's ER and the staff's environmental assessment, so that appropriate feedback to establish the extent and relevance of information contained in this section is provided.

The staff will develop a description of the terrestrial and aquatic communities and habitat types based on information provided by the applicant, a review of the literature, information acquired during the site visit, and consultation with appropriate local, State, and Federal agencies, including the U.S. Fish and Wildlife Service and the director of the State fish and wildlife agency.

The staff will identify species in the site vicinity and offsite areas that are important to site performance. This identification will begin with a review of the previously identified communities and habitats of these areas. The categories and methods of identification will be the following:

(1) Regarding commercially or recreationally valuable species, the staff will consider wildlife and plants that could be adversely affected by the proposed action and could subsequently have an adverse effect on humans. In addition to using the applicant's ER, the staff will consult with State or local agencies or organizations that maintain records of harvest levels of these species.

(2) The staff will identify any species in the site and vicinity whose behavior or characteristics could have an adverse effect on facility performance.

3.3 Input to Environmental Statement and Reviews Under Other SRPs

The staff will prepare as input to the Environmental Statement (ES) descriptions of the site and offsite areas potentially affected by the proposed project. The input should be brief and will include the following information:

(1) The principal terrestrial ecological features of the site and vicinity and offsite areas should be described with emphasis on the communities that will be potentially affected by or affect the construction, operation, maintenance, and closure of the proposed project.

(2) Species lists, if included, will be prepared as an appendix to the ES and should be limited to those "important" species whose presence may characterize community structure and function or that are central to the analysis.

The staff will provide terrestrial ecology data to the staff performing reviews under other SRPs, including a description of the food webs leading to man and a description of the potential effect of selected species on the construction, operation, maintenance, and closure of the facility.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulation applicable to this SRP is

10 CFR 61.12, "Specific Technical Information," (a), as it relates to a description of the biotic features of the disposal site and vicinity

4.2 Regulatory Guidance

There are no regulatory guides that apply to biotic resources for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

The applicant's description of biotic resources at or in the vicinity of the proposed facility should be presented in adequate detail so that the staff can assess the effects on safety.

Descriptions should contain quantified information in sufficient detail to allow for independent manipulation of data during confirmatory analysis.

The applicant should have considered and analyzed the relationships between all biotic species that are important to facility performance and safety.

The applicant should have considered and analyzed the effects of man-induced and, if appropriate, natural changes in the site vicinity and must have analyzed the changes that would affect the abundance and behavior of species important to facility performance and safety.

The applicant should have presented evidence supporting the conclusion that its analyses were exhaustive with respect to species that are likely to affect facility performance and safety.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the biotic features for [name of facility] low-level waste disposal facility according to Standard Review Plan 2.8.

The applicant has described and characterized the biotic features of the disposal site and vicinity in a manner that is consistent with the intent of 10 CFR 61.12(a).

NUREG-1200
U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards

LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 2.9
PREOPERATIONAL ENVIRONMENTAL MONITORING

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Technical Branch (LLTB)

1.2 Secondary - Operations Branch (LLOB)

1.3 Supporting - None

2. AREAS OF REVIEW

The staff* will review the preoperational environmental monitoring program at the proposed disposal site in accordance with the requirements of 10 CFR 61.12(1) and 10 CFR 61.53(a). The staff will evaluate how well the applicant's preoperational environmental monitoring program meets the following objectives: to obtain baseline data in order to radiologically characterize the site before construction and operation; to determine existing levels of selected nonradiological constituents**; to identify a statistical method to relate baseline data to data collected during the operational and postoperational phases; and, in accordance with 10 CFR 61.53(a), to provide the basic environmental data on the disposal-site characteristics.

The staff will review the following items using information given in Section 2.9 of the SAR and information available from other sources as they relate to the preoperational phase of the environmental monitoring program: (1) description of the preoperational environmental monitoring program; (2) equipment, instrumentation, and facilities; (3) data recording and statistical analysis; (4) organization; and (5) quality assurance*** and quality control. The LLTB staff will review Items (1), (2), (3) and (5, technical aspects only), and the LLOB staff will review Items (4) and (5, administrative aspects only).

*Although the primary review responsibility resides with the LLTB staff, the term "the staff" as used in this SRP will generally refer (unless stated otherwise) to the NRC staff as a whole. Special aspects of the review conducted by the LLOB staff are explicitly identified in this SRP.

**In this SRP, the term "selected nonradiological constituents" refers to the water quality parameters identified in Environmental Standard Review Plan (ESRP) 3.4.2.2, "Groundwater Quality" (NUREG-1300). These include parameters such as concentrations of major inorganic and organic constituents, as well as pH, total dissolved solids, turbidity, and temperature. For the balance of this SRP these constituents are simply referred to as nonradiological or other (meaning other than radiological).

***See footnote page 9.1-5.

The staff will be aware of and use results of the reviews required by other SRPs that could influence the environmental monitoring aspects, such as the reviews of site characterization (SRPs 2.1.2, 2.2, 2.4.1, 2.4.2, 2.7.2, and 2.8), facility operations (SRP 4.3), and safety assessment (SRPs 6.1.1 through 6.1.6).

3. REVIEW PROCEDURES

The staff will obtain and use such information as is necessary to ensure that the review is complete. The staff will use and emphasize material from this SRP, the NRC technical position paper on environmental monitoring (NRC, 1988), and the recommendations to the NRC for environmental monitoring review criteria (NUREG/CR-5054), as may be appropriate for a specific case.

3.1 Acceptance Review

The staff will review for completeness the information on the preoperational environmental monitoring program in the SAR in accordance with NUREG-1199 and this SRP.

3.2 Safety Evaluation

The staff will determine if the applicant has followed the regulations, regulatory guides, and industry standards referenced in this SRP by comparing the applicant's submittal and methods with the regulations and guides and by verifying the applicant's references to such guides or to proposed alternatives. The staff will verify that the alternatives are equivalent to or improvements on the methods cited in the referenced regulatory guides. Otherwise, alternatives are likely to be disapproved.

3.2.1 Description of the Preoperational Environmental Monitoring Program

The staff will evaluate the overall acceptability of the monitoring program with respect to the necessary finding that there is reasonable assurance that the program will yield data sufficient to compare future site performance with regulatory requirements and acceptance criteria. This will include evaluating the adequacy of the applicant's information in response to the following concerns:

(1) Is the program based on the requirements of 10 CFR 61.53(a)?

(2) Does the information provided include a description of the environmental monitoring program and the plan for taking corrective measures as required by 10 CFR 61.12(l)?

(3) Are the proper components (media and analyses) included in the monitoring program?

(4) Are the sampling/monitoring procedures appropriate?

(5) Are there sufficient sampling/monitoring locations for each medium?

(6) Is there at least one background/control monitoring location for each medium?

(7) Do the monitoring procedures ensure representative samples/measurements?

(8) Is the frequency of sampling/monitoring/analysis adequate to establish environmental trends?

(9) Were the monitoring data provided by the applicant collected over a sufficiently long period (at least 1 year) to adequately evaluate environmental variability for that area?

(10) Does the program include provisions for special samples or analyses based on site-specific conditions (e.g., high natural background area, other nearby facilities, and previously contaminated groundwater)?

3.2.2 Equipment, Instrumentation, and Facilities

The staff will determine whether the equipment for measuring radiation levels and for sampling radioactive and nonradioactive constituents is consistent with the measurement and sampling requirements of the monitoring program; whether the facilities used for instrument calibration and laboratory analyses are adequate to ensure the availability of appropriate methods and sensitivities; and whether the methods and frequency of calibration are adequate to ensure that the instrument performance requirements will be met. This staff review will include the evaluation of the number, type, range, accuracy, sensitivity, and planned uses of laboratory and field monitoring instruments; the evaluation of the capabilities of the instrument calibration and analytical laboratory facilities; and for selected samples, a detailed review of the processing and radiochemical analyses of each type of field sample (e.g., air, water, soil, and biota).

3.2.3 Data Recording and Statistical Analysis

The staff will review the data handling and recording and statistical analysis procedures for appropriateness in response to the following questions:

(1) Are the data handling and recording and statistical analysis procedures based on standard techniques, such as those provided in Report 58 published by the National Council on Radiation Protection and Measurements or EPA-520/1-80-012 published by the U.S. Environmental Protection Agency (EPA)?

(2) Is the choice of units consistent with those given in Table II, Appendix B of 10 CFR 20 and do the number of significant figures truly reflect the precision of the measured or calculated values?

(3) Is there a clear distinction between measured and calculated values?

(4) Is the overall uncertainty of the data stated, and is it at least at the 95% confidence level?

(5) Are the sources of data variability clearly discussed?

(6) Have the data been appropriately evaluated by grouping, such as spatial and temporal comparisons?

(7) Have data sets containing more than 10 data points been subjected to normality tests?

(8) Did the applicant include a discussion of any other data that was omitted from the preoperational environmental monitoring data summary?

(9) Was an appropriate method used to evaluate less-than-detectable values in the preoperational environmental monitoring data set?

(10) Were appropriate sets of data (e.g., direct radiation and air particulates) subjected to trend analyses?

3.2.4 Organization

The staff will review the organizational position, functional responsibilities, experience, and qualifications of persons responsible for the environmental monitoring program. It will verify that the administrative practices are in accordance with 10 CFR 61.11(b) and consistent with Regulatory Guide (RG) 8.2 and that appropriate personnel are being trained in the use of monitoring equipment and sampling procedures. In its review the staff will also consider the applicant's qualifications in response to the following question:

Does the person responsible for radiation safety and environmental protection have a minimum of a bachelors degree in science or mathematics and 5 years of professional health physics experience?

3.2.5 Quality Assurance* and Quality Control

The staff will evaluate the quality assurance aspects of the environmental monitoring program. In its review, the staff will consider the adequacy of the applicant's quality assurance (QA) program in response to the following questions:

(1) Is the applicant's QA program based on appropriate parameters, such as those identified in RG 4.15 and NUREG-1293?

(2) Are the applicant's organization, authorities, and personnel qualifications adequately discussed in the QA plan?

(3) Were preapproved written procedures used for all sampling and analyses?

(4) Was appropriate supporting documentation provided for testing, maintenance, and calibration of instruments; checks on sampling procedures and analytical analysis; and sample control?

*See footnote page 9.1-5.

(5) Did the analytical laboratory use standards certified by the National Bureau of Standards (NBS) or standards provided by suppliers who participate in measurement assurance programs with NBS?

(6) Did the applicant or the applicant's designated analytical laboratory incorporate replicate analyses of the same sample, including a comparison of those results, and the analysis of blanks and spiked pseudosamples, including a comparison of those results with known concentrations, as part of the quality control program?

(7) Did the analytical laboratory participate in an interlaboratory cross-check program?

(8) Did the analytical laboratory include routine performance checks (e.g., determination of background and individual detector response to appropriate check sources)?

(9) Did the applicant include review and analysis of sample and quality control data for reasonableness and consistency, and provide for independent verification of a substantial fraction of computations?

(10) Did the applicant include planned, periodic audits to verify implementation of the QA program by qualified individuals who did not have direct responsibilities for the areas being audited?

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify its submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are:

(1) 10 CFR 61.12, "Specific Technical Information," (l), which requires that the applicant provide a description of the environmental monitoring program and of a plan for taking corrective measures

(2) 10 CFR 61.53, "Environmental Monitoring," (a), which requires that, at the time a license application is submitted, the applicant shall have conducted a preoperational environmental monitoring program to provide basic environmental data on the disposal site characteristics

4.2 Regula. ry Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in the NRC documents and other supporting references (e.g., industry standards and general guidance documents) identified below. Most of these documents provide general methods for environmental monitoring that can be used in the preoperational as well as operational and post-operational periods. A supplemental bibliography is provided in Appendix A for additional, more in-depth guidance on specific environmental monitoring topics.

NRC Documents

(1) NUREG-1293, "Quality Assurance Guidance for Low-Level Radioactive Waste Disposal Facilities," as it relates to the overall quality assurance of low-level radioactive waste disposal facility operations

(2) Regulatory Guide 4.5, "Measurements of Radionuclides in the Environment - Sampling and Analysis of Plutonium in Soil," as it relates to techniques of soil sampling and soil sample preparation

(3) Regulatory Guide 4.13, "Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications," as it relates to the application of thermoluminescent dosimeters for environmental monitoring

(4) Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," as it relates to quality control of all phases of the program (e.g., organizational structure, responsibility of personnel, records, operating procedures, sampling, and radioanalytical analyses)

(5) Regulatory Guide 8.2, "Guide for Administrative Practices in Radiation Monitoring," as it relates to guidance on administrative practices associated with radiation monitoring programs

(6) Regulatory Guide 8.21, "Health Physics Surveys for Byproduct Material at NRC-Licensed Processing and Manufacturing Plants," as it relates to general methods and procedures for measurements of radioactive material in air, radiological surveys of external radiation levels, and radiological surveys of surface contamination

(7) Regulatory Guide 8.25, "Calibration and Error Limits of Air Sampling Instruments for Total Volume of Air Sampled," as it relates to air sampling, frequency, and documentation of calibration, and error limits for volume measurements

(8) NUREG-1388, "Environmental Monitoring of Low-Level Radioactive Waste Disposal Facility," as it relates to the staff technical position on elements appropriate to an environmental monitoring program at low-level waste disposal facilities

Industry Standards

(9) American National Standards Institute, ANSI N323-1969, "Radiation Protection Instrumentation Test and Calibration," as it relates to guidance on the calibration of instruments

(10) American Public Health Association (APHA), Standard Methods for the Examination of Water and Wastewaters, as it relates to the examination of water samples

(11) American Public Health Association (APHA), Intersociety Committee, Methods of Air Sampling and Analysis, as it relates to standard methods of air sampling and analysis

General Program Guidance

(12) U.S. Department of Energy, "Low-Level Radioactive Waste Management Handbook Series: Environmental Monitoring for Low-Level Waste Disposal Sites," DOE/LLW-13fg, as it relates program design and implementation for environmental monitoring at low-level radioactive waste disposal sites

(13) U.S. Nuclear Regulatory Commission, NUREG/CR-5054, "Recommendations to the NRC for Review Criteria for Alternative Methods of Low-Level Radioactive Waste Disposal - Environmental Monitoring and Surveillance Programs," as it relates to environmental monitoring program objectives, regulations, and implementation criteria for alternative methods of low-level radioactive waste disposal

Guidance on Equipment, Instrumentation, and Facilities

(14) National Council on Radiation Protection and Measurements, "Environmental Radiation Measurements," Report 50, as it relates to requirements for monitoring and surveillance programs, in situ measurements, sample collection and sample preparation for laboratory analysis, and laboratory measurements

(15) National Council on Radiation Protection and Measurements, "A Handbook of Radioactivity Measurements Procedures," Report 58, as it relates to methods for measuring radioactivity, including techniques for the preparation of samples, statistical treatment of data, and quality assurance of measurement accuracy and precision

(16) U.S. Environmental Protection Agency, "Handbook of Radiochemical Analytical Methods," EPA-680/4-75-001, as it relates to radiochemistry procedures for the analysis of samples

(17) U.S. Environmental Protection Agency, "Manual of Ground-Water Sampling Procedures," as it relates to methods for installing groundwater sampling stations and groundwater sampling procedures

Guidance on Data Recording and Statistical Analysis

(18) U.S. Environmental Protection Agency, "Upgrading Environmental Radiation Data," EPA-520/1-80-012, as it relates to statistical methods for radiation data interpretation, reporting of radiation measurement data, and quality assurance for environmental monitoring programs

Specific Guidance on Quality Assurance/Quality Control

(19) U.S. Environmental Protection Agency, "Handbook for Analytical Quality Control in Radioanalytical Laboratories," EPA Report 600/7-77-088, as it relates to quality controls in radioanalytical analyses of environmental

Regulatory Evaluation Criteria

Evaluation criteria necessary to meet the relevant requirements of the regulations for the areas of review described in Sections 2 and 3.2 of this SRP are discussed in the following sections.

4.3.1 Description of the Preoperational Environmental Monitoring Program

The description of the monitoring program is acceptable if the applicant has demonstrated that the proposed preoperational environmental monitoring program for planned waste disposal operations is consistent with NUREG-1388, "Environmental Monitoring of Low-Level Radioactive Waste Disposal Facility," and NUREG/CR-5054, which provides recommendations for NRC review criteria. The description should include a justification for the selection of specific media to be monitored; the choice of sampling locations (onsite as well as offsite); depth and elevation of sample points; the type, number, and methods of collection; the collection frequency; preanalysis treatment; analytical instrumentation and analyses; and minimum sensitivities.

Components of the described preoperational environmental monitoring program should normally include both quality (e.g., concentrations or levels) and quantity (e.g., flow rates, volumes, and directions) for meteorological (e.g., air and precipitation), hydrological (e.g., of saturated zone, vadose zone, and surface waters), geological (e.g., soil and sediment), and biological (e.g., vegetation and other biota) parameters as well as for direct radiation monitoring. The description of the monitoring program should also show that special program features have been considered, such as analyses for specific radionuclides or other contaminants, because of pre-existing site-specific parameters or conditions. The reviews of the meteorological, hydrological, and geological characteristics that are conducted according to SRPs 2.2, 2.4.1, 2.4.2, and 2.5 are beyond the scope of this SRP. The LLTB staff will use the results of these reviews as they relate to or could influence the preoperational environmental monitoring program.

(4) Vegetation and other biota sampling - cutters, knives, and devices for capturing animals

4.3.3 Data Recording and Statistical Analysis

Data should be recorded in appropriate units (mrem, mrad, pCi) and expressed with an appropriate number of significant figures. Unambiguous overall estimates of the uncertainties associated with the measurements of radioactivity and radioactive concentrations should be provided. The applicant should implement the guidance in RG 8.25 and in Items 15 and 18 in Section 4.2 of this SRP (or the provisions of acceptable alternatives) and the following guidance.

Reported measurement results should include descriptive statistics (i.e., measured or calculated values, sample size, mean, standard deviation, overall uncertainty, confidence interval for the mean, etc.). The applicant should adequately estimate the statistical validity of the sampling program. Statistical consideration should be given to the number and distribution of sampling locations, the frequency and number of sample collections, the number of analyses per sample, and the frequency of sample analyses. Descriptions and rationales should be compared against those in the U.S. Department of Energy handbook, NUREG/CR-5054, and the EPA collection of techniques for upgrading environmental data (Items 12, 13, and 18, respectively, Section 4.2), and the list of questions provided in Section 3.2.3 of this SRP.

4.3.4 Organization

The administrative organization for the monitoring program is acceptable if the information submitted by the applicant includes the lines of authority, the qualifications of the technical personnel, and a description of the staff training program as required by 10 CFR 61.11(b) and if the staff specifics are in accordance with RG 8.2.

4.3.5 Quality Assurance* and Quality Control

The quality assurance (QA) measures and quality control (QC) procedures should be adequate to ensure the accuracy and validity of the monitoring program. Components of a QA/QC program should include the following: recordkeeping, audits, quality control on field and laboratory measurements (e.g., source checks, calibration standards, instrument calibration procedures, written operational procedures for the use of instruments, sample collection, sample processing, and radioanlytical analyses), and quality control on the maintenance and calibration of instruments. The staff's determination of acceptability is based primarily on a comparison with the criteria in RG 4.15, guidance in NUREG-1293, SRP 9.1, and the questions noted previously in Section 3.2.5 of this SRP.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

*See footnote page 9.1-5.

5.2 Sample Evaluation Findings

The staff has reviewed the preoperational environmental monitoring program of the [name of facility] low-level waste disposal facility for adherence to the requirements of 10 CFR 20 and 10 CFR 61 according to Standard Review Plan 2.9. The objectives of the review were to ensure that the applicant's preoperational environmental monitoring program was adequate to characterize the site before construction and operation (i.e., to determine existing levels of radiological and selected nonradiological constituents), in accordance with 10 CFR 61.53(a).

In its review, the staff determined the following:

(1) The applicant provided a description of the preoperational environmental monitoring program and of a plan for taking corrective measures as required by 10 CFR 61.12(1). The staff further noted that the program covered at least a 12-month period and included the basic environmental data (e.g., monitoring direct radiation exposures, airborne constituents, groundwater in the saturated and vadose zones, surface water, soil and sediment, and vegetation and biota) in accordance with the requirements of 10 CFR 61.53(a). The applicant's program description is therefore considered acceptable.

(2) The applicant's methods, techniques, and procedures for monitoring radiation and sampling environmental media are consistent with Regulatory Guides (RGs) 4.5, 8.21, and 8.25; American National Standards Institute Standard ANSI N545-1975; NUREG/CR-5054; and "Technical Position on Environmental Monitoring of Low-Level Radioactive Waste Disposal Facilities," (NRC, 1988) and are adequate for determining radiation exposure levels and for obtaining representative samples.

(3) Field and laboratory data are recorded in appropriate units (according to the requirements of 10 CFR 20.401) and include appropriate descriptive statistics, statistical analysis, reporting levels, action levels, and regulatory limits. Maps were provided that clearly show all sampling locations and their direction, distances, and elevations with respect to the disposal units.

(4) The environmental monitoring program organization, lines of authority, staff qualifications, and training of personnel are in accordance with the requirements of 10 CFR 61.11(b) and the implementation guidelines of RG 8.2.

(5) The quality assurance (QA) measures and quality control (QC) procedures include quality controls on the organizational structure, selection and training programs, equipment, instrument testing, and calibration procedures for field monitoring and sampling, sample handling, sample analysis, data reporting, administrative reviews, audits, and general environmental monitoring procedures. The QA/QC program with respect to environmental monitoring is adequate, meets the guidelines of RG 4.15 and NUREG-1293,

At a minimum, the description of the feature that is designed to provide site drainage should address measures that will direct (1) surface water away from the disposed waste in accordance with 10 CFR 61.51(a)(4), and (2) surface water drainage away from the disposal units at velocities and gradients that will not result in erosion in accordance with 10 CFR 61.51(a)(5).

Details on other aspects of this design feature are presented in SRPs 3.2, 3.3.1, 3.4.4, 5.1.1, 5.1.2, 6.3.1, and 6.3.3.

4.3.6 Site Closure and Stabilization

The discussion of the feature designed to facilitate site closure and stabilization and for avoiding the need for active maintenance is acceptable if the design feature is clearly described and the feature is shown to fulfill its required function.

At a minimum, the description of the feature that is designed to facilitate site closure and stabilization should address the provisions needed to (1) provide long-term isolation of the waste and for avoiding the need for active maintenance in accordance with 10 CFR 61.51(a)(1); (2) provide compatibility with the disposal site closure and stabilization plan in accordance with 10 CFR 61.51(a)(2); and (3) complement, where appropriate, the site's natural characteristics in accordance with 10 CFR 61.51(a)(3).

Details on other aspects of this design feature are presented in SRPs 3.2, 3.3.1, 4.3, 5.1.1, 5.1.2, 5.2, and 6.3.3.

4.3.7 Long-Term Maintenance

The discussion of the feature designed for avoiding the need for long-term maintenance is acceptable if the design feature is clearly described and the feature is shown to fulfill its required function.

At a minimum, the description of the feature should address the provisions for avoiding the need for long-term maintenance after site closure in accordance with 10 CFR 61.51(a)(1).

Details on other aspects of this design feature are presented in SRPs 3.2, 5.1.2, and 6.3.2.

4.3.8 Inadvertent Intruder Barrier

The discussion of the feature designed to provide a barrier against inadvertent intrusion is acceptable if the design feature is clearly described and the feature is shown to fulfill its required function.

At a minimum, the description of the feature should include the provisions for providing the required protection from inadvertent intrusion in accordance with 10 CFR 61.42.

Details on other aspects of this design feature are presented in SRPs 3.2, 3.3.1, and 6.2.

4.3.9 Occupational Exposure

The discussion of the feature designed to maintain occupational exposures as low as is reasonably achievable is acceptable if the design feature is clearly described and the feature is shown to fulfill its required function.

At a minimum, the description of the feature designed to reduce occupational exposures should address the information identified in 10 CFR 61.12(k) and the provisions in 10 CFR 61.43.

Other aspects of this design feature are presented in SRPs 3.2, 6.1, 7.1, and 7.3.

4.3.10 Site Monitoring

The discussion of the feature designed to provide adequate monitoring of the disposal site is acceptable if the design feature is clearly described and the feature is shown to fulfill its required function.

At a minimum, the description of the feature should include the information identified in 10 CFR 61.12(k) and (l) and should fulfill the provisions in 10 CFR 61.53.

Details on other aspects of this design feature are presented in SRPs 3.2, 4.4, 5.3, and 6.3.3.

4.3.11 Buffer Zone

The discussion of the feature designed to provide an adequate buffer zone between any buried waste and the disposal site boundary and beneath the buried waste is adequate if the design feature is clearly described and the feature is shown to fulfill its required function.

At a minimum, the description of the feature should fulfill the provisions in 10 CFR 61.52(a)(8).

Details on other aspects of this design feature are presented in SRPs 3.2 and 4.3.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

The LLTB staff will review the applicant's evaluation of the effects of the abnormal events or accidents on exposures from releases of radioactivity in unrestricted areas and on the performance assessment analyses and models. The staff will determine if each principal design criterion provides reasonable assurance that the associated abnormal event or accident will not present an unacceptable challenge to the required functions of a principal design feature. The challenge will be assessed as unacceptable if it would result in failure to meet the performance objectives of 10 CFR 61, Subpart C, or in an inability to successfully model the performance of the disposal facility.

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify the submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (b) through (g), which require descriptions of design features, principal design criteria, and the relationship of the aforementioned with each other and the 10 CFR 61 performance objectives

(2) 10 CFR 61.13, "Technical Analyses," (a) through (d), which require (a) analyses to demonstrate that the performance objectives of 10 CFR 61, Subpart C, will be met and (b) that the role performed by design features in isolating and segregating the wastes be clearly differentiated from the role performed by natural site characteristics

(3) 10 CFR 61.23, "Standards for Issuance of a License," (b) through (f), which require findings that the applicant's design provides protection of the public health and safety and reasonable assurance that the performance objectives in 10 CFR 61, Subpart C, and the technical requirements in Subpart D will be met

(4) 10 CFR 61, Subpart C, "Performance Objectives," 10 CFR 61.41 through 10 CFR 61.44, which present the performance objectives toward the achievement of which the facility design must contribute

(5) 10 CFR 61.51, "Disposal Site Design for Land Disposal," (a), which presents the minimum technical requirements for near-surface disposal site design

(6) 10 CFR 61.52, "Land Disposal Facility Operation and Disposal Site Closure," (a), which presents the minimum technical requirements for disposal facility operation and closure

4.2 Regulatory Guidance

There are no regulatory guides that apply to principal design criteria. The applicant should use the following sections as guidance.

4.3 Regulatory Evaluation Criteria

Principal design features are reviewed under SRP 3.1, and auxiliary systems are reviewed under SRP 3.4. The actual design of the 11 principal design features may not be addressed under this SRP if the applicant chooses to provide the required design details in sections reviewed under subsequent SRPs. However, this section of the SAR should provide the principal design criteria for all the principal design features of the proposed LLWDF reviewed under SRP 3.1. The regulatory evaluation criteria in this SRP are to ensure that the applicant's principal design criteria establish the design, testing, and performance requirements for structures, systems, or components that are necessary to provide reasonable assurance that the LLWDF can be designed, constructed, and operated within the performance objectives of 10 CFR 61, Subpart C, under normal conditions, abnormal conditions, and accident scenarios. The staff will evaluate the applicant's principal design criteria as discussed in the following sections.

4.3.1 Water Infiltration

The applicant's principal design criteria to minimize water infiltration are acceptable if they support the design-related portions of the infiltration analysis reviewed under SRP 6.1.2 and are consistent with the information reviewed under SRPs 3.1, 3.3.1, 4.3, and 5.1.2 regarding minimization of water infiltration.

At a minimum, the principal design criteria should (1) be clearly stated, (2) be consistent with the design feature description reviewed under SRP 3.1, (3) be presented for the design of all site subsurface drainage systems and disposal unit covers, and (4) identify the fraction of precipitation allowed to infiltrate.

The allowable fraction of infiltration to be used in design should be expressed in terms of (1) severe snowmelt conditions, where applicable, or the 10-year, 24-hour rainfall with high antecedent moisture conditions for the normal hydrologic event and (2) the worst condition resulting from snowmelt or the PMP as an abnormal design-basis event. Analyses of increased infiltration resulting from cracking of the cover surface and accidents are not required, but possible changes in infiltration rates through covers from unanticipated degradation should be identified. The description of remedial measures (maintenance, regrading, etc.) to be performed in the event of increased infiltration should be provided to demonstrate that the intended function of this design feature will be maintained.

Principal design criteria for directing and controlling onsite precipitation or seasonally perched groundwater away from disposal units should identify the flow rates and groundwater levels that subsurface drainage systems are expected to handle. These flow rates or groundwater levels at a minimum

At a minimum, the principal design criteria should (1) be clearly stated and (2) be consistent with the description of the design feature reviewed under SRP 3.1.

Principal design criteria related to site closure and stabilization should identify (1) items in the final site closure plan requiring contribution from design and (2) the effects of design-basis abnormal events on closure and potential active maintenance requirements. Analyses of the effect of accidents after site closure are not required.

4.3.7 Long-Term Maintenance

Principal design criteria related to avoiding the need for long-term maintenance are acceptable if they are consistent with the information and support the analyses reviewed under SRPs 5.1.2, 6.3.1, and 6.3.2.

At a minimum, the principal design criteria should (1) be clearly stated and (2) be consistent with the description of the design feature reviewed under SRP 3.1.

Principal design criteria should identify and discuss the provisions to be incorporated that will permit the need for long-term maintenance to be avoided by addressing (1) anticipated material durability, (2) anticipated erosional effects, (3) the effects of anticipated drainage system degradation, (4) anticipated monitoring system degradation, and (5) the potential effects of design-basis abnormal events on long-term maintenance requirements. Analyses of the effects of accidents on long-term maintenance are not required.

4.3.8 Inadvertent Intruder Barrier

Principal design criteria related to inadvertent intruder barriers are acceptable if they are consistent with the information and support the analyses reviewed under SRPs 3.3.1, 4.3, and 6.2.

At a minimum, the principal design criteria should (1) be clearly stated and (2) be consistent with the description of the design feature reviewed under SRP 3.1.

Principal design criteria for inadvertent intruder barriers should identify the potential range of degradation rates for markers, engineered barriers, and the materials separating the stable and unstable wastes. Analyses of accidental effects on intruder barriers may be required at sites where the top of Class C wastes is placed at depths less than 5 meters below the top surface of the disposal unit cover.

4.3.9 Occupational Exposure

Principal design criteria related to occupational exposure are acceptable if they are consistent with the information and support the analyses reviewed under SRPs 4.1, 4.2, 6.1, 7.1, and 7.3.

At a minimum, the principal design criteria should (1) be clearly stated and (2) be consistent with the description of the design feature reviewed under SRP 3.1.

Principal design criteria to limit occupational exposure should identify, on the basis of the information reviewed under SRP 7.3 (1) ALARA requirements for receiving, inspection, handling, storage, and disposal excavation areas; (2) required shielding for anticipated higher activity wastes; and (3) provisions for handling the accidental rupture of nonstable waste containers.

4.3.10 Site Monitoring

Principal design criteria related to site environmental monitoring and surveillance are acceptable if they are consistent with the information and support the analyses reviewed under SRPs 2.9, 4.4, 5.3, 6.1, and 6.3.3.

At a minimum, the principal design criteria should (1) be clearly stated and (2) be consistent with the description of the design feature reviewed under SRP 3.1.

Principal design criteria for site monitoring systems should identify the (1) anticipated life of monitoring system equipment and components, (2) potential rate of degradation and actions to be taken in the event of loss of the various types of monitoring equipment, and (3) the effects of design-basis abnormal events on site monitoring systems. Analyses of accidental effects on the monitoring system are not required.

4.3.11 Buffer Zone

Principal design criteria related to the buffer zone are acceptable if they are consistent with the information and support the analyses reviewed under SRPs 4.3 and 4.4.

At a minimum, the principal design criteria should (1) be clearly stated and (2) be consistent with the description of the design feature reviewed under SRP 3.1.

Principal design criteria for the buffer zone should identify (1) dimensional requirements to be available for monitoring and (2) dimensional requirements for taking corrective measures if unacceptable migration of radionuclides is indicated. Analyses of accidental effects on the buffer zone are not required.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

3.2.5 Impacts of Site Factors

Important technical requirements in 10 CFR Part 61 covering such features as site suitability, site design, facility operation and site closure, environmental monitoring, waste classification, and waste characteristics remain regulatory requirements that must be addressed in a license application. Under this SRP, the applicant should provide a description of how site factors (i.e., geology, seismology, meteorology, climatology, hydrology, and geotechnical and geochemical characteristics) have been considered and addressed in the structural design of the BGV and EMCB. The applicant may choose to address the impacts of the site factors under other SRPs, where the siting features are initially discussed, but should provide references under this SRP to the sections where the impacts are discussed.

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify the submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (b) through (e), which require descriptions of design features, principal design criteria, codes and standards applied in the design, and the relationship of the aforementioned with each other and the performance objectives of 10 CFR 61

(2) 10 CFR 61.13, "Technical Analyses," (b), which requires that adequate barriers to inadvertent intrusion be provided

(3) 10 CFR 61.23, "Standards for Issuance of a License," (b) through (f), which require findings that the applicant's design provides protection of the public health and safety and reasonable assurance that the performance objectives of 10 CFR 61, Subpart C, and the technical requirements of Subpart D will be met

(4) 10 CFR 61, Subpart C, "Performance Objectives," 10 CFR 61.41 through 10 CFR 61.44, which present the performance objectives toward the achievement of which the facility design must contribute

(5) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a), which lists the site suitability requirements that must be met by a near-surface disposal facility and that are pertinent to design

(6) 10 CFR 61.51, "Disposal Site Design for Land Disposal," (a), which presents the minimum technical requirements for near-surface disposal site design

(7) 10 CFR 61.52, "Land Disposal Facility Operation and Disposal Site Closure," (a)(2) through (a)(11), which present the minimum technical requirements for disposal facility operation and closure

4.2 Regulatory Guidance

Guidance on structural design criteria are provided in NUREG/CR-5041, Volumes 1 and 2, Sections 2.1 and 2.2.

4.3 Regulatory Evaluation Criteria

Regulatory evaluation criteria pertaining to the areas of review in Section 2 of this SRP are given in the following sections.

4.3.1 Loads and Load Combinations

The information on loads and load combinations is acceptable if the loads and load combinations were conservatively established and are generally consistent with the General Design Criteria and Specific Design Review Criteria in Sections 2.1.1, 2.1.2.3, and 2.2.2.3 of NUREG/CR-5041. The staff will use as the basis for acceptance the allowable limit, U, identified in Section 3.2.1 of this SRP for the load combinations in the design of concrete structures. For the design of steel members, the staff will use the allowable limit, S, as the basis for acceptance.

4.3.2 Applicable Codes, Standards and Regulatory Guidance

The staff will compare the codes, standards and specifications used by the applicant in the structural design with the codes, standards, and regulatory guidance document listed in Section 3.2.2 of this SRP. Conservative and proper interpretation and use of the listed codes and standards are acceptable. The applicant should describe any deviations from the listed codes and standards and justify the bases for their adoption. The staff will indentify inadequately justified deviations as unacceptable and provide the reasons for this determination to the applicant.

4.3.3 Design and Analytical Procedures

The information on the design and analysis of structures and structural systems and components is acceptable if the design, analytical method used and described by the applicant, and the results are conservative and representative of good engineering practice and are generally consistent with the General Design Criteria and Specific Design Review Criteria in Sections 2.2.1 and 2.2.2 of NUREG/CR-5041.

4.3.4 Principal Design Criteria

The information on the principal design criteria is acceptable if the criteria meet the intent of the General Design Criteria in Section 2.2.1 of NUREG/CR-5041 and if they are clearly identified and demonstrated to result in long-term safe isolation of the disposed waste and to eliminate to the extent practicable the need for continuing active maintenance after site closure.

Criteria that are generally consistent with the codes, standards, and regulatory guidance document listed in Section 3.2.2 of this SRP would be found acceptable.

4.3.5 Impacts of Site Factors

The information on the impacts of site factors is acceptable if the applicant has clearly defined and assessed the potential impacts and has shown that the site factors will not have any adverse effects on the proposed design and operation of the BGV and EMCB in meeting the performance objectives in Subpart C of 10 CFR 61.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the structural design aspects for the below-ground vault [or earth-mounded concrete bunker] for [name of facility] according to Standard Review Plan 3.2A. The objectives of the review were to ensure that (1) the loads and load combinations imposed on the engineered structure in the design were conservative and were consistent with established criteria; (2) the codes and standards used in the design were properly interpreted and any deviation including justification for its acceptance was adequately documented; (3) the design and analytical procedures that were followed are reasonable and representative of good engineering practice; (4) the principal design criteria established by the applicant provide reasonable assurance of safe long-term isolation of the disposed waste and elimination to the extent practicable of the need for active maintenance after site closure; and (5) the impact from site factors such as geologic, seismic, hydrologic, and geotechnical features were properly assessed and the site factors did not have any adverse effects on the design and operation of the engineered structures.

The staff concludes that the objectives of the review have been met.

On the basis of its review, the staff concludes that the information provided by the applicant gives reasonable assurance that the BGV [or EMCB] is properly designed, will be acceptably constructed, and will satisfy the applicable portions of 10 CFR 61.12(b) through (e), 10 CFR 61.13(b), 10 CFR 61.23(b) through (f), 10 CFR 61.41 through 61.44, 10 CFR 61.51(a) and 10 CFR 61.52(a)(2) through (a)(11).

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for an engineered structure at a low-level radioactive waste disposal

facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC staff's plans for performing such a technical review.

Except when an applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

American Concrete Institute, ACI 318, "Building Code Requirements for Reinforced Concrete," Detroit, MI, 1983.

---, ACI 349, "Code Requirements for Nuclear Safety Related Concrete Structures," Detroit, MI, 1985.

American Institute of Steel Construction, "Specification for Design, Fabrication, and Erection of Structural Steel for Buildings," Chicago, IL, eighth edition, 1981.

American National Standards Institute, ANSI A58.1, "Minimum Design Loads for Buildings and Other Structures," New York, 1982.

Applied Technology Council, ATC 3-06, "Tentative Provisions for the Development of Seismic Regulations for Buildings," Palo Alto, CA, 1978.

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

---, NUREG/CR-5041, "Recommendations to the NRC for Review Criteria for Alternative Methods of Low-Level Radioactive Waste Disposal," Vols. 1 and 2, R. H. Denson, R. D. Bennett, R. M. Wamsley, D. L. Bean, and D. L. Ainsworth, U.S. Army Engineer Waterways Experiment Station, November 1987 (Vol. 1) and January 1988 (Vol. 2).

Most of the discussions in the preceding sections address the construction of a below-ground vault and related construction activities (e.g., fill placement around the vault). Information on the placement of waste containers above the vaults in the tumulus portion of the EMCB is not discussed. The staff anticipates, however, that an applicant proposing to construct an EMCB would provide in the SAR the information on the tumulus portion that is now identified in other SRPs. For example, the information needed with regard to waste emplacement, filling of void spaces, placement of fill adjacent to waste packages, waste covering, disposal unit closure and stabilization and buffer zone provisions for the tumulus portion of an EMCB would be similar to those described in SPRs 3.3.1 and 4.3. Therefore, these information requirements are not discussed herein for an EMCB.

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify the submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (e) and (f), which require a description of the codes and standards the applicant has applied to the design and will apply to the construction of the land disposal facility and a description of the construction of the disposal facility, which should include, as a minimum, the methods of construction of disposal units and of waste emplacement and the methods to control surface water and groundwater access to the wastes

(2) 10 CFR 61.12(j) as it relates to the description of the quality control program for the design and construction of the disposal facility

(3) 10 CFR 61.43, "Protection of Individuals During Operations," which requires that operations at the land disposal facility be conducted in compliance with the standards for radiation protection in 10 CFR 20 and that every reasonable effort be made to maintain radiation exposures as low as is reasonably achievable

(4) 10 CFR 61.51, "Disposal Site Design for Land Disposal," (a)(2), which requires that the disposal site design and operation be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that will provide reasonable assurance that the performance objectives of Subpart C of 10 CFR 61 will be met

(5) 10 CFR 61.52, "Land Disposal Facility Operation and Disposal Site Closure," (a)(4), which requires that wastes be emplaced in a manner that will maintain package integrity during emplacement, minimize the void spaces between packages, and permit the void spaces to be filled

(6) 10 CFR 61.52(a)(5), which requires that void spaces between waste packages be filled with earth or other material to reduce subsidence within the fill

(7) 10 CFR 61.52(a)(6), which requires that waste be placed and covered in a manner that will limit the radiation dose rate at the surface of the cover to levels that, at a minimum, will permit the licensee to comply with all provisions of 10 CFR 20.105 at the time the license is transferred pursuant to 10 CFR 61.30

4.2 Regulatory Guidance

Guidance on the construction and operation of a BGV or EMCB are provided in NUREG/CR-5041, Sections 2.3 and 2.4. Many useful, comprehensive, and acceptable industrial standards related to construction materials and methods are identified in NUREG/CR-5041. An applicant may choose to significantly reduce the extent of information to be submitted in an SAR by providing a commitment to comply with certain accepted standards. In cases where commitments to standards are given, the applicant should identify the specific chapters or sections of the standard that will be fully complied with and identify where deviations are to be made along with the bases for accepting the substitute procedures.

4.3 Regulatory Evaluation Criteria

Regulatory evaluation criteria pertaining to the areas of review in Section 2 of this SRP are given in the following sections.

4.3.1 Construction Materials Quality and Durability

The information on the quality and durability of construction materials is acceptable if the materials to be used in construction are generally consistent with the General Design Criteria and Specific Design Review Criteria in Sections 2.3.2 and 2.3.3 of NUREG/CR-5041. The staff will evaluate alternative construction materials proposed by an applicant on a case-by-case basis to determine if the supporting test results and data demonstrate that the quality and durability characteristics ensure that the material will be able to resist the adverse forces identified in Section 3.2.1 of this SRP. Materials that are proposed without sufficient supporting data are unacceptable, and the staff will provide the reasons for this determination to the applicant.

4.3.2 Construction Methods and Disposal Operations

The information on construction methods and disposal operations is acceptable if it reflects an organized and logical plan of activities for BGV or EMCB construction and operation and is generally consistent with the General Design

Specific Design Review Criteria in Sections 2.4.1 and 2.4.2 of NUREG/CR-5041. Deviations from the construction methods and operational procedures described in Section 3.2.2 of this SRP are anticipated to allow the greatest flexibility to the constructor of the engineered structures. However, the applicant should identify those deviations in the license application to permit staff review and evaluation and verification that regulatory requirements will be met.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has evaluated the quality and durability of the construction materials and the construction methods and disposal operations for the below-ground vault [or earth-mounded concrete bunker] for [name of facility] according to Standard Review Plan 3.3A.

The applicant has adequately described the construction materials to be used with supporting test data and inservice performance records to permit the staff to conclude that the engineered structures will acceptably perform for the long term in the waste disposal environment that is expected to exist.

The applicant's description of the major construction methods and operational procedures to be followed reflects an organized and logical plan of activities that should result in the safe construction and operation of the BGV [or EMCB] and fulfillment of the pertinent regulatory requirements. The staff plans a site visit during the initial construction and operation activities to verify the satisfactory implementation of the applicant's methods and procedures.

On the basis of the findings, the staff concludes that the construction materials proposed for construction and the construction methods and operational procedures to be followed by the applicant are acceptable and there is reasonable assurance that the applicable regulatory requirements of 10 CFR 61.12(e), (f), and (j), 10 CFR 61.43, 10 CFR 61.51(a)(2), and 10 CFR 61.52(a)(4) through (a)(6) will be met.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for an engineered structure at a low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

---, NUREG/CR-5042, "Recommendations to the NRC for Review Criteria for Alternative Methods of Low Level Radioactive Waste Disposal," Vols. 1 and 2, R. H. Denson, R. D. Bennett, R. M. Wamsley, D. L. Bean, D. L. Ainsworth, U.S. Army Engineer Waterways Experiment Station, November 1987 (Vol. 1) and January 1988 (Vol. 2).

procedures for backfilling existing wells or open boreholes. The applicant's description of the site preparation procedures should be closely coordinated and referenced with the appropriate engineering drawings and construction specifications.

3.2.2 Control and Diversion of Water

The staff will review the applicant's plans for controlling surface water and groundwater in the proposed excavations and fill areas. Where appropriate, the applicant should discuss the methods used in constructing control and diversion features (temporary or permanent dikes, diversion ditches, etc.) and the time schedule for completing this work. The staff review will consider the requirements for water control both during the construction stage of individual disposal units, as identified in the applicant's planned construction sequence, and at the time of site closure.

3.2.3 Construction of Disposal Units

The staff will review the applicant's description of the construction methods for individual disposal units and the sequence for closure of these units. The description should cover construction operations up to the actual placement of waste into the individual disposal unit and should include information on (1) excavations (types of soil and rock materials to be removed; limits, slopes, and depths or bottom elevations shown in plan and sectional views; requirements on final surface preparation, including identification of any unsuitable materials, and on excavated surfaces where concrete is to be placed; disposition of excavated materials); (2) fill areas (limits, slopes, and heights or top elevations; requirements on surfaces that will receive fill, such as no placement over frozen ground and scarifying to promote bonding and proof rolling; types of fill materials; requirements for spreading and moisture conditioning of fill layers, removal of oversize particles, and field procedures to obtain the required degree of compaction); (3) preplacement details for directing and controlling precipitation and surface water runoff in excavations (thickness of permeable base layer, slopes for drainage, sump locations, etc.); and (4) quality control testing (e.g., testing to determine field density, fill moisture, laboratory compaction, gradation, and plasticity), including identification of test standard and testing frequency.

3.2.4 Concrete and Steel Construction

The staff will evaluate the applicant's information on disposal facility construction that involves the use of concrete and structural steel materials. For concrete, this information should include the design, manufacture, mixing, reinforcement, forming, transporting, placing, finishing, and curing of concrete. For structural steel, this information should include the design, fabrication, and erection of buildings and components.

3.2.5 Backfilling

The staff will review the information on backfilling, which should address the technical requirements for emplacement of the waste packages in the land

disposal facilities, as well as the requirement that void spaces between the waste packages be filled in order to reduce future subsidence within the excavations. Staff guidance on backfilling with a cohesionless soil is contained in Appendix A to SRP 4.3, "NRC Staff Recommendations for Filling Void Spaces Around Waste Containers Emplaced in Low-Level Waste Land Disposal Excavations." The staff will check backfilling operations of land disposal excavations to determine if they are at least equivalent to those in the above recommendations in order to ensure long-term stability of backfilled excavations.

The information on backfilling should include (1) the planned stacking arrangement of the waste containers, (2) the provisions that restrict the placement of decomposable materials in the excavation in order to minimize future long-term subsidence, (3) the construction controls required to ensure proper gradation and moisture condition of the cohesionless backfill materials that are placed around the containers so as to avoid bridging and clumping of the backfill soils and the resulting creation of voids, and (4) the construction operations, and their sequence, that are planned for the actual placement of the waste containers and the fill materials (e.g., the placement of fill after each successive layer of waste is placed to ensure the filling of interstitial spaces rather than delaying the placement of fill until the full height of waste has been placed).

3.2.6 Closure of Individual Disposal Units

The staff will review the information on closure, which should include the construction features of the materials to be placed in the cover above the backfilled waste to ensure minimization of water infiltration and acceptable performance of the disposal facility both during construction and after site closure. These materials may include an uppermost layer to promote vegetative growth and to resist surface cracking and other layers such as an intruder barrier, permeable drainage and impermeable layers, and possibly geotechnical fabrics.

For many of the types of material to be placed in the excavation cover over the waste, the applicant should provide information that is similar to that identified for fill areas and quality control testing in Section 3.2.3 of this SRP, "Construction of Disposal Units." The applicant should discuss any unique consideration of these materials, such as the use of construction methods that will prevent undesirable mixing or contamination of the different materials in the excavation cover. The applicant should identify and discuss special manufacturer or handling or placement requirements for the intruder barrier or geotechnical fabric materials.

The staff will review documentation provided by the applicant on the overall construction plans and sequence of operations covering development activities (access ramps, separation of disposal units according to waste classification, phased backfilling, etc.) and closing activities that demonstrate a safe and effective disposal facility operation that will meet the requirements of 10 CFR 61.

4.3.1 Construction Methods and Procedures

The staff will review the information on the construction methods and procedures for site preparation, control and diversion of water, construction of disposal units, concrete and steel construction, backfilling, and closure to establish that sufficient information is provided and is acceptable and to ascertain that the applicant's construction methods and procedures are consistent with the relevant acceptance criteria in the following SRPs:

(1) 3.1, "Principal Design Features"
(2) 3.2, "Design Considerations for Normal and Abnormal/Accident Conditions"
(3) 3.4.1, "Utility Systems"
(4) 3.4.2, "Auxiliary Facilities"
(5) 3.4.3, "Fire Protection System"
(6) 4.3, "Waste Disposal Operations"
(7) 5.1, "Site Stabilization"
(8) 6.2, "Intruder Protection"
(9) 6.3, "Long-Term Stability"

4.3.2 Applicable Codes, Standards, and Specifications

The staff will review the information on the design and construction codes, standards, and specifications that were applied in the design and that will be applied in the construction of the disposal facility and will ensure that appropriate codes or standards are used. The following codes and standards on concrete and structural steel materials are acceptable to the NRC staff:

(1) American Concrete Institute, ACI 349, "Code Requirements for Nuclear Safety-Related Concrete Structures," 1980

(2) American Institute of Steel Construction, "Specification for Design, Fabrication, and Erection of Structural Steel for Buildings," eighth edition, 1981

(3) American National Standards Institute, ANSI N45.2.5, "Supplementary Quality Assurance Requirements for Installation, Inspection and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants," 1974

(4) State and local building, electrical, and fire codes

4.3.3 Construction Materials and Quality Assurance

The staff will review the information on the materials that will be used in the construction of the disposal facility. The major materials of construction include the excavation and fill materials, the concrete and grouting ingredients, reinforcing bars, and structural steel. If any material not used previously in NRC-licensed facilities is proposed, the applicant should provide sufficient testing and user data to establish the acceptability of the material. The staff also will evaluate the applicant's quality control procedures and construction techniques to ensure that there will be no degradation

of the construction quality that might affect the stability and structural integrity of the disposal facility.

4.3.4 Site Plans, Engineering Drawings, and Contruction Specifications

The staff will review the completeness and adequacy of the site plans and engineering drawings for conveying the design features. The engineering drawings should show dimensions, sections, and relative locations of the various facilities within the disposal site boundary. All plans and drawings should be drawn to a scale large enough to convey the design information adequately and should be signed by a licensed engineer. As-built condition should ultimately be documented by the applicant as a permanent record for the constructed disposal facility. Construction specifications should be compatible and consistent with the design and operation requirements. The contents and procedures specified in the specifications should conform to the applicable industry codes and standards.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the construction methods and features for the [name of facility] low-level waste disposal facility according to Standard Review Plan (SRP) 3.3.1 to ensure that the construction methods used by the applicant will result in the long-term stability of the disposal site and that the required construction procedures and methods will ensure that the construction of the waste disposal facility will meet 10 CFR 61.41, 61.42, 61.43, and 61.44.

The construction procedures and methods that will be used by the applicant are applicable to the construction features of the disposal site and are related to site preparation, control and diversion of water, construction of disposal units, concrete and steel construction, backfilling, and disposal unit closure. The procedures and methods to be used will ensure that the functional requirements of the principal design features will be met.

The site plans have clearly shown the site boundary, restricted zone, security area, buffer zone, operational area, and general layout of the disposal facility. The engineering drawings have provided the necessary information for the construction of the waste disposal facility at [name of site]. Construction specifications provided by the applicant are based on the function and design requirements of the land disposal facility. Compliance with the construction, drawings, and specifications will provide assurance that the land disposal facility will be properly constructed and will perform its intended safety function.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (e), as it relates to the codes and standards that the applicant has applied to the design and that will apply to the construction of the disposal facility

(2) 10 CFR 61.12(f), as it relates to the description of the construction and operation of the disposal facility, which should include as a minimum, the methods of construction and the equipment to be used for the construction and operation of the disposal units and for waste emplacement

(3) 10 CFR 61.12(j), as it relates to the description of the quality control program for the design, construction, and operation of the disposal facility and the receipt, handling, and emplacement of waste

(4) 10 CFR 61.12(k), as it relates to the description of the radiation safety program for controlling and monitoring radioactive effluents to ensure compliance with the performance objective of 10 CFR 61.41 and the occupational radiation exposure requirements of 10 CFR 20 and to control contamination of personnel, vehicles, equipment, buildings, and the disposal site

4.2 Regulatory Guidance

There are no regulatory guides that apply to construction equipment for low-level waste disposal facilities. However, NUREG/CR-3144, "Trench Design and Construction Techniques for Low-Level Radioactive Waste Disposal," discusses heavy construction equipment specifications and capabilities and offers guidance on the proper selection of construction equipment for use at low-level waste disposal facilities.

4.3 Regulatory Evaluation Criteria

Because there are no regulatory guides that directly cover construction equipment to be used at low-level waste disposal facilities, the staff's evaluation will be based primarily on engineering judgment. On the basis of this judgment, the staff will conclude whether or not the information provided by the applicant acceptably fulfills the requirements of 10 CFR 61.12(e), (f), (j), and (k). The type and scope of information to be provided have been identified in Section 3 of this SRP, and acceptance considerations are discussed in the following sections.

4.3.1 Types of Equipment

The information on construction equipment in the SAR will be acceptable to the staff if the subject matter addressed in Section 3.3.2 of NUREG-1199 and in

this SRP is covered in sufficient detail with regard to the types of equipment and their functions. The applicant should provide information on the following categories of equipment:

(1) equipment for site preparation and safe control of surface water and groundwater

(2) equipment for excavation of disposal units

(3) equipment for hauling materials

(4) equipment for fill placement and compaction

(5) equipment for transporting, handling, and placing of low-level waste

(6) equipment for backfilling disposal units

(7) equipment for concrete and steel construction

(8) equipment for closure of individual disposal units and site closure

4.3.2 Equipment Specifications and Capabilities

Staff acceptance of the information provided on equipment manufacturer's specifications will be based on the capabilities of the construction equipment to safely perform its intended functions and fulfill design objectives.

.3.3 Storage, Maintenance, Replacement, and Inspection of Equipment

Staff acceptance will be based on the adequacy of the procedures and measures pertinent to the storage, maintenance, replacement, and inspection of equipment and on whether or not reasonable assurance is provided that construction activities will not be interrupted and unsafe conditions will not be permitted to develop because of the breakdown or scarcity of important and required equipment.

4.3.4 Quality Assurance* and Quality Control Program

The construction equipment QA/QC program provided by the applicant will be acceptable to the staff if provisions for purchasing, handling, repairing, replacing, and maintaining equipment are effectively in place and properly administered to provide reasonable assurance that the equipment will reliably perform and not impair the quality and integrity of the disposal facility.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

*See footnote page 9.1-5.

5.2 Sample Evaluation Findings

The staff has reviewed the types of equipment, and their capabilities, that are to be used in the construction and operation of the [name of facility] low-level waste disposal facility according to Standard Review Plan (SRP) 3.3.2 to ensure that the equipment will meet the construction requirements and will safely perform its intended functions. Selection and use of the designated construction equipment are based on the construction function and capability of the equipment. The applicant has ensured that, with the use of the designated equipment, the construction and operation of the disposal facility will meet the performance objectives of 10 CFR 61, Subpart C.

The staff has reviewed the information on the construction equipment provided by the applicant and has concluded that the equipment is acceptable because reasonable assurance has been provided that it (1) will perform its intended function, (2) is in conformance with the construction requirements, and (3) will permit safe construction and operation of the disposal facility.

The applicant has met SRP 3.3.2 and 10 CFR 61.12(e), (f), and (k) and has provided adequate information on the types of equipment and on equipment specifications and capabilities that will provide assurance of the safe performance of the equipment. The land disposal facility constructed and operated by the use of this equipment will meet the required safety function and will fulfill the performance objectives of 10 CFR 61, Subpart C.

The applicant has provided acceptable documentation on the quality assurance/quality control program for the equipment that will be used in the construction and operation of the land disposal facility. This documentation provides evidence and assurance that the selected equipment will reliably perform its intended function without impairing the quality and integrity of the disposal facility and that the applicable portions of 10 CFR 61.12(j) will be met.

The applicant's procedures for the purchase, replacement, maintenance, and inspection of equipment are adequate, and the use of these procedures will ensure that there will be no unacceptable breakdown, interruption, or delay in the construction and operation of the land disposal facility.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG 1:99, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

---, NUREG/CR-3144, "Trench Design and Construction Techniques for Low-Level Radioactive Waste Disposal," P. G. Tucker, U.S. Department of the Army, Army Engineers Waterways Experiment Station, February 1983.

4.3.1 Communication System

The communication system is acceptable if it is designed and installed so that it (1) will provide clear communication, either visual or sound, between plant personnel at all times during waste receipt, handling, and disposal operations; (2) will provide a reliable link with offsite officials, particularly during a period of emergency response; (3) will be constructed according to common and accepted practice; and (4) will not interfere with the design or operation of the facility.

4.3.2 Electric System

The electric system is acceptable if it is designed and installed so that it (1) will provide onsite power as required to safely operate the disposal facility and (2) will be constructed according to common and accepted practice.

4.3.3 Water System

The water system is acceptable if it is designed and constructed so that it (1) will provide adequate volumes of water for construction, operation, and fire fighting as required to safely operate the disposal facility; (2) will be installed according to common and accepted practice; (3) will provide potable water for workers; and (4) will provide warm water for the decontamination of workers as discussed in SRP 7.

4.3.4 Lighting System

The lighting system is acceptable if it is designed and installed so that it (1) will provide adequate lighting during periods of construction and operation as required to safely operate the disposal facility, (2) will provide emergency lighting as required for anticipated accident scenarios, and (3) will be constructed according to common and accepted practice.

4.3.5 Sanitary Waste Disposal System

The sanitary waste disposal system is acceptable if it is designed and constructed so that it (1) will be adequately sized for its anticipated usage, (2) meets applicable State and local codes and standards, and (3) will not interfere with the design and safe operation of the facility.

4.3.6 Fuel Delivery System

The fuel delivery system is acceptable if it is designed and constructed so that it (1) will provide adequate fuel for the onsite building equipment, and disposal activities; (2) would result in isolation of accidental fires, if they were to occur, (3) will meet or exceed the standards of common and accepted practice, and (4) will not interfere with the design or operation of the facility.

4.3.7 Other Utility Systems

Any other utility system that may be required for the safe operation of the proposed facility is acceptable if the system is designed and installed so that it (1) will be adequately sized for the proposed design, (2) will be constructed according to common and accepted practice, and (3) will not interfere with the design or operation of the facility.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the utility systems for [name of facility] low-level waste disposal facility according to Standard Review Plan (SRP) 3.4.1 to verify that sufficient information has been provided for each utility system that is required by the facility design; that each utility system has been designed and will be constructed to provide the support functions required by the principal design features, construction, and safe operation of the facility; and that the design and construction of the utility system will not adversely affect facility performance.

The applicant has accurately described the required functions of the [specify] system, including all the materials and components that are necessary so that it will function as required and at the capacity required. The staff has evaluated the adequacy of the applicant's proposed design criteria and bases for the [specify] system and the requirements for facility operations. The staff has determined that the applicant's proposed design of the [specify] system is consistent with the principal design criteria and bases. The system's design does not interfere with the design of the principal design features or the safe operation of the facility. Therefore, there is reasonable assurance that the [specify] system, which the staff has found meets 10 CFR 61.12(b) through (f), 10 CFR 61.23(b) through (f), and 10 CFR 61.51, will provide adequate support for the principal design features.

On the basis of its review, the staff concludes that the design of the [specify] system conforms to all applicable regulations and industry standards and is acceptable.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

(3) 10 CFR 61.51, "Disposal Site Design for Land Disposal," (a), which presents minimum technical requirements for near-surface disposal site design (auxiliary facilities are not specifically mentioned, but their proper functioning may be required to support the principal design features, construction, and safe operation of the facility)

4.2 Regulatory Guidance

There are no regulatory guides or general design criteria that apply directly to the safety-related performance of the auxiliary facilities. Staff guidance on roadways is provided in Section 3.1 of "Technical Position Paper on Near-Surface Disposal Facility Design and Operation," specifically in the section entitled "Access Roads."

4.3 Regulatory Evaluation Criteria

The staff will evaluate the information on each auxiliary facility according to the criteria given in the following sections.

4.3.1 Auxiliary Buildings

Auxiliary buildings are acceptable if they have been designed so that they (1) will support operations at the facility in a manner consistent with 10 CFR regulations; (2) are constructed in accordance with applicable and appropriate Federal, State, and local building codes and industry standards (e.g., ACI 349 of the American Concrete Institute); (3) will perform safely under loading imposed by normal design-basis events anticipated during the operational life of the facility, and (4) will not interfere with operations at the facility, including planned closure and stabilization activities.

4.3.2 Roadway Layout and Traffic Controls

The information on the roadway layout and traffic controls is acceptable if the proposed traffic system will support and not adversely affect safe operation of the facility, will not interfere with closure measures completed on disposal units during operations, and will not interfere with the buffer zone proposed for the facility. The roadway system is acceptable if it is compatible with the closure and stabilization plan proposed for the facility. The traffic controls should follow applicable industry standards, and the roadways should be of sufficient dimensions to allow for safe movement of facility equipment and vehicles. The layout should be designed so that environmental and site monitoring and remedial actions that may have to be undertaken in the buffer zone will not be affected.

4.3.3 Roadway Characteristics

The information on roadway characteristics is acceptable if the proposed roadways will support and not adversely affect safe operation of the facility and are compatible with the closure and stabilization plan proposed for the facility. The roadway materials should be sufficiently durable to handle traffic

loads expected during operations without deterioration and should follow applicable and accepted industry standards. The roadway materials and characteristics including appurtenant drainage features should be consistent with the final plans for closure and stabilization proposed for the facility.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the auxiliary facilities for [name of facility] low-level waste disposal facility according to Standard Review Plan (SRP) 3.4.2 to verify that sufficient information has been provided by the applicant for each auxiliary facility that is required by the facility design; that each auxiliary facility has been designed to provide the supporting functions required by the principal design features, construction, and safe operation of the facility; and that the design and construction of the auxiliary facilities will not adversely affect the disposal facility performance.

The staff concludes that the objectives of the review have been met and that the review supports the following conclusions for the auxiliary facilities.

The applicant has accurately described the required functions of each auxiliary facility, including all buildings and roadways necessary to function as required by the disposal facility design, construction, and operation. The staff has determined the adequacy of the applicant's proposed design criteria and bases for each auxiliary facility. The staff has determined that each auxiliary facility conforms to the design criteria and bases and that the design does not interfere with the design of the principal design features, construction, or operation of the disposal facility. Therefore, there is reasonable assurance that the auxiliary facilities which the staff has found meet 10 CFR 61.12(b) through (f), 10 CFR 61.23(b) through (f) and 10 CFR 61.51, will provide adequate support for the principal design features.

On the basis of its review, the staff concludes that the design of each auxiliary facility conforms to all applicable regulations and industry standards and is acceptable.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.11, "General Information," (b)(3) and (4), which require that information submitted by the applicant include a description of the applicant's personnel training program and a plan to maintain an adequate complement of trained personnel to carry out waste receipt, handling, and disposal in a safe manner

(2) 10 CFR 61.12, "Specific Technical Information," (k), which requires that information submitted by the applicant include a description of the radiation safety program for control and monitoring of radioactive effluents to ensure compliance with the performance objective in 10 CFR 61.41 and occupational radiation exposure to ensure compliance with the requirements of 10 CFR 20 and to control contamination of personnel, vehicles, equipment, buildings, and the disposal site; both routine operations and accidents must be addressed, and the program description must include procedures, instrumentation, facilities, and equipment

(3) 10 CFR 61.43, "Protection of Individuals During Operations," which requires that operations at the land disposal facility be conducted in compliance with the standards for radiation protection in 10 CFR 20 and that every reasonable effort be made to maintain radiation exposures as low as is reasonably achievable

4.2 Regulatory Guidance

Guidance is provided in the following national fire codes published by the National Fire Protection Association:

(1) NFPA 801-1986, "Recommended Fire Protection Practice for Facilities Handling Radioactive Materials"

(2) NFPA 901-1981, "Uniform Coding for Fire Protection"

4.3 Regulatory Evaluation Criteria

Evaluation criteria pertaining to the areas of review listed in Section 2 of this SRP are given in the following sections.

4.3.1 Accidental Fire Analysis

The information on the accidental fire analysis is acceptable if fires and their effects in the presence of radioactive substances are postulated for the waste receipt area, the waste storage area, and the waste disposal area, at a minimum. The analysis should consider the location where the most severe fire could occur, the materials likely to be consumed, the construction arrangement of any buildings or areas likely to be consumed, and the harmful effects of smoke and heat associated with the fire.

4.3.2 Fire Protection System

The information on the fire protection system is acceptable if (1) the procedures, materials, equipment, and systems for fire protection will protect workers and the public from radiation and fire hazards, (2) there is a suitable program for the prevention of hazards from radiation and fire, and (3) there is a program to adequately train facility personnel to respond to fire emergencies and to prevent fires. The methods proposed to provide this system should meet the prescribed recommendations of NFPA 801-1986 and NFPA 901-1981, including the referenced recommended practices, especially in regard to the equipment for the detection of fires; equipment for the prevention of fire hazards (sprinklers, etc.); onsite and offsite alarm systems; wet, dry, and chemical fire extinguishers; foam-extinguishing systems; personnel training; building materials; and facilities handling radioactive wastes. Buildings on site should meet the requirements of the Uniform Fire Code for their intended purposes, especially the waste receipt and storage areas, the vehicle washdown facility, and the waste repackaging areas.

4.3.3 Emergency Response

The information on the emergency response in the event of a fire is acceptable if the accidental fire analysis does not indicate any conditions that may adversely affect the results of the review and conclusions drawn under SRP 8.4. The emergency response plan reviewed under SRP 8.4 should contain adequate measures for the notification and evacuation of workers and nearby residents if a fire should occur.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the fire protection system for the [name of facility] low-level waste disposal facility according to Standard Review Plan 3.4.3. The staff concludes that the fire protection system has been designed (1) to maintain occupational exposures as low as is reasonably achievable if an accidental fire should occur and (2) to be compatible with the facility's radiation safety and emergency planning programs. The applicant has provided provisions for an adequate training program for personnel in fire prevention and protection. The fire protection system, therefore, meets 10 CFR 61.11(b)(3) and (b)(4), 10 CFR 61.12(k), and 10 CFR 61.43 as they relate to fire protection.

The staff will review the applicant's analyses pertinent to the identification of the design-basis-flood magnitudes, levels, and velocities. Acceptance of the analyses is based on general agreement of the staff's and the applicant's estimates of static flood level and peak discharges and the adequacy of the computational methods used for such estimates.

4.3.3 Dam Failures

Acceptance criteria for dam-failure flood analyses and hydraulic designs are identical to those presented in SRP 6.3.1.

4.3.4 Flood Control Designs

Flood control features should be either (1) capable of preventing erosion and flooding of disposal units or (2) designed so that inundation does not result in the release of wastes from the disposal area. In general, flood control measures that are designed to accommodate an occurrence of the PMP or PMF provide an acceptable design. Details and acceptable methods of analysis of floods and flood velocities may be found in Draft Regulatory Guide, "Design of Long-Term Erosion Protection Covers for Reclamation of Uranium Mill Sites." If the design assumptions and calculations are conservative, reasonable, and accurate and/or compare favorably with independent staff estimates, the designs are found to be acceptable.

In many instances, engineering designs will be provided that will be used during both the postclosure period and the operational period. Specific examples of such designs include diversion channels and riprapped embankments. For those cases, acceptable design procedures and methods of analysis are also presented in SRP 6.3.1.

5. EVALUATION FINDINGS

5.1 Introduction

If the evaluation by the staff, based on a complete review of the hydraulic engineering aspects of the site design, confirms that regulatory guidelines have been met, documentation of the review will state that, in accordance with 10 CFR 61.51(a)(5) and (a)(6), the flood analyses and investigations adequately characterize the flood potential at the site, are appropriately documented, employ an acceptable level of conservatism, and/or represent a feasible plan for ensuring that disposal units will not be subject to flooding and erosion during the operational period.

5.2 Sample Evaluation Findings

The staff has reviewed the erosion and flood control system for [name of facility] low-level waste disposal facility according to Standard Review Plan 3.4.4.

During the operation of the facility, rock-protected diversion channels and flood embankments will be constructed to protect the site from the effects of

onsite flooding. The diversion ditches will eventually become part of the long-term design against flooding.

For both offsite and onsite local flooding, the NRC staff independently estimated peak flood flows and velocities to determine the adequacy of the design features. These features were analyzed in accordance with the hydrologic procedures discussed in SRP 6.3.1. On the basis of these independent analyses, the staff concludes that the design of the facility meets the requirements of 10 CFR 61.51(a)(5) and (a)(6), so that site hydrologic features, when enhanced with the proposed design features, will prevent erosion and flooding of the disposal units during operation. Additional details related to the staff analysis are found in SRP 6.3.1, particularly for those features that will become part of the long-term design.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Same as those listed in Section 7 of SRP 6.3.1.

those reported on the waste manifest and as independent of the source as practicable.

The proposed frequency for direct sampling may be less than that proposed for nondestructive testing, but it should be based on a consideration of the anticipated volumes and activities and physical characteristics of the various waste streams expected to be received at the site.

The staff will review the SAR to ensure that procedures are in place to analytically verify that the waste received at the site will meet the waste characteristic and waste form stability requirements. This verification testing will most likely involve direct sampling (although techniques such as the use of x-ray scanners and sonic probes may in some cases offer supporting information). Destructive testing (e.g., coring and cutting) will require that facilities be available (on site or through a contractor) to remotely handle, test, and repackage waste of all classes. Equipment or contracts should be available to identify the chemical components of the waste and to determine that U.S. Environmental Protection Agency requirements are met for hazardous waste that may enter the site.

The staff will determine that procedures are provided to ensure that waste acceptance criteria are met in accordance with the license conditions that will be part of the facility license. The staff will ensure that waste acceptance criteria, which become license conditions, have been considered in the development of these procedures.

However, generic acceptance criteria do exist independent of the facility site and as a minimum should be those listed in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

Acceptance of the applicant's procedures for the receipt and inspection of waste is based on the applicant's meeting the requirements of 10 CFR 61.55, 61.56, 61.81, 71.87, and 20.311 and 49 CFR 173.441 and 173.443 and the performance objectives of 10 CFR 61.

In addition, the applicant should provide the information requested in Section 4.1 of NUREG-1199. The regulations applicable to the areas of review of this SRP are:

(1) 10 CFR 20.101, "Radiation Dose Standards for Individuals in Restricted Areas," as it relates to the total occupational dose an individual may receive in a restricted area

(2) 10 CFR 20.205, "Procedures for Picking Up, Receiving, and Opening Packages," as it relates to receiving and opening packages

(3) 10 CFR 20.311, "Transfer for Disposal and Manifests," as it relates to the transfer of radioactive waste intended for disposal at a land disposal facility and the establishment of a manifest tracking system

(4) 10 CFR 61.41, "Protection of the General Population From Releases of Radioactivity," as it relates to limits on radiation doses from land disposal facilities to the general public and requirements on the licensee to maintain doses as low as is reasonably achievable

(5) 10 CFR 61.42, "Protection of Individuals From Inadvertent Intrusion," as it relates to ensuring that intruder protection is provided by proper waste classification

(6) 10 CFR 61.43, "Protection of Individuals During Operations," as it relates to maintaining occupation exposures as low as is reasonably achievable

(7) 10 CFR 61.44, "Stability of the Disposal Site After Closure," as it relates to eliminating to the extent practicable the need for ongoing active maintenance of the disposal site after closure

(8) 10 CFR 61.55, "Waste Classification," as it relates to the methodology for properly classifying waste for near-surface disposal

(9) 10 CFR 61.56, "Waste Characteristics," as it applies to the minimum waste form stability and intruder protection requirements for waste entering the disposal site

(10) 10 CFR 61.81, "Tests at Land Disposal Facilities," as it pertains to tests of radioactive wastes and facilities used for receipt, storage, treatment, handling, and disposal of radioactive wastes

(11) 10 CFR 71.47, "External Radiation Standards for all Packages," as it relates to external radiation standards for all packages

(12) 10 CFR 71.87, "Routine Determinations," as it relates to transport conditions required for packages and to ensuring that waste packages and their contents satisfy transportation regulations

(13) 40 CFR 261, "Identification and Listing of Hazardous Wastes," as it relates to hazardous waste constituents in low-level waste

(14) 49 CFR 173.441, "Radiation Level Limitations," as it relates to limits of allowable external gamma radiation levels for packages to be transported

(15) 49 CFR 173.443, "Contamination Control," as it relates to limits for removable external radiation levels (wipe limits)

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in the following documents:

NRC Regulatory Documents

(1) "Technical Position on Low-Level Radioactive Waste Classification and Manifest Reporting," as it pertains to acceptable procedures for classifying waste

(2) "Technical Position on Waste Form for 10 CFR Part 61," as it pertains to ensuring stability for nonsegregated Class A waste and Class B and C waste

Industry Standards

(3) American Nuclear Society, ANS 55.1, "American National Standard for Solid Radioactive Waste Processing System for Light Water Cooled Reactor Plants," 1979, as it pertains to determining the amount of freestanding liquid in a solidified waste form

(4) American Society for Testing and Materials, ASTM C-39, "Compressive Strength of Cylindrical Concrete Specimens," 1979, as it pertains to determining the compressive strength of waste forms

(5) American Society for Testing and Materials, ASTM D 1074, "Compressive Strength of Bituminous Mixtures," 1980, as it pertains to determining the compressive strength of plastic waste forms

4.3 Regulatory Evaluation Criteria

Evaluation criteria pertaining to the areas of review of this SRP are given in the following sections.

4.3.1 Examination of Shipping Documents

The applicant's procedures are acceptable if they (1) provide reasonable assurance (for example, through the use of check lists) that U.S. Department of Transportation, NRC, and U.S. Environmental Protection Agency waste manifest information requirements are met and (2) result in written certification by a knowledgeable and responsible individual (such as the radiation safety officer (RSO) or the RSO's authorized representive) that such information has been provided on the manifest as required by 10 CFR 20.311.

4.3.2 Visual Check of the Waste Package

The applicant's procedures are acceptable if they provide for (for example, through the use of check lists) examination of waste package markings, labels, probable waste contents (as evidenced by the type of package), and the waste manifest, which should correctly describe the size, type, and waste contents of the package. The procedures for visual inspection should determine that the "routine determinations" of 10 CFR 71.87(a) through (h) are satisfied. These procedures should include (1) required written certification by a person of reasonable knowledge and authority and (2) reporting requirements for items that are found to be in noncompliance.

4.3.3 Survey for Non-Fixed (Removable) and External Radiation Levels

The applicant's procedures are acceptable if they contain methods for determining non-fixed (removable) and external radiation levels in the most appropriate locations as required by 10 CFR 71.87. The non-fixed levels determined by taking smear samples should be compared with the maximum permissible limits of Table V, "Removable External Radioactive Contamination Wipe Limits," in 10 CFR 71.87. The external radiation levels around the package and around the vehicle should be compared with the limits specified in 10 CFR 71.47, "External Radiation Standards for all Packages." Written certification should be required from a person of reasonable knowledge and authority (such as the RSO or the RSO's authorized representative), and reporting requirements should be mandatory for measurements that do not meet the limits prescribed in the regulations cited above.

4.3.4 Verification of Waste Classification

The applicant's procedures are acceptable if the following conditions are met:

(1) The applicant has identified and has access to equipment and facilities capable of performing the waste classification determinations required by 10 CFR 20.311.

(2) The procedures and equipment demonstrate the applicant's capability to perform quantitative determinations for the principal radionuclides in Tables 1 and 2 of 10 CFR 61.55. These determinations should have an accuracy equivalent to that recommended for the waste generator in "Technical Position on Waste Classification for 10 CFR Part 61."

(3) The applicant's procedures and equipment should be capable of and directed toward identifying and quantifying significant chemicals in the waste, in particular those chemicals listed as hazardous by the U.S. Environmental Protection Agency in 40 CFR 261.

An acceptable frequency for direct sampling assay will be site and waste stream specific and will be dependent on regional activity and volume data. The technical data base used for comparison will be based on information gathered from waste manifests accompanying previous waste shipments to other disposal sites.

4.3.5 Verification of Minimum Waste Form and Stability Requirements

The procedures and equipment are acceptable if the following tests can be performed for all waste classes as outlined in the "Technical Position on Waste Form for 10 CFR Part 61":

(1) Solidified Class A Segregated Waste Products

These procedures should, as a minimum, allow identification of the wastes as a freestanding monolith and provide assurance that the waste has less than 0.5% freestanding liquid.

(2) Commingled, Solidified Class A Waste

(a) Procedures should, as a minimum, include compressive strength and immersion testing of cored, solidified waste specimens.

(b) Class A solidified waste should have less than 0.5% freestanding liquid by volume of the waste and should be solidified completely.

(3) Class B and C Stable Waste

These waste should be tested as in (2) above.

(4) High-Integrity Containers

(a) The maximum free liquid in a high-integrity container (HIC) should be less than 1% the waste volume.

(b) Procedures should, as a minimum, include specific HIC materials testing to verify compliance with HIC certificates of compliance, including the appropriate testing on specimens removed from HICs.

4.3.6 Identification of Packages Requiring Remediation

The procedures are acceptable if the following types of waste can be identified and made safe:

(1) waste that does not meet the U.S. Department of Transporation's external radiation or surface contamination levels

(2) waste that is not packaged properly

(3) waste containing unacceptable materials

(4) waste that exceeds the maximum allowable activity levels and concentrations for specific radionuclides

(5) waste that does not meet the applicable waste form requirements

(6) waste that does not carry the proper manifest (e.g., waste that does not contain information required for identification of major constituents or pertinent information on the identification of the person(s) shipping the waste)

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the applicant's procedures for the receipt and inspection of waste entering the [name of facility] low-level waste disposal facility according to Standard Review Plan 4.1 and finds that the information is as requested in NUREG-1199, Section 4.1.

The applicant's procedures will result in routine inspections that provide reasonable assurance that waste entering the disposal facility meets the packaging, labeling, placarding, and survey requirements of the U.S. Department of Transportation and 10 CFR 71.

The applicant's procedures will result in verification of the waste manifest requirements of 10 CFR 20.311, including identification of the waste class, chemical and physical contents, identification of the person shipping the waste, and probable assurance that the waste meets the requirements for waste form and waste classification as required by 10 CFR 61.55 and 61.56.

The applicant's procedures provide for adequate and reasonable measures to ensure that the waste does not contain hazardous constituents, as defined by the U.S. Environmental Protection Agency's regulation in 40 CFR 261.

The applicant's procedures help to ensure that the performance objectives of 10 CFR 61, Subpart C, will be met with regard to the following:

(1) protection of the general population from releases of radioactivity and the maintaining of any releases as low as is reasonably achievable as required by 10 CFR 61.41

(2) protection of individuals from inadvertent intrusion as required for certain waste classes that are identified and verified by the applicant's inspection procedures and as required by 10 CFR 61.42

(3) protection of individuals during operations as determined by a comparison of exposures against 10 CFR 20 as it applies to occupational exposures and as required by 10 CFR 61.43

(4) stability of the disposal site after closure (10 CFR 61.44) as ensured by meeting the minimum waste form and stability requirements of 10 CFR 61.56

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

(2) 10 CFR 61.43, "Protection of Individuals During Operations," which requires that operations at the land disposal facility be conducted in compliance with the standards for radiation protection in 10 CFR 20 and that every reasonable effort be made to maintain radiation exposures as low as is reasonably achievable

(3) 10 CFR 61.51, "Disposal Site Design for Land Disposal," (a)(6), which requires that the disposal site be designed to minimize to the extent practicable the contact of water with waste during storage and disposal

(4) 10 CFR 61.52, "Land Disposal Facility Operation and Disposal Site Closure," (a)(1), which requires that wastes designated as Class A be segregated from other wastes by placing them in disposal units that are sufficiently separated from disposal units for the other waste classes so that any interaction between Class A wastes and other wastes will not result in failure to meet the performance objectives in 10 CFR 61, Subpart C; this segregation is not necessary for Class A wastes if they meet the stability requirements for waste in 10 CFR 61.56(b)

4.2 Regulatory Guidance

Guidance is provided in Section 3.3 of the "Branch Technical Position on Near-Surface Disposal Facility Design and Operation" as it relates to waste storage and the efforts needed to minimize the contact of water with waste containers. Guidance for implementing the 10 CFR 61 waste form requirements is provided in "Technical Position on Waste Form for 10 CFR Part 61."

4.3 Regulatory Evaluation Criteria

Evaluation criteria pertaining to the areas of review listed in Section 2 of this SRP are given in the following sections.

4.3.1 Waste Handling

The information on waste handling is acceptable if the procedures proposed provide for the proper definition, identification, handling, and segregation of Class A, Class B, and Class C wastes at all times. The waste handling procedures should be similar to accepted procedures at facilities of similar design. The proposed procedures should provide for the protection of workers during all phases of handling with special emphasis on the procedures when handling Class C wastes. Segregation procedures should provide for the protection of any packages against damage. Handling procedures should contain contingency plans for damaged packages and propose repackaging procedures. Equipment to be used should meet industry standards and have the capability to permit safe handling of waste and to carry out its intended design functions.

4.3.2 Interim Storage

The information on interim storage of waste is acceptable if the procedures proposed result in the use of storage space only when necessary, in the use of storage space efficiently, and in the disposal of waste as soon as possible

after receipt. The proposed storage system is acceptable if the waste, buildings, and equipment will be protected by shelter or covers from precipitation, and waste will be protected from surface water by the use of grading to control runoff or by the placement of waste on platforms so that the waste will be located above surface runoff. Equipment to be used should meet industry standards and be installed to meet the intended safety functions of the disposal facility.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the waste handling and interim storage operations for the [name of facility] low-level waste disposal facility according to Standard Review Plan 4.2.

The staff concludes that the waste handling and interim storage operations are designed to (1) maintain radiation exposures as low as is reasonably achievable, (2) minimize contact of water with waste while it is in storage, and (3) appropriately segregate Class A unstable wastes from stable Class B and Class C wastes during disposal. The facility, therefore, meets 10 CFR 61.43 as it relates to radiation protection of individuals during operations, 10 CFR 61.51(a)(6) as it pertains to minimizing contact of water with waste, and 10 CFR 61.12(f) and 61.52(a)(1) as they relate to the storage and segregation of waste. In meeting these requirements, the applicant has used the methods recommended in "Branch Technical Position on Near-Surface Disposal Facility Design and Operation," including those for (1) minimizing the extensive storage of waste, (2) disposing of waste after receipt as soon as possible, (3) protecting any needed storage areas from precipitation by the use of shelters or covers, (4) protecting any needed storage areas from surface water runoff by grading or by placing the waste on platforms so that it is above surface water runoff, and (5) the proper handling of waste during receipt that will ensure the segregation of waste designated as unstable Class A.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

the filling of void spaces are presented in Appendix A to this SRP. Equipment to be used for filling voids should meet industry standards and be operated safely according to commonly accepted industry procedures and have the capability to fulfill the required function of minimizing the void spaces.

4.3.3 Waste Covering

The information on waste covering is acceptable if the procedures, processes, materials, and equipment that are proposed result in the disposal of all classes of waste in a way that will limit the radiation dose rate at the surface of the cover to levels that, at a minimum, will permit the applicant to comply with all provisions of 10 CFR 20. The information should include the class of waste to be buried in each disposal unit and information on the shielding that will be provided by the waste container and cover materials. Equipment used to place waste cover materials should meet industry standards and be operated safely according to commonly accepted industry procedures.

4.3.4 Locating Disposal Units and Boundary Markers

The information on the locating of disposal units and boundary markers is acceptable if the procedures, processes, materials, and equipment that are proposed accurately locate disposal units and facility boundaries in the field and accurately provide for permanent mapping and marking of the disposal units and the facility boundaries. Three permanent survey marker control stations must be established on the site, and these must provide horizontal and vertical controls as checked against USGS or NGS record files. The procedures, processes, and materials that are established are acceptable if they result in a permanent record of the boundaries of the disposal units and the facility and include durable monuments in the field for the period that the wastes will remain hazardous and good quality office records that are to be made available before the period of institutional control. At a minimum, the survey personnel and procedures should meet the requirements necessary to perform a third-order, Class III survey level of control. Equipment should meet industry standards and be properly calibrated and operated according to commonly accepted industry procedures.

4.3.5 Disposal Unit Closure and Stabilization

The information on disposal unit closure and stabilization is acceptable if the procedures, processes, materials, and equipment ensure that ongoing operations will not disturb completed disposal units and that the individual disposal unit closures are compatible with the final closure and stabilization plan for the disposal facility. Acceptable closure methods should include appropriate fill and compaction of waste cover materials to minimize water infiltration and to facilitate drainage that ties into the surface water management plan of the facility and that may include the planting of appropriate vegetation growth or the use of durable, good-quality rip-rap, or similar methods for erosion control. The procedures for the closure of individual disposal units must provide for a program of regular inspections to include identification of areas of unsuccessful vegetation growth, subsidence, water ponding, infiltration, or unsuccessful diverting of surface water drainage. The closed disposal units should be separated from disposal units in use

so that operations at the active units will not be interfered with and required equipment will be able to travel and operate. Drainage from waste disposal areas that are in use should be directed away from completed and closed disposal units. Location and access to fill and borrow areas should be planned and controlled so that their use does not interfere with the integrity of the completed disposal units. Roadways and traffic controls should direct traffic away from completed and closed units where engineered intruder barriers have been installed.

4.3.6 Buffer Zone

The information on the buffer zone is acceptable if the provisions established result in an area that is large enough so that adequate environmental monitoring activities can be completed and reasonably anticipated mitigative measures can be performed. The buffer zone provisions must consider the three dimensions of the disposal facility, and the information on the buffer zone should describe how the buffer zone beneath the disposal units will function. Waste may not be disposed of in any portion of the buffer zone. The applicant must show that other waste disposal activities will not interfere with monitoring and/or mitigative actions in the buffer zone. The buffer zone must surround the entire area containing disposal units. An acceptable buffer zone should be a minimum of 30 meters wide around the entire facility. A desirable feature of a buffer zone would be to have wider dimensions in the downstream direction of groundwater flow. The information on the buffer zone should demonstrate that site geology and topography, soil and rock characteristics, direction, depth, and velocity of groundwater flow, location of wells and water users, and sufficient space for performing mitigative measures were considered in its design.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the waste disposal operations for the [name of facility] low-level waste disposal facility in accordance with Standard Review Plan 4.3.

The staff concludes that the waste disposal operations are designed to (1) segregate wastes designated as Class A unstable wastes from stable Class B and Class C wastes; (2) emplace waste packages in a manner that maintains package integrity, minimizes void spaces between packages, and permits void spaces between packages to be filled with an acceptable backfill material; (3) place and cover wastes in a manner that limits water infiltration and the

(1) Is the program based on the requirements of 10 CFR 61.12(l) and 10 CFR 61.53(c)?

(2) Does the program description include a plan for taking corrective measures as required by 10 CFR 61.12(l) and 10 CFR 61.53(b)?

(3) Does the information provided by the applicant satisfy the data requirements of 10 CFR 61.13(a)?

(4) Is the monitoring system capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary as required by 10 CFR 61.53(c)?

(5) Do the surveillance activities include visual observations for evidence of subsidence, erosion and/or gullies, excessive ground deformation such as slope bulging failure, and unusual flora or fauna activity on at least an annual basis?

(6) Does the program identify action levels for various parameters monitored that would trigger a warning requiring further evaluation of a potential problem and possibly a mitigative action, if necessary?

3.2.2 Equipment, Instrumentation, and Facilities

The staff will determine whether the equipment, instrumentation, and facilities for evaluating radiation levels and radioactive and nonradioactive constituents in the environment are consistent with the measurement and sampling methods used during the preoperational environmental monitoring program. The equipment, instrumentation, and facilities should be similar to those used during the preoperational environmental monitoring program, and the review will include an evaluation of those items identified in Section 3.2.2 of SRP 2.9 as applicable during the operational phase.

3.2.3 Data Recording and Statistical Analysis

The staff will review the data handling and recording and statistical analysis procedures for appropriateness in response to the questions in Section 3.2.3 of SRP 2.9 and those provided below for surveillance activities during the operational phase:

(1) Are plans specified for evaluating the surveillance data and for taking appropriate followup action?

(2) Are appropriate methods identified for evaluating and reporting the annual surveillance activities?

3.2.4 Organization

The staff will review any changes in the organization of the environmental monitoring or training programs that relate to the authority and responsibility of those persons responsible for the environmental monitoring program that have occurred since the preoperational environmental monitoring program

(see Section 3.2.4 of SRP 2.9). The staff will review the experience and qualifications of any new personnel responsible for the environmental monitoring and surveillance programs and for sampling and handling radioactive material, as well as to ensure that existing personnel are retrained on a periodic basis.

3.2.5 Quality Assurance* and Quality Control

The staff will evaluate the quality assurance aspects of the operational environmental monitoring and surveillance program. In its review, the staff will consider the adequacy of the applicant's quality assurance program in response to the questions in Section 3.2.5 of SRP 2.9 and those provided below for surveillance activities:

(1) Does the applicant provide for the review and analysis of surveillance information, including the need for followup action in the event surveillance observations indicate that there is evidence of environmental disturbance or change?

(2) Does the applicant specify planned, periodic audits to verify implementation of the followup action in regard to surveillance activities, when surveillance observations indicate that there is evidence of environmental change?

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify its submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are the specific sections of 10 CFR 20 and 10 CFR 61 identified below and 10 CFR 20.201, 10 CFR 20.401 and 10 CFR 61.12(1), noted in Section 4.1 of SRP 2.9 as they apply to environmental monitoring during the operational phase:

(1) 10 CFR 20.105, "Permissible Levels of Radiation in Unrestricted Areas," which requires the control of radiation doses to individuals in unrestricted areas during any pattern of release of pollutants from the low-level radioactive waste disposal site

(2) 10 CFR 20.405, "Reports of Overexposures and Excessive Levels and Concentrations," which requires the reporting of radiation levels or concentrations of radioactive materials in excess of certain values to the NRC

(3) 10 CFR 61.13, "Technical Analyses," (a), which requires that certain radionuclide migration pathways (air, soil, groundwater, surface water, plant uptake, and exhumation by burrowing animals) be analyzed to

*See footnote page 9.1-5.

demonstrate that the performance objectives of Subpart C and the technical requirements of Subpart D of 10 CFR 61 will be met - the operational environmental monitoring and surveillance program provides the data needed for the technical analyses

(4) 10 CFR 61.41, "Protection of the General Population From Releases of Radioactivity," which requires that concentrations of radioactive material that may be released to the general environment in groundwater, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other body organ - the operational environmental monitoring and surveillance program provides some of the data needed for dose calculations

(5) 10 CFR 61.53, "Environmental Monitoring," (b), which requires that the licensee have plans for taking corrective measures if migration of radionuclides would indicate that the performance objectives of Subpart C of 10 CFR 61 may not be met

(6) 10 CFR 61.53, (c), which requires that the licensee maintain an environmental monitoring program to collect the data needed to evaluate the potential health and environmental impacts, long-term effects, and the need for mitigative measures, and to provide a system capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in the NRC regulatory documents and other supporting references (e.g., industry standards and general guidance documents) identified in Section 4.2 of SRP 2.9. The following is an additional regulatory guide applicable to environmental monitoring during the operational phase:

Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operational)," as it relates to compliance with the general principles of quality assurance during operations at low-level radioactive waste disposal facilities

4.3 Regulatory Evaluation Criteria

Evaluation criteria necessary to meet the relevant requirements of the regulations for the areas of review described in Sections 2 and 3.2.1 of this SRP are discussed in Section 4.3 of SRP 2.9 (the word "operational" should be substituted for the word "preoperational"). It is expected that the scope of the operational environmental monitoring program, especially the radiological and nonradiological constituents to be monitored, may be modified on the basis of waste disposal operations and other in situ conditions at the disposal site. Planned changes from the preoperational program design, if any, should be adequately described and justified. The need for routine surveillance (i.e., periodic visual observations mentioned in Item 3 of Section 3.2.1 of this SRP) activities, including the need for followup action, should also be described.

Additionally, provisions for the monitoring of routine effluent releases (e.g., precipitation that collects in operational trenches) and proposed actions for resolving conditions where the action level limits are exceeded should be specified.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The evaluation findings should be similar to those for the preoperational phase, except for program changes that apply to the operational phase and additional findings with respect to surveillance. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the proposed operational environmental monitoring and surveillance program of the [name of facility] low-level radioactive waste disposal facility for adherence to the requirements of 10 CFR 20 and 10 CFR 61 according to Standard Review Plan 4.4. The objectives of the review were to ensure that the applicant's operational environmental monitoring program was adequate to yield data sufficient to assess compliance with the regulatory requirements and acceptance criteria applicable to the site.

In its review, the staff determined the following:

(1) The applicant's description of the operational environmental monitoring and surveillance program and of a plan for taking corrective measures was in accordance with the requirements of 10 CFR 61.12(1), 10 CFR 61.53(b), and 10 CFR 61.53(c). The applicant's description also included an adequate and defined surveillance program.

(2) The applicant's methods, techniques, and procedures for monitoring radiation and for sampling environmental media are consistent with those used during the preoperational period.

(3) Field and laboratory data will be recorded in appropriate units (according to the requirements of 10 CFR 20.401), and the statistical analysis techniques will be consistent with those used during the preoperational period.

(4) The environmental monitoring program organization and changes thereto are in accordance with the requirements of 10 CFR 61.11(b) and the implementation guidelines of Regulatory Guide 8.2.

(5) The quality assurance measures and quality control procedures with respect to the operational environmental monitoring and surveillance program are adequate and consistent with those applied during the preoperational phase.

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify the submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (g), which requires that the specific technical information needed to demonstrate compliance with the performance objectives of 10 CFR 61, Subpart C, is the description of the disposal site closure plan, including those design features that are intended to facilitate site closure and to eliminate the need for ongoing active maintenance

(2) 10 CFR 61.23, "Standards for Issuance of a License," (e), which requires that the applicant's proposed disposal site, disposal site design, land disposal facility operations, disposal site closure, and postclosure institutional control are adequate to protect the public health and safety in that they will provide reasonable assurance that long-term stability of the disposed waste and the disposal site will be achieved and will eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure

(3) 10 CFR 61.43, "Protection of Individuals During Operations," which requires that operations at the land disposal facility be conducted in compliance with the standards for radiation protection in 10 CFR 20 and that every reasonable effort be made to maintain radiation exposures as low as is reasonably achievable

(4) 10 CFR 61.44, "Stability of the Disposal Site After Closure," which requires that the disposal site be sited, designed, and closed to achieve long-term stability of the site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure

(5) 10 CFR 61.51, "Disposal Site Design for Land Disposal," (a)(2), which requires that the disposal site design and operation be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that will provide reasonable assurance that the performance objectives of Subpart C of 10 CFR 61 will be met

(6) 10 CFR 61.52, "Land Disposal Facility Operation and Disposal Site Closure," (a)(6), which requires that waste be placed and covered in a manner that will limit the radiation dose rate at the surface of the cover to levels that, at a minimum, will permit the licensee to comply

with all provisions of 10 CFR 20.105 at the time the license is transferred pursuant to 10 CFR 61.30

4.2 Regulatory Guidance

Guidance and recommendations for review criteria on site closure and stabilization considerations for a BGV or an EMCB including structural performance monitoring, filter and drainage systems, and waste cover system are provided in NUREG/CR-5041, Volumes 1 and 2, Sections 2.6, 2.7, and 2.8.

4.3 Regulatory Evaluation Criteria

Regulatory evaluation criteria pertaining to the areas of review in Section 2 of this SRP are given in the following sections.

4.3.1 Structural Performance Monitoring

The information on structural performance monitoring is acceptable if (1) the monitoring program described is adequate in scope and detail for verifying structural design assumptions and for confirming structural performance and stability and (2) the performance monitoring is generally consistent with the General Design Criteria and Specific Design Review Criteria in Sections 2.6.1, 2.6.2.1 through 2.6.2.4, and 2.6.2.7 through 2.6.2.9 of NUREG/CR-5041.

4.3.2 Filter and Drainage Systems

The information on the design of filter and drainage systems is acceptable if (1) the systems conservatively allow for the handling of infiltration and subsurface waters before the water would contact the waste and provide for the safe collection and removal of any liquid flows and (2) the design is generally consistent with the General Design Criteria and Specific Design Review Criteria in Sections 2.7.1, and 2.7.2.1 through 2.7.2.6 of NUREG/CR-5041.

4.3.3 Waste Cover System

The information on the design of the waste cover system over engineered BGV or EMCB structures is acceptable if (1) the cover system provides the required protection against radiation; minimizes infiltration, ponding, and erosion; protects inadvertent intruders; and provides long-term stability without the need for active maintenance; and (2) the design is generally consistent with SRP 6.1.2 and the General Design Criteria and Specific Design Review Criteria in Sections 2.8.1, and 2.8.2.1 through 2.8.2.3 of NUREG/CR-5041. The design of the soil and rock protection for the outer cover layer will be evaluated in accordance with SRP 5.1.1.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and generally address the guidance of this SRP and to be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the site closure and stabilization features for the below-ground vault [or earth-mounded concrete bunker] for [name of facility] according to Standard Review Plan 5.1A.

The information provided by the applicant clearly describes a structural performance monitoring program that will allow verification of important design assumptions and confirmation that the structure is stable and performing as designed. The applicant has committed to monitor with experienced and qualified personnel the essential parameters of structural performance that include strains, settlements, joint movements, water levels, and flow quantities at suitable locations and at reasonable intervals of time. In addition, the optional monitoring to be performed on stresses, deflections under loading, and settlements of the in situ soils will provide a conservative approach for projecting long-term structural behavior and an early warning system should adverse conditions begin to develop.

The applicant's description of the proposed filter and drainage systems is comprehensive and indicative of conservative, good engineering practice that should result in safe control, collection, and removal of any liquids in the vicinity of the below-ground vault [or earth-mounded concrete bunker]. The applicant's design complies with established filter criteria, thereby ensuring resistance to internal erosion and adequate permeability and drainage. Features of the drainage system that include drain pipes and openings and collector sumps have been sized to ensure adequate capacity in handling conservatively estimated flow quantities. The construction materials selected for the filter and drainage systems are of high quality and have been carefully chosen to remain functional under the severe conditions that could develop in the waste disposal environment.

The applicant has adequately described the waste cover system to be constructed over the engineered BGV [or EMCB] structure. The information and details provided on the closing and sealing of the vault roof and on the placement and compaction controls to be followed for the cover materials over the waste provide reasonable assurance that the waste cover system will function as designed. The proposed waste cover system will (1) protect against radiation, (2) minimize infiltration, (3) protect inadvertent intruders, and (4) ensure long-term stability without requiring active maintenance.

On the basis of the findings, the staff concludes that the applicant's proposed structural performance monitoring, filter and drainage systems, and waste cover system are acceptable and that there is reasonable assurance that the applicable regulatory requirements 10 CFR 61.12(g), 61.23(e), 61.43, 61.44, 61.51(a)(2), and 61.52(a)(6) will be met as a result of the applicant's plans and activities for closing and stabilizing the site where the BGVs [or EMCBs] are to be constructed.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for an engineered structure at a low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

---, NUREG/CR-5041, "Recommendations to the NRC for Review Criteria for Alternative Methods of Low-Level Radioactive Waste Disposal," Vols. 1 and 2, R. H. Denson, R. D. Bennett, R. M. Wamsley, D. L. Bean, and D. L. Ainsworth, U.S. Army Engineer Waterways Experiment Station, November 1987 (Vol. 1) and January 1988 (Vol. 2).

control should be provided along with the justification for any modifications to the program resulting from observed performance during the initial 5-year period.

(c) Evaluations of the long-term (static and dynamic stability) performance of all permanent slopes at the site and the long-term settlement and/or subsidence at the site. These evaluations should be performed according to the acceptance criteria in SRPs 6.3.2 and 6.3.3, respectively.

The information on the geotechnical aspects of the overall site closure plan should be sufficient to allow the staff to determine that there is reasonable assurance that the disposal site will not experience instability of slopes, excessive settlement and/or subsidence, and infiltration of water into backfilled disposal unit excavations and will not require active maintenance during the institutional control period.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Finding

The staff has reviewed the geotechnical stability aspects of the proposed site closure plan for the [name of facility] low-level waste disposal facility according to Standard Review Plan 5.1.2. The objectives of the review were to ensure that (1) the overall site grading plan provides for adequate cover on all the disposal unit excavation caps and for appropriate grading to direct the flow of surface water away from the disposal unit excavations, taking into consideration the anticipated long-term settlement and/or subsidence at the site; (2) all the natural and engineered slopes of dikes and ditches at the disposal site will be stable in the long term and the disposal site will require minimal care and maintenance during the institutional control period; (3) the monitoring prorams to evaluate the performance of the disposal unit excavations are adequate in scope so that the needed data can be collected; and (4) the applicant has committed to use all the data collected during the operational phase of the facility to revise and/or improve the final site closure plan that will be submitted before site closure.

The staff reviewed the information in the SAR to determine if

(1) the applicant has adequately described how the disposal unit excavations will be backfilled, how the excavation covers will be constructed, and how the performance of the first few disposal unit excavations to be filled and closed will be monitored

(2) the applicant has committed to analyze the monitoring program data from the first few disposal unit excavations, either to validate the predicted performance of the excavation cover or to change, if necessary, the design and/or construction procedures to enhance the performance of the backfill and cover of the remaining disposal unit excavations

(3) the applicant's proposal for final grading of the site provides for a cover of adequate thickness on all disposal unit excavations and appropriate grading to direct the flow of surface water away from the disposal units

(4) all artificial and natural slopes of the dikes and ditches within the disposal site will be stable in the long term

(5) the long-term monitoring program to evaluate the performance of the geotechnical aspects of the disposal site is adequate in scope and presented in appropriate detail

(6) the applicant has committed to use the data and experience gained during the operational phase to revise and/or improve the site closure plan that will be submitted for the staff's review during the final stage of the operational phase

The information on the geotechnical stability aspects of the site closure plan in the SAR is adequate to satisfy the objectives of the staff review. On the basis of its review of the information provided, the staff concludes that there is reasonable assurance that the disposal facility, if closed according to the site closure plan, will satisfy the long-term performance objectives of 10 CFR 61.12(g), 61.23(e), 61.44, and 61.52(a)(10).

On the basis of its review, the staff concludes that the geotechnical stability aspects of the site closure plan in the SAR meet all applicable regulations and are acceptable.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensee regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

American Society for Testing and Materials, Annual Book of ASTM Standards, Philadelphia, PA, revised annually.

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 5.2
DECONTAMINATION AND DECOMMISSIONING

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Technical Branch (LLTB)

1.2 Secondary - None

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the actions necessary to return the low-level waste disposal facility to a condition that will not require active ongoing maintenance during the institutional control period. This requires that the facility be decommissioned in such a way that future risk (from earlier operations) is reduced and maintained within acceptable limits. The applicant's commitment to this concern should be described in detail in the decommissioning plan that is submitted as part of the application to operate a low-level waste disposal facility. This SRP examines the proposed procedures in the applicant's decommissioning plan and provides for a limited examination of the estimated cost and surety mechanism associated with the applicant's proposed decontamination and decommissioning method. The procedures submitted as the decontamination and decommissioning plan are part of the closure plan required by 10 CFR 61.28. The performance objectives of 10 CFR 61 are paramount in assessing the adequacy of a decontamination and decommissioning plan.

Arrangements or plans for postclosure observations (SRP 5.3) should consider changes to disposal facility operations that might affect closure determinations. It is intended that the applicant's proposed decontamination and decommissioning plan be a dynamic document that will be revised when significant changes in disposal facility operations require reevaluation to determine that the performance objectives of 10 CFR 61, in particular 10 CFR 61.41, are met. This is not limited to, but includes, significant changes to waste acceptance criteria, which could require more stringent and rigorous decontamination and decommissioning procedures and techniques.

3. REVIEW PROCEDURES

3.1 Acceptance Review

The staff will review for completeness the information on the decontamination and decommissioning plan in the SAR in accordance with NUREG-1199 and this SRP.

3.2 Safety Evaluation

The LLTB staff will review the facility's radiation protection design features in coordination with the review of the radiation protection design features under SRP 7.3 to determine that acceptable surface radiation levels can be maintained to reduce decontamination requirements and help to eliminate large "decon-waste" disposal volumes before the license is terminated.

The staff will evaluate the adequacy of the survey methods proposed by the applicant for characterizing and identifying equipment and structures requiring decontamination to meet applicable regulatory limits and guidelines before the activities associated with dismantlement, transfer, release for unrestricted use, or disposal on site take place.

The staff will assess the procedures for dismantlement of equipment or aboveground structures (10 CFR 61.62(a)) and the details of the final means of disposal for adequacy and reasonableness.

The staff will determine if the applicant has provided an estimate of the volume activities (waste class for significant radionuclides) and a description of the anticipated waste that will be generated during decontamination and decommissioning.

The staff will review the applicant's procedures for processing and disposing of waste generated during decontamination and decommissioning operations to provide reasonable assurance that they meet waste form, packaging, and acceptance criteria and that the final waste disposal operations are in accordance with 10 CFR 61

The staff will review the decommissioning plan to assess the occupational exposure anticipated during decommissioning operations and to determine that these levels are in accordance with applicable regulations and are as low as is reasonably achievable. The staff should verify that decontamination wastes generated during decontamination and decommissioning operations are included in the proposed source term for pathway analysis.

The staff will review the applicant's procedures for site surveys to ensure that fixed and removable contamination of buildings and grounds are at acceptable levels. This contamination could potentially result from (1) surface contamination on waste packages, (2) routine release of gases and particulates from partially breached waste packages, and (3) accidental spills not completely removed.

The staff will review the proposed limits on residual contamination and external gamma radiation levels taking into consideration the potential restrictions on land use and the estimated dose to the maximally exposed individual following decommissioning. This review will include an assessment of the adequacy of the applicant's proposed measurements and equipment to radiologically characterize the site in a manner generally consistent with the procedures given in Section 2.2.3 of SRP 5.3.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the decontamination and decommissioning plan for the [name of facility] low-level waste disposal facility according to Standard Review Plan 5.2.

The staff has verified that (1) sufficient information has been provided in the SAR and amendments to meet 10 CFR 61.29; (2) fixed and removable levels will be maintained below the levels specified in Regulatory Guide 1.86 and are ALARA; (3) wastes generated from decontamination operations will be disposed of in accordance with 10 CFR 61; (4) all materials secured on site will be licensed for possession, and surveillance will be maintained where required; (5) the site will meet the performance objectives of 10 CFR 61 following decommissioning; (6) before the facility is released for unrestricted use, the applicant will have entered into an agreement with the site owner and/or custodian to provide the assurances recommended in Draft Regulatory Guide, "Guidelines for Closure and Stabilization of LLW Disposal Sites"; and (7) the applicant has verified that residual contamination levels are sufficiently low so that (a) potential doses to an onsite individual during the institutional control period are less than 25 mrem per year and ALARA and (b) potential doses to offsite individuals meet the performance objectives of 10 CFR 61.

On the basis of its review, the staff concludes that the decontamination and decommissioning plan meets all applicable regulations and is acceptable.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington DC, revised annually

U.S. Nuclear Regulatory Commission, Draft Regulatory Guide, "Guidelines for Closure and Stabilization of LLW Disposal Sites," 1985.

---, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

---, NUREG/CR-0570, "Technology, Safety, and Costs of Decommissioning a Reference Low-Level Waste Burial Ground," Vols. 1 and 2, Battelle Pacific Northwest Laboratory, June 1980.

---, Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors."

---, Regulatory Guide 8.8, "Information Relevant to Ensuring That Occupational Exposure at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable."

---, Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposure As Low As Is Reasonably Achievable."

---, "Technical Position on Low-Level Radioactive Waste Classification and Manifest Reporting," February 1986.

---, "Technical Position on Waste Form for 10 CFR Part 61," May 1983.

(3) Does the information provided include a requirement that the postclosure monitoring program be operational for implementation by the site owner as required by 10 CFR 61.30(a)(4)?

(4) Do the surveillance activities include visual observations at appropriate frequencies and proper documentation of any evidence of subsidence, ponding, cracking of covers, erosion and/or gullies, excessive ground deformation such as a bulging slope, and unusual flora and fauna activities?

(5) Does the program identify action levels for various parameters monitored that would trigger a warning requiring further evaluation of a potential problem and possibly a mitigative action, if necessary?

3.2.2 Equipment, Instrumentation, and Facilities

The staff will determine whether the equipment, instrumentation, and facilities for evaluating radiation levels and radioactive and nonradioactive constituents in the environment are consistent with the measurement and sampling methods used during the operational period. The equipment, instrumentation, and facilities during the first 5 years of the postoperational phase should be similar to those used during the operational environmental monitoring program, and the review will include an evaluation of those items identified in Section 3.2.2 of SRP 4.4 as applicable during the early postoperational phase. Durability and long-term performance aspects of the equipment and instruments used in the postoperational environmental monitoring will be reviewed.

3.2.3 Data Recording and Statistical Analysis

The staff will review the data handling and recording and statistical analysis procedures for appropriateness in response to the questions in Section 3.2.3 of SRP 4.4, especially with respect to surveillance activities during the postoperational period.

3.2.4 Organization

The staff will review the organizational and functional responsibilities of person(s) responsible for the postoperational environmental monitoring and surveillance program, with special emphasis on the need to maintain continuity during the postclosure observation and maintenance period in accordance with 10 CFR 61.29 and for license transfer in accordance with 10 CFR 61.30(a)(4).

3.2.5 Quality Assurance* and Quality Control

The staff will evaluate the quality assurance and quality control aspects of the environmental monitoring program. In its review, the staff will consider the adequacy of the applicant's quality assurance and quality control program in response to the questions in Section 3.2.5 of SRP 4.4.

*See footnote page 9.1-5.

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify its submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are the specific sections identified below as they apply to environmental monitoring during the postoperational phase:

(1) 10 CFR 61.7, "Concepts," (c)(3), which requires that the licensee remain at the disposal site for a postclosure observation and maintenance period of 5 years to ensure that the disposal site is ready for institutional control

(2) 10 CFR 61. (c)(4), which requires that the site owner, following site closure and license transfer, carry out a program of monitoring to ensure continued satisfactory disposal site performance

(3) 10 CFR 61.29, "Post-closure Observation and Maintenance," which requires that the licensee observe and monitor the site for 5 years, or for a different time period, as established and approved by the NRC as part of the site closure plan, on the basis of site-specific conditions

(4) 10 CFR 61.30, "Transfer of License," (a)(4), which requires that the postclosure monitoring program be operational for implementation by the disposal site owner

(5) 10 CFR 61.44, "Stability of the Disposal Site After Closure," which requires that only surveillance, monitoring, or minor custodial care be needed after disposal site closure

(6) 10 CFR 61.53, "Environmental Monitoring," (d), which requires that the licensee be responsible for postoperational surveillance of the disposal site and maintain a monitoring system capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 of this SRP is provided in the NRC regulatory documents and other supporting references (e.g., industry standards and general guidance documents) identified in Section 4.2 of SRP 4.4.

4.3 Regulatory Evaluation Criteria

Evaluation criteria necessary to meet the relevant requirements of the regulations for the areas of review described in Sections 2 and 3.2.1 of this SRP are discussed in Section 4.3 of SRP 2.9 and 4.4 (the word "postoperational" should be substituted for the words "operational" and "preoperational") Planned changes from the operational program design should be adequately described and justified by the applicant.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the postoperational (postclosure) environmental monitoring program of the [name of facility] low-level radioactive waste disposal facility for adherence to the requirements of 10 CFR 20 and 10 CFR 61 according to Standard Review Plan 5.3. The objectives of the review were to ensure that the applicant's postoperational environmental monitoring program was adequate to yield sufficient data to assess long-range compliance with the regulatory requirements and acceptance criteria applicable to the site.

In its review, the staff determined the following:

(1) The applicant provided a description of the postoperational environmental monitoring and surveillance program as required by 10 CFR 61.53(d). The staff further noted that the components of the program included monitoring groundwater, vegetation, and biota, and an active surveillance program that included visual as well as periodic photographic reconnaissance. The applicant's description of the program is therefore considered acceptable.

(2) The applicant's methods, techniques, and procedures for monitoring radiation and for sampling environmental media are consistent with "Technical Position on Environmental Monitoring of Low-level Radioactive Waste Disposal Facilities" (NRC, 1988) and are adequate for obtaining representative samples and performing applicable surveillance activities.

(3) Field and laboratory data, as committed to by the applicant in the license application, will be recorded in appropriate units (according to the requirements of 10 CFR 20.401) and will include appropriate descriptive statistics, statistical analysis, reporting levels, action levels, and regulatory limits.

(4) The postoperational environmental monitoring program organization, lines of authority, and functional requirements comply with the requirements of

10 CFR 61.29 and 10 CFR 61.30(a)(4) to permit satisfactory site closure and license transfer.

(5) The quality assurance and quality control program is adequate and provides reasonable assurance that the applicant's postoperational environmental monitoring and surveillance program will be maintained according to acceptable standards.

The location of the sampling points and the type and frequency of samples obtained have been adequately justified by the applicant on the basis of site-specific data with regard to locations of critical pathways and their measured variability. Therefore, the staff concludes that the applicant's postoperational environmental monitoring and surveillance program meets the review criteria noted, thereby satisfying the requirements of 10 CFR 61.29, 10 CFR 61.30(a)(4), and 10 CFR 61.53(d).

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility, including alternative disposal facilities relative to shallow land burial. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

The references for this SRP are the same as those listed in Section 7 of SRP 2.9.

cause the potential for radiological impacts on individuals. Many of these scenarios may be insignificant or bounded by other scenarios. In any case, they may be grouped into offsite scenarios due to normal conditions (both during and after the operational period), offsite scenarios due to operational accidents or unusual conditions, and onsite scenarios during the institutional control period. Typical lists of scenarios are provided as Tables 6.1-1 through 6.1-3.

These lists of potential scenarios are provided for the purposes of illustration and should not be construed as being necessarily complete. Other scenarios may also be considered based on waste, site, design, or operational specific condi-tions. Each scenario involves radioactivity release and transfer via particu-lar transfer mechanisms, which may result in an accumulation of radioactivity at a human access location. On the basis of this accumulation of radioactivity, the potential for dose rates to humans may be determined and compared against regulatory limits. Transfer mechanisms of interest include groundwater, air, surface water, direct radiation, and biota.

It is important to note that the scenarios that should be considered will vary depending on the particular period of the disposal facility life. The assumptions for radionuclide release, transport, and impacts on humans may also vary. This is because different activities by different licensees are carried out in each period.

REGULATORY ASSESSMENT

Regulatory Criteria

The principal function of SRP 6.1 is to document, with reasonable assurance, that the following performance objective will be met:

> 10 CFR 61.41, "Protection of the General Population From Releases of Radioactivity"

This regulation essentially states that radioactive releases to the general environment (that is, offsite releases) must not result in an annual dose exceeding an equivalent of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of any member of the public.

Furthermore, reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment to levels as low as reasonably achievable. This should be interpreted as being applicable to normal condi-tions during the operational, closure, observation and surveillance, active institutional control, and passive institutional control periods.

Two other sources of radiological impacts are also considered in this SRP. These include those on offsite individuals resulting from accidents or unusual

Table 6.1-1 Typical scenarios - offsite impacts on individuals

Scenario	Radiation*	Release/transport mechanism	Human access location	Theoretical periods of concern**
(1) Doses to individuals near disposal site from parked waste delivery vehicles	g	None	Area at nearest off-site location to incoming truck park	O
(2) Doses to individuals near disposal site from site operations (e.g., hoisting liners by crane)	g	None	Area at site boundary	O
(3) Airborne releases from contaminated surfaces such as buildings and grounds	a,b,g	Air	Air at site boundary	O,C,S,I,P
(4) Airborne releases from decomposing waste (e.g., methane gas, CO_2)	b	Air	Air at site boundary	O,C,S,I,P
(5) Airborne disperson of contamination unearthed by plants and animals	a,b,g	Air	Air at site boundary	O,C,S,I,P
(6) Airborne discharges from disposal cells (e.g., evaporate water collected in trenches or sumps)	b	Air	Air at site boundary	O,C,S,I
(7) Airborne disperson of contamination associated with demolition activities	a,b,g	Air	Air at site boundary	C

See footnotes at end of table.

Table 6.1-3 Impacts on onsite individual during institutional control period

Scenario	Radiation*	Release/ transport mechanism	Human access location	Dose rates calculated**
(1) Direct radiation impacts on individuals maintaining site during institutional control period	g	None	Site surfaces	mrem/yr to individual
(2) Impacts on individuals resulting from dispersal of residual contamination	a,b,g	Air	Air above site surfaces	mrem/yr to individual
(3) Airborne releases from decomposing waste (e.g., methane, Co_2)	b	Air	Air above site	mrem/yr to individual

*a = alpha; b = beta; g = gamma.

**As a working limit, potential dose rates to custodial personnel maintaining the site during the active institutional control period should be controlled so that they will not exceed 25 mrem per year to the whole body, 75 mrem per year to the thyroid, or 25 mrem per year to any other organ.

operating conditions, and those on onsite individuals during the institutional control period. Note that radiological impacts on onsite individuals (site workers) during the operational, closure, and observation and surveillance periods are not addressed in this SRP. These impacts are addressed in SRP 7.

The Part 61 (10 CFR 61) regulation currently contains no design limits for impacts on offsite individuals resulting from accidents or unusual operating conditions. The NRC staff will therefore entertain the applicant's proposals for specific design limits on a site-specific basis.

The Part 61 regulation also contains no design limits for impacts on an onsite individual during the institutional control period, except for the requirement in 10 CFR 61.52(a)(6) that "waste must be placed and covered in a manner that limits the radiation dose rate at the surface of the cover to levels that at a minimum will permit the licensee to comply with all provisions of §20.105 of this chapter at the time the license is transferred pursuant to §61.30 of this part." This "onsite individual" refers to an agent or representative of the site owner who carries out various minor maintenance and monitoring activities during the institutional control period and normally should not be expected to come in contact with appreciable quantities of radioactive material. It was the intention of the Part 61 rulemaking that impacts on custodial personnel should be minimized; that is, the site grounds and remaining buildings should be "clean" of removable contamination, and impacts from fixed contamination should be negligible. It was believed that this should be not only readily achievable at well-operated disposal facilities, but was entirely consistent with the operating philosophy of the disposal facilities in operation at the time of the Part 61 rulemaking.

Given this, the NRC staff will accept a maximum residual contamination level following the observation and surveillance period so that an onsite individual performing routine maintenance and monitoring activities will not receive an annual dose exceeding an equivalent of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ. Reasonable effort should also be made to reduce potential impacts to levels as low as reasonably achievable. This working criterion is consistent with the above performance objectives for releases to an offsite individual.

The NRC staff will also consider an applicant's proposals for alternative higher limits; however, the proposed alternative limits should be justified by the applicant on the basis of the intended uses of the disposal site during the institutional control period. The applicant should furthermore provide the NRC staff with documentation indicating the acceptability of these alternative limits to the site owner.

Assessment Approach

The overall approach that should be taken is to first identify a complete set of possible release scenarios and pathways, and then by argument and/or

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LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 6.1.1
DETERMINATION OF TYPES, KINDS, AND QUANTITIES OF WASTE

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Regualtory Branch (LLRB)

1.2 Secondary - Technical Branch (LLTB)

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the information in the SAR pertaining to the applicant's projections of the quantities and physical, chemical, and radiological characteristics of the low-level wastes to be disposed of at the disposal facility. Waste projections under consideration include (1) waste delivered to the disposal facility during the operational period and (2) waste generated as part of closure activities.

The findings and conclusions of the review under this SRP will be principally used, in conjunction with those of the reviews under SRP 6.1.2 ("Infiltration"), SRP 6.1.3 ("Radionuclide Release - Normal Conditions"), and SRP 6.1.4 ("Radionuclide Release - Accidents or Unusual Operational Conditions"), to analyze the applicant's estimates of potential releases from the disposal facility. The findings and conclusions of the review under this SRP will also assist in determining the adequacy of the applicant's plans to ensure sufficient availability of funds for closure (see SRP 5.2, "Decontamination and Decommissioning").

3. REVIEW PROCEDURES

3.1 Acceptance Review

The staff will review for completeness the information on waste projections in accordance with NUREG-1199 and this SRP. If the information is inadequate or insufficient in detail, the staff may request that the applicant supply additional information or explanation through the comment process. The staff may recommend at this time that the application be either rejected or accepted for documentation, pending the submittal of additional information.

3.2 Safety Evaluation

The staff will review the projections of radioactive waste provided by the applicant and verify that the projections are reasonable. The staff will also verify that sufficient information has been provided to enable an independent

evaluation of the releases expected from the disposal facility and to perform the safety evaluations called for in SRP 6.1.

3.2.1 Waste During Operational Period

The staff will review the applicant's projections of low-level wastes expected to be delivered to the disposal facility over its operational life. The staff's assessment of the adequacy of the projections should be principally based on past waste-generating history. Waste generated by each of the most significant generating facilities should be reviewed, and major discrepancies between the past and projected future generation rates should be clarified with the applicant. The staff should also consider contacting the principal generators directly for confirmation of current and future waste-generating plans. If a facility is not yet generating waste (e.g., a nuclear power plant is still under construction at the time of the application), then the staff should refer to generic estimates of waste generation. This could include information obtained from NUREG reports or other sources.

3.2.2 Waste During Closure Period

The staff will review the applicant's projections of low-level wastes expected to be generated on site and disposed of during the closure period. It should be recognized that these projections are preliminary in nature.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The information reviewed under this SRP will be used, in conjunction with information reviewed under the other SRPs of SRP 6.1, to help assess the applicant's compliance with the following regulatory requirements:

(1) 10 CFR 20, "Standards for Protection Against Radiation"

(2) 10 CFR 61.13, "Technical Analyses," (a)

(3) 10 CFR 61.41, "Protection of the General Population From Releases of Radioactivity"

(4) 10 CFR 61.43, "Protection of Individuals During Operations"

(5) 10 CFR 61.52, "Land Disposal Facility Operation and Disposal Site Closure," (a)(6)

4.2 Regulatory Guidance

There are currently no regulatory guides that apply to projections of waste types, kinds, and quantities.

4.3 Regulatory Evaluation Criteria

4.3.1 Waste During Operational Period

The information provided and the applicant's methods for determining the types, kinds, and quantities of waste will be acceptable if in its review, the staff can confirm that, at a minimum, the applicant has provided the following information:

(1) An identification of the region of concern, that is, the States forming the compact.

(2) A discussion of the potential for receipt of waste from outside the region of concern, as well as the conditions for such waste receipt.

(3) An identification of the major individual waste streams that constitute the majority of the waste volume and activity. These waste streams should furthermore be identified in terms of specific waste-generating facilities (e.g, activated metals from a particular power plant).

(4) An identification of the wastes streams that constitute the remaining waste volume and activity. These waste streams may be identified in terms of typical waste streams generated by a number of generators (e.g., a waste stream consisting of low-activity trash generated by all hospitals in the region of concern).

(5) Information on the physical, chemical, and radiological characteristics of each waste stream so identified in items (3) and (4) above. At a minimum this information should include (a) annual volumes, (b) waste class, (c) average concentrations of the principal radionuclides constituting the waste stream (including those listed in 10 CFR 61.55), (d) the chemical and physical form, (e) the presence of chelating agents, (f) packaging characteristics (e.g., whether the waste will be disposed of in a high-integrity container), and (g) solidification agent. Descriptions of the chemical and physical form should provide information important to an estimation of release rates (e.g., whether the waste stream consists of activated metals, sealed sources, ion-exchange resins, etc.).

(6) For the information discussed above on annual volumes, an estimate of trends - for example, whether the waste stream will be generated at a constant annual rate or only occasionally. Waste streams only expected to be generated at a future time (e.g., waste streams associated with decommissioning of a nuclear power plant) should be specifically identified.

(7) For major generators, any plans to alter waste generation rates (e.g., changes in volume reduction and decommissioning plans) over the first 5 years of the operational life of the disposal facility.

(8) A presentation and discussion of any limitations that will be imposed on waste receipt, form, packaging, or other characteristics that would influence assessments of disposal facility performance. Such limitations

could potentially include limitations on total site inventories of radionuclides of concern (e.g., C-14, H-3, Tc-99, or I-129), or requirements on the structural stability of certain Class A wastes. These proposed limitations will be incorporated into disposal facility licenses as conditions of operation.

(9) A summary of the total projected waste volume and activity for each year of the operational life.

4.3.2 Waste During Closure Period

The information provided and the applicant's methods for determining the types, kinds, and quantities of waste will be acceptable if in its review, the staff can confirm that, at a minimum, the waste description provides sufficient information for the staff to independently assess potential closure costs and effects. The waste description should thus include information similar to that discussed in item (5) in Section 4.3.1 of this SRP.

5. EVALUATION FINDINGS

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. Documentation of conclusions should include a list of the applicant's commitments and/or limiting conditions of operations. These commitments and limiting conditions of operation will form the basis for staff development of disposal facility license conditions.

If the description of waste types, kinds, and quantities satisfies the review procedures and acceptance criteria in Sections 3 and 4 of this SRP, the staff will conclude that the information and results are adequate so that the staff can confirm the applicant's compliance with the regulatory requirements in Section 4.1 of this SRP. However, if the staff should find that the analyses and results are inadequate, it will document the inadequacies, specify the technical basis for the comments, and describe alternative approaches to resolve the inadequacies.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U. S. Government Printing Office, Washington, DC, revised annually.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 61.13, "Technical Analysis," (d), as it relates to the analysis of the long-term stability of the cover and adjacent soils to reduce infiltration

(2) 10 CFR 61.51, "Disposal Site Design for Land Disposal," (a)(4), as it relates to the ability of the cover to minimize infiltration and to direct percolating water away from the waste

Conclusions from this SRP are input to reviews under subsequent SRPs on meeting 10 CFR 61.41, "Protection of the General Population From Release of Radioactivity," as it relates to source terms not leading to exposure criteria being exceeded.

4.2 Regulatory Guidance

There are currently no regulatory guides that apply to characterization of infiltration for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

To adequately evaluate the information on determination of flux through the engineered cover system and the results of any calculations or analyses, the staff will need information pertaining to

(1) the justification, documentation, verification, and calibration of any equations or program codes used in the analysis

(2) the description of data and justification for the manipulation of any data used in the analyses

Moreover, the staff may require information reviewed under the following SRPs:

(1) SRP 2.2, "Meteorology and Climatology," as it relates to information on amount and temporal distribution of rainfall and possible design-basis events for the site and vicinity

(2) SRP 2.4.2, "Groundwater Characterization," as it relates to the physical characteristics of the natural, unsaturated regime; the potential for lateral movement; and the development of perched aquifers

(3) SRP 3.1, "Principal Design Features," as it relates to the engineered design of the cover system, including thickness and lateral extent, grain size, slopes, total and effective porosity, hydraulic conductivity and the relationship between moisture content and capillary potential to hydraulic conductivity (i.e., characteristic curves)

(4) SRP 6.3.3, "Settlement and Subsidence," as it relates to the possible formation of fractures and subsidence features that can result in increased infiltration

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

If the description and analyses of water flux through the engineered cover system satisfy the review procedures and acceptance criteria in Sections 3 and 4 of this SRP, the staff will conclude that the information and results adequately define the probable volume and temporal distribution of fluid entering the disposal area and indicate this in the Safety Evaluation Report. However, if the staff should find that the analyses and results are inadequate, it will document the inadequacies, specify the technical basis for the comments, and describe alternative approaches to resolve the inadequacies.

5.2 Sample Evaluation Findings

The staff has reviewed the information pertaining to the characterization of the water infiltrating through the cover system for [name of facility] low-level waste disposal facility according to Standard Review Plan 6.1.2. The staff concludes that infiltration at the site has been adequately described.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

transferred from the site by the actual biota, as opposed to the situations considered in Sections 4.3.2 and 4.3.3 of this SRP in which the transfer mechanisms are air and water. An example might consist of a burrowing animal such as a rabbit that picks up contamination from the site and then leaves the site only to be killed and eaten by a hunter. In any case, bounding analyses are acceptable that are based on the typical biota observed in the immediate site environment and on facility design and operational considerations (e.g., establishment of particular types of grasses and installation of biological barriers).

5. EVALUATION FINDINGS

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows. [illegible]mentation of conclusions should include a list of the applicant's commitments and/or limiting conditions of operations. These commitments and limiting conditions of operation will form the basis for staff development of disposal facility license conditions.

If the description of radioactivity release satisfies the review procedures and acceptance criteria in Sections 3 and 4 of this SRP, the staff will conclude that the information and results are adequate so that the staff can confirm the applicant's compliance with the regulatory requirements in Section 4.1 of this SRP. However, if the staff should find that the analyses and results are inadequate, it will document the inadequacies, specify the technical basis for the comments, and describe alternative approaches to resolve the inadequacies.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

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Office of Nuclear Material Safety and Safeguards

LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 6.1.4
RADIONUCLIDE RELEASE - ACCIDENTS OR UNUSUAL OPERATIONAL CONDITIONS

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Technical Branch (LLTB)

1.2 Secondary - None

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the information in the SAR pertaining to the applicant's assessment of the types, significance, and magnitudes of radioactivity release associated with accidents or unusual operational conditions.

The findings and conclusions of the review under this SRP will be principally used, in conjunction with those of the review under SRP 6.1.1 ("Determination of Types, Kinds, and Quantities of Waste"), to analyze the applicant's projections of potential releases from the disposal facility resulting from accidents or unusual operational conditions. The numerical estimates of radionuclide release form the source term for calculations of transfer of radioactivity to human access locations. These are expected to principally involve transport via air (SRP 6.1.5.2), but may also involve transport via surface water (SRP 6.1.5.3). Resultant radiological impacts are then determined under SRP 6.1.6 ("Assessment of Impacts and Regulatory Guidance").

3. REVIEW PROCEDURES

3.1 Acceptance Review

The staff will review for completeness the information on radioactivity release in accordance with NUREG-1199 and this SRP. If the information is inadequate or insufficient in detail, the staff may request that the applicant supply additional information or explanation through the comment process. The staff may recommend at this time that the application be either rejected or accepted for documentation, pending the submittal of additional information.

3.2 Safety Evaluation

The staff will review the information provided by the applicant and verify that it is reasonable. The staff will also verify that sufficient information has been provided so that it can perform an independent evaluation of the releases anticipated from the disposal facility.

3.2.1 Identification of Accidents or Unusual Operating Scenarios

The staff will review the accidents or unusual operating scenarios identified by the applicant to ensure that they are complete and representative. The staff may base this review on the results of generic analysis, regulatory requirements, operational history and procedures at other disposal facilities, and the applicant's proposed waste acceptance criteria and proposed design and operational procedures.

3.2.2 Evaluation of Release

The staff will review the applicant's estimates of event frequency and radioactivity release for each of the principal scenarios identified by the applicant to ensure that they are reasonable, yet pessimistic. The staff also should confirm that sufficient information is provided to provide a source term for an independent analysis of potential impacts. The staff may base this review on the results of generic analyses, regulatory requirements, operational history and procedures at other disposal facilities, and the applicant's proposed waste acceptance criteria and proposed design and operational procedures.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The information reviewed under this SRP will be used, in conjunction with information reviewed under the other SRPs of SRP 6.1, to help assess the applicant's compliance with 10 CFR 61.12(k) and 10 CFR 61.13(c).

4.2 Regulatory Guidance

There are currently no regulatory guides that apply to the identification of accident or abnormal operational conditions at a low-level disposal facility or to assessments of accident frequency and radioactivity release.

4.3 Regulatory Evaluation Criteria

4.3.1 Identification of Accidents or Unusual Operating Scenarios

The information provided and the applicant's methods for identifying a bounding set of scenarios for accidents or unusual operating conditions will be acceptable if in its review, the staff can confirm that, at a minimum, the following information has been provided:

(1) The applicant has identified and discussed the principal accidents or unusual operating scenarios by which radioactivity may be released and result in impacts on offsite individuals. This discussion should first identify a complete spectrum of possible release scenarios and then eliminate those that are trivial or are bounded by other scenarios. This discussion should include justification as to the choice and ranking of possible scenarios. The intent is to go from a complete list of possible scenarios to those that are representative and bounding.

(2) In the above discussion, the applicant may reference (a) generic information and analyses, (b) regulatory requirements that preclude certain scenarios from occurring or otherwise limit the release of radioactivity (e.g., in terms of the rate at which radioactivity is released or the period of time during which the release rate occurs), and (c) proposed conditions of waste acceptance or facility design and operation that preclude certain scenarios from occurring or otherwise limit the release of radioactivity. The applicant's proposed operational procedures should be reviewed to ensure compliance with the above commitments.

4.2.2 Evaluation of Release

The information provided and the applicant's methods for determining releases resulting from accidents or unusual operating condition will be acceptable if in its review, the staff can confirm that, at a minimum, the following information has been provided:

(1) For each of the principal scenarios identified in Section 3.2.1 of this SRP, its applicant has provided estimates of radioactivity release and event frequency that are reasonable, yet pessimistic. In so doing, the applicant may reference (a) generic information and analyses, (b) regulatory requirements that limit or bound the possible event frequency or magnitude of release, and (c) proposed conditions of waste acceptance or disposal facility design and operation that limit or bound the possible event frequency or magnitude of release. Experience at other disposal facilities may also be referenced provided that the relationshi between other and proposed disposal operations is clear.

(2) The applicant has provided information that enables quantification of the source terms for the principal transfer mechanisms of concern. These transfer mechanisms may include air and surface water pathways.

5. EVALUATION FINDINGS

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows. Documentation of conclusions should include a list of the applicant's commitments and/or limiting conditions of operations. These commitments and limiting conditions of operation will form the basis for staff development of disposal facility license conditions.

If the description of radioactivity release satisfies the review procedures and acceptance criteria in Sections 3 and 4 of this SRP, the staff will conclude that the information and results are adequate so that it can independently confirm the applicant's compliance with the regulatory requirement in Section 4.1 of this SRP. However, if the staff should find that the analyses and results are inadequate, it will document the inadequacies, specify the technical basis for the comments, and describe alternative approaches to resolve the inadequacies.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

numerical/analytical transport model(s) used to calculate predicted radionuclide concentrations and representativeness with respect to the hydrogeologic and geochemical conditions of the site and vicinity. The values assumed in the analysis should be a conservative representation of the measured data. The staff should ensure that the use of the input parameters has been justified and that the data are sufficient to provide a reasonably accurate or conservative analysis regarding groundwater pathways. If adequate site-specific parameters are not available, the staff should ensure that adequate conservatism is applied. If there is uncertainty or inconsistency in the input parameters, the values should be compared with ranges of values found in the literature that have been determined for similar geologic media.

3.2.3 Contaminant Transport Models

The staff will compare the numerical/analytical transport models used by the applicant to predict radionuclide transport through the saturated and unsaturated zones for compatibility with the conceptual models reviewed under this SRP and the groundwater flow models used to characterize the flow regime reviewed under SRP 2.4.2. The staff will ensure that all potential groundwater pathways have been considered in the modeling effort. The staff will ensure that the applicant has considered in its analysis both potential radionuclide migration based on existing groundwater flow conditions (input data obtained from the review under SRP 2.4.2) and potential radionuclide migration based on transient flow conditions resulting from potential groundwater exploitation (input data obtained from the review under SRP 2.7.2) and other factors. The transport models will be evaluated for their defensibility, suitability, and basic conservatism and the conservatism of their application. The staff must ensure that the codes are based on sound physical, chemical, and mathematical principles (verified), and that the codes are correctly applied. The staff also will ensure that the codes are sufficiently documented as suggested in NUREG-0856.

3.2.4 Model Results

The staff will examine the applicant's results of the modeling analysis to confirm that the prediction of radionuclide contaminants was conducted in accordance with acceptable and defensible techniques, approaches, and practices. The staff will determine whether the predicted concentrations are reasonable representations of the anticipated response of the hydrogeologic system, as compared with background water quality data reviewed under SRP 2.6 and other hydrogeologic information reviewed under Section 2.4.2.

The staff initially will perform independent calculations of radionuclide concentrations at appropriate groundwater user and potential user locations at the site and vicinity using simple analytical modeling techniques with demonstrably conservative assumptions and coefficients. The staff's preliminary results will be compared with the applicant's results for conservatism. If the results are similar, no further analysis is warranted. If the applicant's results are more realistic than conservative then the applicant must clearly justify the application and results of the model, including the underlying assumptions and input parameter values used in the analysis. If questions

arise concerning the applicant's modeling effort, the staff may undertake more sophisticated numerical modeling techniques, which rely on less conservative and more realistic assumptions to check the applicant's results.

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or reevaluate its analysis and modify those areas that do not meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to this SRP are

(1) 10 CFR 61.13, "Technical Analyses," (a), which requires information to demonstrate reasonable assurance that releases of radioactivity from the site will not exceed the dose limits in 10 CFR 61.41

(2) 10 CFR 61.23, "Standards for Issuance of a License," (f), and 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a)(2), which require information that demonstrates that the site is capable of being characterized, modeled, analyzed, and monitored

4.2 Regulatory Guidance

There are currently no NRC regulatory guides that apply to groundwater pathways for a low-level waste disposal facility. However, the NUREG reports listed in Section 7 of this SRP can be used as general guidance.

4.3 Regulatory Evaluation Criteria

The applicant should perform a technical analysis of groundwater pathways for contaminant migration and present the results of the analysis in terms of reasonably accurate or conservative concentrations at the site boundary and appropriate groundwater user locations downgradient of the site. So that the staff can perform an independent evaluation of the analysis, the applicant should provide the following information pertinent to the areas of review listed in Section 2 of this SRP.

(1) a complete description of the contaminant transport pathways between the engineered disposal unit and the site boundary and existing or known future groundwater user locations

(2) estimates and justification for the physical and chemical input parameters used in the transport models to calculate radionuclide concentrations

(3) a description of the contaminant transport models used in the analysis, including modeling procedures and complete documentation of the codes as required in NUREG-0856

(3) at the nearest offsite present and known future receptors (i.e., residence, milk cow, milk goat, meat animal, and farm and vegetable garden larger than 50 m2) for each of the 22.5° radial sectors

(4) to offsite individuals during the operational, closure, observation and surveillance, active institutional control, and passive institutional control periods

(5) to offsite individuals as a result of operational accidents or abnormal conditions during the operational period

(6) to onsite individuals during the active institutional control period

3. REVIEW PROCEDURES

The staff will obtain and use such information as is necessary to ensure that the review procedure is complete. The staff will use and emphasize material from the SRP as may be appropriate for a specific case.

3.1 Acceptance Review

The staff will review for completeness the description of the air pathway analysis in the SAR in accordance with NUREG-1199 and this SRP.

3.2 Safety Evaluation

The staff will determine if the applicant has followed the regulations and regulatory guide referenced in this SRP by comparing the applicant's submittal and methods with the regulations and guides and by verifying the applicant's references to the guide or to proposed alternatives. The staff will verify that the alternatives are equivalent to or improvements on the methods cited in the referenced regulatory guide. Otherwise, alternatives are likely to be disapproved.

The staff will evaluate the areas of review given in Section 2 against the criteria listed in Section 4. The staff will

(1) Compare the technical description of the types of models and computational equations used by the applicant to predict atmospheric transport and dispersion with the types of models acceptable to the NRC staff.

(2) Determine if the models simulate atmospheric transport and diffusion in the site-specific region from source to receptor.

(3) Review the information on the sensitivity of the models to ensure valid predictions of transport behavior under a range of applicable variations in site-specific parameters.

(4) Determine the acceptability of the applicant's computational methods for simulating ground-level releases, for estimating the effective release heights for vents or elevated release points, for simulating various

source geometries such as point sources and areal sources, and for simulating releases of both short and long duration.

(5) Review the mathematical methods for quantifying removal mechanisms, wet and dry deposition rates, areal deposition, and plume depletion.

Computational consideration includes types of radionuclides released, site precipitation data, distances from source to receptor points, and stability classes for both ground-level and elevated-level release models.

(6) Verify that methods for estimating surface contamination resulting from wet and dry deposition take into account the characteristics of the radionuclide species, site meteorological conditions, and site terrain.

(7) Compare meteorological measurement specifications and collection with guidance provided in Draft Regulatory Guide Task ES 401-4.

(8) Determine whether the meteorological information is applicable and sufficient for the airborne transport and diffusion model used by the applicant.

(9) Review the sources of meteorological data for the models to ensure that the data are representative of the site and its environs.

(10) Verify that wind speed and wind direction have been measured in appropriate time steps and that time-averaged wind directions have been divided into an appropriate number of compass point sectors in accordance with Draft Regulatory Guide Task ES 401-4.

(11) Compare the applicant's means of establishing directionally dependent dispersion parameters and atmospheric stability classes for the calculation of airborne transport and diffusion for both ground-level and elevated-level releases with acceptable methods for determining such data as described in Draft Regulatory Guide Task ES 401-4.

(12) Verify the applicant's projected radioactive concentrations at all receptor locations using referenced, acceptable computational models and analytical methods.

3.3 Requests for Additional Information

On the basis of its review, the staff may request that the applicant provide additional information or modify the submittal to meet the acceptance criteria in Section 4.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The information in the SAR is acceptable if it (1) meets the requirements of 10 CFR 61.13, 61.41, and 61.43; (2) meets the relevant requirements of

10 CFR 20.105 as it relates to control of radiation doses to individuals in unrestricted areas.

4.2 Regulatory Guidance

The following regulatory guide provides information, recommendations, and guidance and in general describes a basis acceptable to the staff for implementing the requirements of 10 CFR 20 and 61:

> Draft Regulatory Guide Task ES 401-4, "Onsite Meterological Measurement Program for Uranium Recovery Facilities - Data Acquisition and Reporting," as it relates to obtaining appropriate meteorological information required for a valid estimate of atmospheric diffusion at a particular site, data accuracy, and suitable data reduction and compilation

4.3 Regulatory Evaluation Criteria

Acceptance criteria necessary to meet the relevant requirements of the regulations for the areas of review described in Section 2 of this SRP are discussed in the following sections.

4.3.1 Atmospheric Transport and Diffusion Model

The staff will determine the acceptability of the atmospheric transport and diffusion model based in part on (1) the representativeness of the site-specific input data used for the model, (2) the capability of the model to account for the physical characteristics of the site (such as structures, irregular terrain, and wet and dry deposition), and (3) the capability of the model to account for the physical and chemical characteristics of releases from the low-level waste disposal site (such as particle size and transformations during transport).

4.3.2 Meterological Data for the Model

The staff will accept the site-specific meterological data collected in the site-characterization monitoring phase (SRP 2.9) if they are in accordance with Draft Regulatory Guide Task ES 401-4 and with "Draft Technical Position Paper - Environmental Monitoring of Low-Level Waste Disposal Facilities" prepared by the Division of Waste Management. Other acceptable sources include nearby National Weather Service stations and other nearby, well-maintained meterological facilities. The applicant should have provided locations, downwind distances, and elevations for each receptor point identified in Section 2.3 of this SRP (preferably on a topographic map) in order to enable the staff to verify the applicant's calculations.

4.3.3 Airborne Concentrations (Applicant-Calculated)

The staff will find this part of the SAR acceptable if the applicant has calculated airborne concentrations and the concentrations of contaminants deposited on terrestrial surfaces for all locations of the receptors identified in Section 2.3 of this SRP. Airborne concentrations should have been presented

for the operational and postoperational monitoring phases for both routine and accident conditions. These concentrations should have been reported as annual average values for comparison to the performance objectives in 10 CFR 61.41. However, for those concentrations calculated for intermittent or infrequent releases, consideration should also have been given to the frequency and duration of the release. The staff will accept the applicant's information if it is complete and consistent with meterological, demographic, and transfer factor data provided in the related sections of the SAR and if the applicant's results compare favorably with estimates of concentrations determined independently by the staff.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the air pathway analysis for [name of facility] low-level waste disposal facility according to Standard Review Plan 6.1.5.2.

On the basis of the following findings, the staff concludes that the methodology for the analysis of airborne transport and diffusion is acceptable and meets 10 CFR 20 and 61.

The diffusion of individual plume elements is determined from the general Gaussian diffusion model.

The applicant's analysis methodology considers both ground-level releases and releases from vents at the level of solid structures. Wind speed, wind direction, and a measure of atmospheric stability data representative of actual release heights are available and have been appropriately considered.

Input data on classification of atmospheric stability and meteorological parameter values have been established to within specified recommended limits in accordance with Draft Regulatory Guide Task ES 401-4. Wind speed data have been appropriately presented in terms of suitable wind speed classes, and wind directions have been divided into 16 compass directions (22.5° sectors, centered on true north).

The representativeness of meteorological data has been adequately established by numerous site-specific meteorological measurements performed by the applicant during the site characterization period and by verification of the data by comparing the data with long-term information from nearby National Weather Service and/or well-established weather stations.

The applicant has appropriately used annual average meteorological data in considering the continuous-release source term (resuspension resulting from

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LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 6.1.5.3
TRANSFER MECHANISM - SURFACE WATER

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Technical Branch (LLTB)

1.2 Secondary - None

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the information in the SAR on the ability of the surface water environment to dilute normal or accidental radioactive liquid effluent releases from the low-level waste burial sites, particularly in regard to relating the effects of such releases to existing and known future uses of surface water resources. The staff will review the following areas:

(1) the conceptual model that describes all potential surface water pathways for radionuclide migration

(2) surface water transport models used to analyze the spatial and temporal concentrations of radionuclides at appropriate distances downgradient from the site

(3) source term data used as input parameters to surface water transport models, particularly the release rate and source terms at groundwater interfaces, where applicable

(4) estimates of radionuclide concentrations calculated from surface water transport models

3. REVIEW PROCEDURES

3.1 Acceptance Review

The staff will review for completeness the information on surface water pathways in the SAR in accordance with this SRP. If the information is inadequate or insufficient in detail, the staff may request that the applicant supply more information or an explanation. The staff may recommend that the application be rejected or accepted for documentation, pending the submittal of the requested information.

If the staff finds that the information furnished by the applicant is adequate, the technical analyses will begin.

3.2 Safety Evaluation

The staff will review the applicant's analyses and make independent conservative calculations for annual average and maximum (for accidental releases) concentrations at points of surface water use. Utilizing the release mechanisms from SRPs 6.1.3 and 6.1.4, the staff will estimate concentrations using the transport models and general guidance given in NUREG-1054, NUREG/CR-3332, and Regulatory Guide 1.113. Conservatism will be used in the selection of coefficients and parameters for use in any of these methods. The staff also will review the analyses to verify that any potential future changes (which might result from variations in precipitation or by the construction of known future wells, reservoirs, and intakes) are reflected in the computations.

For some release scenarios, the surface water pathway analysis may be performed in conjunction with the groundwater pathway analysis; generally, the source term and rate of release of each radionuclide are determined using the procedures given in SRP 6.1.5.1.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

Requirements relating to the adequacy of information and technical analyses of surface water pathways for radionuclide migration are found in the following regulations:

(1) 10 CFR 61.13, "Technical Analyses," (a), which requires information to demonstrate clearly with reasonable assurance that releases of radioactivity from the site will not exceed the dose limits in 10 CFR 61.41

(2) 10 CFR 61.23, "Standards for Issuance of a License," (b), and 10 CFR 61.41, "Protection of General Population From Releases of Radioactivity," which require that the general population be protected from radioactive releases

(3) 10 CFR 61.50, "Disposal Site Suitability Requirements for Land Disposal," (a)(2), which requires information to demonstrate that the site is capable of being characterized, modeled, analyzed, and monitored

4.2 Regulatory Guidance

Transport models suited to the types of analyses needed to estimate concentrations at points of surface water use are described in Regulatory Guide 1.113, NUREG-1054, and NUREG/CR-3332. Use of these models is not required however. In addition, they may not be suitable for all situations.

4.3 Regulatory Evaluation Criteria

Acceptable analyses of radionuclide migration should (1) describe the dispersion characteristics and dilution capability of the surface water environment with respect to existing and known future users under both normal and accident conditions, (2) provide estimates and bases for annual average and

(2) 10 CFR 61.13, "Technical Analyses," (a)

(3) 10 CFR 61.41, "Protection of the General Population From Releases of Radioactivity"

(4) 10 CFR 61.43, "Protection of Individuals During Operations"

(5) 10 CFR 61.52, "Land Disposal Facility Operation and Disposal Site Closure," (a)(6)

4.2 Regulatory Guidance

There are currently no regulatory guides that apply to gamma attenuation or biotic transfer of radioactivity from low-level disposal facility facilities.

4.3 Regulatory Evaluation Criteria

The information in the SAR is acceptable if it is sufficient to ensure a reasonable, yet conservative assessment of gamma attenuation and biotic transfer for each period of concern in the life of the disposal facility. For gamma attenuation, the period of concern is the operational period for offsite individuals and the institutional control period for the onsite custodial personnel. For biotic transfer, the period of concern is from startup of operations through the passive institutional control period. The information should furthermore be sufficient to enable the staff to perform an independent, confirming analysis.

5. EVALUATION FINDINGS

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

If the description of gamma attenuation and biotic transfer satisfies the review procedures and acceptance criteria in Sections 3 and 4 of this SRP, the staff will conclude that the information and results are adequate so that the staff can confirm the applicant's compliance with the regulatory requirements in Section 4.1 of this SRP. However, if the staff should find that the analyses and results are inadequate, it will document the inadequacies, specify the technical basis for the comments, and describe alternative approaches to resolve the inadequacies.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U. S. Government Printing Office, Washington, DC, revised annually.

National Council on Radiation Protection and Measurements, "Environmental Radiation Measurements," Report 50, Washington, DC, 1976.

Rockwell, T., ed., Reactor Shielding Design Manual, Naval Reactors Branch, Division of Reactor Development, U.S. Atomic Energy Commission, March 1956.

U.S. Department of Health, Education, and Welfare, Radiological Health Handbook, Public Health Service, Food and Drug Administration, Bureau of Radiological Health, Rockville, MD, revised edition, 1970.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

(2) Potential impacts on offsite individuals resulting from operational accidents and unusual occurrences will be controlled to levels as low as reasonably achievable.

(3) Potential impacts on onsite individuals carrying out routine activities during the active institutional control period will be controlled so that they will not exceed the limits specified in 10 CFR 61.41 and are furthermore reduced to levels as low as reasonably achievable.

The staff's assessment of regulatory compliance is not limited to numerical assessments of potential dose rates but may also include consideration of the applicant's commitments and proposed limiting conditions of operation, the applicant's proposed environmental monitoring and survey program, the ease in which operations can be adjusted to eliminate or mitigate potential releases of radioactivity, past environmental monitoring and disposal history at other disposal facilities, and the applicant's training and experience.

5. EVALUATION FINDINGS

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows. Documentation of conclusions should include a list of the applicant's commitments and/or limiting conditions of operations. These commitments and limiting conditions of operation will form the basis for staff development of disposal facility license conditions.

If the assessment of impacts and regulatory compliance satisfies the review procedures and acceptance criteria in Sections 3 and 4 of this SRP, the staff will conclude that the information and results are adequate so the staff can confirm the applicant's compliance with the regulatory requirements in Section 4.1 of this SRP. However, if the staff should find that the analyses and results are inadequate, it will document the inadequacies, specify the technical basis for the comments, and describe alternative approaches to resolve the inadequacies.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except where the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U. S. Government Printing Office, Washington, DC, revised annually.

International Commission on Radiological Protection, Limits for Intakes of Radionuclides by Workers, Part 1, Publication 30, Pergamon Press, Oxford, England, July 1978.

U. S. Nuclear Regulatory Commission, Draft Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," March 1976.

---, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

---, NUREG/CR-1918, "Dose-Rate Conversion Factors for External Exposure to Photons and Electrons," D. C. Kocher, Oak Ridge National Laboratory, August 1981.

---, Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance With 10 CFR Part 50, Appendix I,"

disposal units, and (2) so that the disposal of Class B and Class A wastes will not disrupt the construction of the intruder protection system.

4.3.2 Method of Intruder Protection

4.3.2.1 Minimum Depth of Burial

The minimum depth-of-burial method for providing intruder protection is acceptable if the wastes designated as Class C will be disposed of at all times so that the top of the Class C waste will be at least 5 m below the top surface of the cover over the waste. Acceptable methods of accomplishing this are to dispose of Class C waste in a disposal unit with sufficient overburden to provide the minimum depth or to dispose of Class C waste at the bottom of a disposal unit with layers of Class B and stable Class A wastes and sufficient overburden to provide the minimum depth of cover over the Class C wastes.

4.3.2.2 Engineered Intruder Barrier

The engineered intruder barrier method for providing protection is acceptable if the wastes designated as Class C will in all cases be covered entirely with an intruder barrier system that is designed and constructed with a life expectancy of 500 years after site closure.

4.3.3 Intruder Protection Analysis

4.3.3.1 Minimum Depth of Burial

The analysis pertaining to the depth-of-burial method is acceptable if the following conditions have been met:

(1) The analysis appropriately considers and addresses the occurrences of natural and abnormal events that may affect the site and demonstrates that the required 5-m minimum depth will be maintained.

(2) The methodology used is appropriate for the site, the assumptions and data are reasonable, and the specifications, field controls, and procedures to be followed are practical and reasonable.

4.3.3.2 Engineered Intruder Barrier

The analysis pertaining to the intruder barrier is acceptable if the following conditions have been met:

(1) The analysis clearly demonstrates that the intruder barrier is designed and will be constructed to last at least 500 years after site closure and has appropriately considered and addressed the occurrences of natural and abnormal design-basis events.

(2) The provisions of Sections 5.1 and 10 of American National Standards Institute Standard ANSI N101.6-1972 as they apply to such intruder barriers have been followed (where concrete is to be used).

(3) The recommendations of ACI 201.2R-77 as they apply to such intruder barriers have been followed (where concrete is to be used).

(4) A concrete inspection program has been developed and is designed specifically for the intruder barrier system (as recommended by ACI 311.4R-80) using methods recommended in the Manual of Concrete Inspection, SP-2, of the American Concrete Institute (where concrete is to be used).

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the intruder protection system for the [name of facility] low-level waste disposal facility according to Standard Review Plan 6.2. The staff concludes that the intruder protection system is designed to give reasonable assurance that an inadvertent intruder will be adequately protected after active institutional control of the facility is removed. The staff concludes that wastes designated as Class C will be disposed of using methods that will protect the inadvertent intruder. This conclusion is based on [one of the following depending on the information provided in the SAR].

Wastes designated as Class C will be disposed of so that the top of the waste will be a minimum of 5 m below the top surface of the disposal unit cover.

or

Wastes designated as Class C will be disposed of with an engineered intruder barrier that is designed to protect against inadvertent intrusion for at least 500 years after site closure.

The design and construction of the intruder protection system, therefore, meets 10 CFR 61.13(b), 61.23, 61.42, and 61.52(a)(2).

6 IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

(2) a summary and description of the appropriate static and dynamic properties of the soil and rock constituting the slope and a discussion of the procedures used to establish, from the available field and laboratory data, soil properties to be used in the analyses

(3) a description of the groundwater and seepage conditions at the slope

4.3.2.2 Stability Analyses

The design criteria and analyses of the short-term and long-term stability of the slopes are acceptable if valid static and dynamic analyses have been presented to demonstrate that the factor of safety is adequate. Slopes, whose instability during the construction/operation phase may have an adverse effect on the disposal facility meeting the 10 CFR 61 performance objectives, should be analyzed for short-term stability under both static and appropriate dynamic loading conditions. A number of different methods of analyses such as Bishop's method of slices, Morgenstern's method, the sliding wedge method, and the finite element method are available for static analysis. Other methods such as the pseudostatic method, Newmark's deformation method, and the finite element method are available in the literature for the dynamic analysis.

Static Stability

To be acceptable, the static stability analyses should assess the following factors:

(1) the uncertainties with regard to the boundaries and properties of the several types of soil in the foundation and within the slope, the forces acting on the slope, and the pore pressures acting within the slope

(2) failure surfaces (slip circle, sliding wedge, etc.) corresponding to the lowest factor of safety for the anticipated conditions of loading (e.g., long-term, seismic, and flooding)

(3) the effect of the assumptions inherent in the method of analysis on the resulting margin of safety

The lowest factor of safety from the short-term and long-term static stability analyses under the worst combination of water levels and pore pressures should be 1.30 and 1.50, respectively.

Dynamic Stability

To be acceptable, the dynamic analyses must account for the effect of cyclic motion of the earthquake on soil strength properties. Just as the static analyses, the dynamic stability analysis should demonstrate that the factor of safety is adequate. A sophisticated dynamic analysis such as the finite element method using earthquake parameters such as acceleration, velocity, and duration with adequate supporting investigations and testing may be appropriate under certain conditions such as where the soil in the slopes would

develop high pore pressures and experience loss of strength during an earthquake. However, the need for such an analysis should be decided on a case-by-case basis depending on the level of earthquake shaking, type of soil in the slopes, and consequences of a seismically induced failure of the slope. The analysis should consider the amplification of the earthquake resulting from the soil conditions at the site. Pseudostatic analysis in lieu of the dynamic analysis is acceptable if the strength parameters used in the analysis are based on a conservative interpretation of the test data, the materials are not subject to significant loss of strength and development of high pore pressures under dynamic loads, and the resulting lowest factor of safety is greater than 1.0, preferably greater than 1.05.

Liquefaction Potential

If the foundation materials and/or materials in the slope at the site of the LLWDF are saturated, loose, cohesionless soils, then an analysis of the liquefaction potential of the saturated soils at the site is required for long-term stability considerations. The need for a detailed analysis is determined on the basis of the level of earthquake shaking, a case-by-case study of the site stratigraphy, critical soil parameters (relative density, standard penetration test (SPT), percent fines, etc.), and the consequence of a liquefaction-induced failure. The SPT, undisturbed samples obtained at the site, and appropriate laboratory tests may be required to show if the soils are likely to liquefy. When the need for an indepth analysis is indicated, an assessment of the potential adverse effects that complete or partial liquefaction could have on the stability of the slope should be based on cyclic triaxial test data obtained from undisturbed soil samples taken from the critical zones in the site area.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the long-term stability of the slopes at [name of facility] low-level waste disposal facility according to Standard Review Plan 6.3.2. The objectives of the review were to ensure that (1) critical slopes at the disposal site have been identified for evaluation, (2) the information on the geotechnical characterization of the slope area and borrow material is adequate, (3) slope characteristics have been described in appropriate detail, (4) the design and analysis of slope stability were presented in appropriate detail, (5) there are provisions for quality control during construction, and (6) information in the SAR meets SRP 6.3.2.

In its review, the staff

settlement (more than that predicted or assumed in the design) is observed, to conduct a study to determine the causes for the excessive settlement and to delineate remedial actions. The scope of the remedial action depends on the seriousness of the cause of the excessive settlement. The remedial action may range from a simple task of regrading or filling the area of subsidence to a complex task of dewatering the disposal units excavations, treating the contaminated water, and rectifying the problem of infiltration into the excavation. In the SAR a commitment by the applicant to carry out the required remedial action, if necessary, is acceptable.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the long-term settlement and/or subsidence aspects for [name of facility] low-level waste disposal facility according to Standard Review Plan (SRP) 6.3.3. The objective of the review was to ensure that (1) information on the site characteristics, construction of the facility, waste disposal operations, and disposal unit excavation cover is adequate; (2) the areas that are potentially susceptible to long-term settlement have been identified and their modeling (characterization of the problem) is reasonable and conservative; (3) the uncertainties have been considered and addressed appropriately in the settlement analyses; (4) the applicant had committed to perform remedial actions if long-term settlement should be a potential problem; and (5) the information presented meets the guidance and acceptance criteria in SRP 6.3.3.

In its review, the staff

(1) determined if the information on site characteristics, the excavation and backfilling of disposal unit excavations during the operations phase, and disposal unit excavation cover design and construction was adequate to justify the applicant's interpretation of stratigraphy, the typical section of disposal units excavations, and the parameters used in the settlement analyses

(2) identified both the general areas within the disposal site and the disposal unit excavation cover areas that are potentially susceptible to long-term settlement, and determined if the applicant's description of the typical sections, the long-term condition of the backfill and buried waste within the disposal unit excavation, the parameters used in estimating the settlement, and the assumptions on groundwater conditions were a reasonable and conservative interpretation of the available data

(3) determined if the uncertainties such as severe events or conditions resulting in settlement, the extent and boundaries of the various materials within the sections being analyzed, and the effect of assumptions inherent in the method of analysis were considered by the applicant in the settlement analyses

(4) determined if the applicant had provided definite proposals for remedial actions if excessive settlement and/or settlement-induced cracks should occur in the disposal excavation cover, and evaluated the scope and feasibility of such proposals

The information on long-term settlement and its safety implications is adequate to satisfy the objectives of the staff review except for the long-term characterization of degraded waste and its container and backfill within the disposal unit excavation. The applicant has made reasonable assumptions concerning this item in estimating the long-term settlement and has evaluated the potential for cracking of the disposal unit excavation cover. Because of the uncertainties involved in characterizing the deformational behavior of a heterogenous mass such as degraded waste with its container and backfill, the staff cannot determine the validity of the applicant's assumptions. However, if excessive settlement should occur during the operational phase and the initial 5 years of the institutional control phase, the applicant has proposed remedial action to mitigate the adverse effect of long-term settlement. The remedial action includes filling the areas of subsidence to mitigate the adverse effects of ponding and maintaining the surface drainage characteristics of the disposal site. A detailed plan of the remedial action, if necessary, will be filed with the application for site closure and stabilization for the site. On the basis of its review of the information provided by the applicant and the commitment for remedial action during the operational phase and initial 5 years or longer, if necessary, of the institutional control phase, the staff concurs with the applicant that the potential for long-term settlement and/or cracking of the disposal unit excavation cover is minimal and thereby the settlement and/or subsidence aspects of 10 CFR 61.13(d), 61.23(e), 61.44, and 61.51(a)(1) and (a)(2) are satisfied.

On the basis of its review, the staff concludes that the adverse effect of long-term settlement and/or subsidence on the performance of the disposal facility is minimal and the information on the settlement and/or subsidence aspects meets all the applicable regulations, contingent on the commitment by the applicant to perform remedial actions, if necessary, to mitigate the adverse effects of settlement and/or subsidence on the performance of the disposal facility.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level readioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commissions's regulations, the staff will use the methods described herein.

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LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 7.1
OCCUPATIONAL RADIATION EXPOSURES

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Technical Branch (LLTB)

1.2 Secondary - Regulatory Branch (LLRB)

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the areas of the SAR given in the following sections as they relate to ensuring that occupational radiation exposures will be as low as is reasonably achievable (ALARA).

2.1 Policy Considerations

(1) management policy on designing, constructing, and operating the facility and the planned organizational structure

(2) the applicable activities by management staff responsible for radiation protection

(3) the implementation of the policy, organization, training, and design review guidelines in Regulatory Guides (RGs) 1.8, 8.8, and 8.10 and any proposed alternatives

2.2 Design Considerations

(1) information on how experience with past designs and from operating facilities has been used to develop improved radiation protection design facilities

(2) the implementation of the design guidelines of RG 8.8 and other industry-developed design guidance that includes ALARA criteria, including any proposed alternatives

2.3 Operational Considerations

(1) the methods of planning and performing work, including the interrelationships of radiation protection, operations, maintenance, planning, and scheduling

(2) the use of operating experience in planning the operational considerations for facility designs

(3) the implementation of the radiation protection program and operational guidance of RGs 8.8 and 8.10 and any proposed alternatives

2.4 Radiation Protection Considerations

The applicant should have a radiation protection plan adequate for the requirements in 10 CFR Part 20. A plan consistent with the provisions of NUREG/CR-3343 would be adequate.

3. REVIEW PROCEDURES

3.1 Acceptance Review

The staff will review for completeness the information on occupational radiation exposures in relation to the ALARA principle in the SAR in accordance with NUREG-1199 and this SRP.

3.2 Safety Evaluation

The staff will review the management policy and the planned organizational structure to determine how the guidance in RGs 8.8, 8.10, and 1.8 will be implemented and will consider any alternatives proposed. It will review the organizational structure to determine (1) whether the individuals responsible for the radiation protection program are at a sufficiently high level of management to ensure independence from operating pressures, (2) the implementation of management's commitment for ensuring that occupational radiation exposures will be ALARA, and (3) whether radiation protection management has direct access to facility management in radiation protection matters. The LLOB staff's review of the organizational structure related to the radiation protection manager will be coordinated with that of the staff primarily responsible for the review of the organizational items under SRP 8.

The staff will evaluate the information in the SAR in accordance with RG 8.8 to determine whether the organizational structure provides a mechanism for the radiation protection manager and the radiation protection organization to interact with design review groups in such a way that methods and techniques for reducing occupational radiation exposures will be incorporated in the design of the facility. If the radiation protection manager has not yet been selected, the design review should be conducted in accordance with the guidance of RG 8.8, unless acceptable alternatives are proposed.

The staff will determine if appropriate personnel with operating facility experience have reviewed the proposed design and if the applicant has incorporated previously accepted design features and has used operating experience to improve the design of the facility with regard to ensuring that occupational radiation exposures will be ALARA. The staff will evaluate the information against the requirements of 10 CFR 20 and the guidelines of RGs 8.8 and 8.10.

3.3 Request for Additional Information

On the basis of its review, the staff may request that the applicant supply additional information or modify its submittal to meet the acceptance criteria in Section 4 of this SRP.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The information in the SAR is acceptable if it meets the requirements of 10 FR 61.12 and if it is sufficient as delineated in Section 7.1 of NUREG-1199 so that the relevant requirements of 10 CFR 19 and 20 are met.

The regulations applicable to the areas of review of this SRP are

(1) 10 CFR 19.12, "Instruction to Workers," as it relates to workers entering restricted areas being kept informed about the storage, transfer, or use of radioactive materials or radiation in such areas and instructed as to the risk associated with occupational radiation exposure, precautions and procedures to reduce exposures, and the purpose and function of protective devices

(2) 10 CFR 20.1, "Purpose," (c), as it relates to persons involved in licensed activities making every reasonable effort to maintain radiation exposures ALARA

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in meeting the requirements in Section 4.1 is provided in the following documents:

(1) NUREG/CR-3343, "Recommended Radiation Protection Practices for Low-Level Waste Disposal Sites," as it relates to the content of a radiation protection plan and the elements to be included in a comprehensive radiation protection program as well as procedural details and outlines for incorporation into implementing procedures

(2) Regulatory Guide 1.8, "Personnel Selection and Training," as it relates to the qualifications of radiation protection personnel

(3) Regulatory Guide 8.8, "Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable," as it relates to radiation protection information pertaining to actions taken during the design, construction, operation, decommissioning, and site closure to ensure that occupational radiation exposures are kept ALARA in order to meet 10 CFR 20.1(c)

(4) Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," as it relates to

the commitment by the applicant's management and vigilance by the radiation protection manager and the radiation protection staff to maintain occupational radiation exposures ALARA in order to meet 10 CFR 20.1(c)

4.3 Regulatory Evaluation Criteria

Evaluation criteria pertaining to the areas of review of this SRP are given in the following sections.

4.3.1 Policy Considerations

Acceptability will be based on evidence that a policy for ensuring that occupational radiation exposures will be ALARA has been formulated in accordance with the training requirements in 10 CFR 19.12 and the ALARA provisions of 10 CFR 20.1(c) and that the policy has been described and displayed and will be implemented generally within the guidelines of RGs 8.8 and 8.10 and NUREG/CR-3343 (Section 2), as they relate to maintaining doses ALARA. A specific individual should be designated and assigned responsibility and authority for implementing ALARA policy. Alternative proposed policies should be evaluated on the basis of a comparison with the above regulatory guides and NUREG/CR-3343.

4.3.2 Design Considerations

Acceptability will be based on evidence that the design methods, approach, and interactions are in accordance with the ALARA provisions of 10 CFR 20.1(c) and RG 8.8 and will incorporate measures for reducing the time spent in radiation areas, measures for improving the accessibility to components requiring periodic maintenance or inservice inspection, measures for ensuring that occupational radiation protection during decommissioning will be ALARA, reviews of the design by competent radiation protection personnel, instructions to designers and engineers regarding ALARA design, experience from operating facilities and with past designs, and continuing facility design reviews. Alternative proposed design policies will be evaluated on the basis of a comparison with the design guidance in RG 8.8.

4.3.3 Operational Considerations

Acceptability will be based on evidence that the applicant plans to develop a radiation protection program and procedures generally within the guidelines of RGs 8.8 and 8.10 that can incorporate the experiences obtained in facility operation into facility and equipment design and into operations planning and that will implement specific exposure control techniques.

4.3.4 Radiation Protection Considerations

Acceptability will be based on evidence that the applicant has prepared the radiation protection plan generally within the guidelines of NUREG/CR-3343, including the criteria, concepts, and implementation schemes to be included as part of the operational radiation protection programs for the waste disposal facility.

4.3 Regulatory Evaluation Criteria

The applicant should describe radiation sources that require shielding, ventilation systems, special storage locations and conditions, traffic or access control, special plans or procedures, or monitoring equipment. The description should include all pertinent information required as input to shielding codes used in the design process, for establishing related facility design features, for developing plans and procedures, and for assessing radiation occupational exposure.

For contained sources the description should include plan drawings to scale of the facility and site on which all sources are shown and identified in a manner that can easily be related to tables containing the pertinent and necessary quantitative source parameters. Their positions should be located accurately, and the approximate sizes and shapes should be indicated. Relevant experience from operating facilities may be used.

Airborne sources that are created by leakage, by opening closed containers, by storage of leaking waste packages, etc., should be identified by location and magnitude, in a manner useful for designing appropriate ventilation systems and in specifying appropriate monitoring systems. Airborne radioactivity concentrations in frequently occupied areas should be a small fraction of the concentrations specified in 10 CFR 20.103, Appendix B. The assumptions made in arriving at quantitative values for these various sources should be specified, either in this section or by reference to other sections of the SAR.

The tables of source parameters, which can be placed in Section 9 or referenced in other sections, are acceptable if the accompanying text either in this section or other referenced sections makes it clear how the values are used in a radiation protection calculation or in a ventilation system design.

The applicant should provide a general discussion of its approach to meeting the requirements by specifying the design concept selected and the supporting design bases and criteria. The applicant also should demonstrate that the design concept is technically feasible and within the state of the art and that there exists reasonable assurance that the requirements will be implemented properly before construction is completed and the receipt and disposal of radioactive waste is initiated.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the radiation sources for [name of facility] low-level waste disposal facility according to the Standard Review Plan 7.2.

On the basis of the following findings, the staff concludes that the information provided by the applicant on radiation sources is acceptable and meets 10 CFR 20.

The applicant has described a facility that can meet the requirements of 10 CFR 20.101, 20.103, 20.104, 20.106, and 20.207 as they relate to the evaluation of source terms.

The applicant has provided a description of contained and airborne radioactivity sources used as inputs for the dose assessment and for shielding and ventilation designs. Also included are the applicant's assumptions in arriving at quantitative values for these contained and airborne source terms based on 10 CFR 20.101, 20.103, and 20.104.

During operation, the greatest potential for personnel radiation dose during operation is [list or describe on the basis of the staff's evaluation]. Otherwise, the primary sources of personnel exposure are [describe on the basis of evaluation]. Gamma source terms are based on experience from operating facilities. Other parameters used, as well as a complete description of the routine operation source term development, and the accident source terms are contained in [describe]. Source terms presented are comparable to estimates by other applicants with similar designs.

Almost all of the airborne radioactivity within the facility is due to leakage from waste packages. The applicant has provided a tabulation of the maximum expected routine radioactive airborne concentrations in operating areas. The bases for these calculations are [describe].

The source terms used to develop these airborne concentration values are comparable to estimates by other applicants with similar designs and are acceptable.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

(4) The accident monitoring sytems have usable ranges that include the maximum calculated accident levels and are designed to operate properly in the environment caused by the accident.

Regulatory Guide 8.2 provides guidance on surveys to evaluate radiation hazards. ANSI N13.1-1969 provides detailed guidance on sampling airborne radioactive materials in nuclear facilities and may be used to evaluate the actual sampling process and certain techniques involved. Regulatory Guide 8.8 provides further guidance on monitoring systems.

Instrumentation to monitor for accidental criticality is acceptable if it meets 10 CFR 70.24(a)(1), RG 8.12, and ANSI N16.2-1969.

4.3.5 Dose Assessment

The dose assessment is acceptable if, in general accordance with the guidelines of RG 8.19, it documents the assumptions made; the calculations used; the results for each radiation zone, including numbers and types of workers for each zone; expected and design dose rates; and projected person-rem doses.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the radiation protection design features for [name of facility] low-level waste disposal facility according to Standard Review Plan (SRP) 7.3.

On the basis of the following findings, the staff concludes that the radiation protection design features are acceptable and meet 10 CFR 20, 10 CFR 61, and 10 CFR 70.24.

The radiation protection design features are intended to help maintain occupational radiation exposures within regulatory limits and as low as is reasonably achievable (ALARA), consistent with 10 CFR 20.1(c) and the dose-limiting provisions of 10 CFR 20.101, 20.103, 20.203, and 20.207, as well as Regulatory Guides (RGs) 8.8 and 8.10. Many of these design features have been incorporated as a result of the applicant's radiation protection design review and on the basis of experience gained on radiation exposure during the operation of other waste disposal facilities. [Include examples of design features that reduce radiation exposure to workers where operations must be performed, that provide remote operational capability, or that reduce the time required for work in radiation fields, and some examples of other features that reduce radiation exposure of personnel.] These design features are consistent with those discussed in RG 8.8 and are acceptable.

Access control is in accordance with 10 CFR 20.203 and is acceptable.

Areas within the restricted area will be divided into [supply number] radiation zones. The dose rate criterion for each of these zones is derived from expected occupancy and access restrictions. These criteria are then used as the basis for the radiation shielding design. This allows for arrangements of radioactive equipment that are in accordance with 10 CFR 20 and RG 8.8. During plant operation and under refueling conditions, the health physics staff will evaluate area access classifications and monitor entry into areas to update posting and entry requirements in accordance with 10 CFR 20.203.

All plant radiation sources capable of producing radiation levels in excess of 100 rads per hour will be shielded and clearly marked, indicating that potentially lethal radiation fields are possible. If other than permanent shielding is used, administrative controls will be initiated and local audible and visible alarming monitors must be installed to alert personnel if temporary shielding is removed.

The radiation shielding is designed to provide protection against radiation for operating personnel, both inside and outside the facility, and for the general public. The following are several of the shielding design features that have been incorporated into the facility's design. [List several examples of shielding design features.] These shielding techniques are designed to maintain personnel radiation exposures ALARA in accordance with RGs 8.8 and 8.10 and are acceptable.

The general shield design methodology and source term inventories are similar to those at operating facilities. The basic radiation transport analysis used for the applicant's shield design is based on [list appropriate shielding computer codes used]. All concrete shielding in the plant will be constructed in general compliance with RG 1.69. The staff finds the shielding design and methodology in the application acceptable.

The ventilation system is designed to ensure that plant personnel are not inadvertently exposed to airborne contaminants exceeding those given in 10 CFR 20.

The applicant intends to maintain personnel exposures ALARA by (1) maintaining air flow from areas of potentially low airborne contamination to areas of higher potential concentrations, (2) ensuring negative or positive pressures to prevent exfiltration or infiltration of potential contaminants, and (3) locating ventilation system intake structures so that intake of potentially contaminated air from other building exhaust points is minimized. These design criteria comply with RG 8.8. [List examples of exposure-reduction features in the ventilation system.]

The applicant's area radiation monitoring system is designed to (1) monitor the radiation levels in areas where radiation levels could become significant and where personnel may be present, (2) alarm when the radiation levels exceed preset levels, and (3) provide a continuous record of radiation levels at key locations throughout the facility. To meet these objectives, the

(c) head covers, shoe covers, gloves, and safety-related items
(d) pressure demand full-face-piece air line respirators
(e) pressure demand full-face-piece self-contained breathing apparatus
(f) full-face mechanical filter respirators

Respiratory protection equipment should meet 10 CFR 20.103.

(5) Radiation protection support facilities or areas to be provided include as a minimum

(a) portable instrument calibration and storage area, the latter easily accessible

(b) personnel decontamination area with necessary monitoring equipment, which should be located and designed to expedite rapid and separate cleanup of male and female personnel and should not be used as a multiple-purpose area

(c) facility and equipment to clean, sanitize, repair, and decontaminate personnel protective equipment, such as monitoring instruments and respirators

(d) change room between "clean" and contaminated areas

(e) control points for entrance or exit into controlled-access areas of the plant, caution signs, labels, and signals in accordance with 10 CFR 20.203 and 20.204

(f) storage and control capability for licensed materials in unrestricted areas in accordance with 10 CFR 20.205 and 20.207

(g) one or more radiation protection stations that may be used as locations for portable radiation survey equipment, respiratory protective equipment, personnel monitoring equipment, and contamination control supplies; the equipment readily accessible and the stations equipped to facilitate communication throughout the plant

Acceptance will also be based on implementation of the guidance of RG 8.8 or the provision of acceptable alternatives.

4.3.3 Radiation Protection Procedures

Plans and procedures are acceptable if they meet the criteria for access control in 10 CFR 20.203 and RGs 1.8, 8.8, and 8.10 or appropriate alternatives. There should be provision for a special control procedure for designated zoned areas or higher, including a special survey of the area before entry, and the development of a radiation work permit program. The work permit program should include data on radiation levels in the area, allowable working time, protective clothing and respiratory protective equipment, special tools, portable shielding, and special personnel monitoring devices.

Operation, maintenance, repair, surveillance, and refueling procedures and methods used by the applicant should be reviewed to ensure that occupational radiation exposures will be ALARA and in accordance with RG 8.8. For major dose-accumulating functions, the staff should conduct a postoperational review to evaluate the effectiveness of the work permit program in ensuring that occupational radiation exposures will be ALARA in similar future activities.

There should be provisions for supervision and control of the handling or movement of material within and from radiation or controlled-access areas and procedures for controlling the spread of radioactive materials.

There also should be provisions for personnel monitoring procedures, bioassays, and keeping records and reporting of personnel radiation doses. 10 CFR 20.102, 20.201, 20.401, 20.405, 20.407, and 20.408 provide the criteria for personnel monitoring, bioassays, recordkeeping, and reporting pertaining to radiation surveys. Guidance regarding these areas is provided by RG 8.2 (surveys and personnel monitoring), RG 8.3 (personnel monitoring equipment), RGs 8.9 and 8.26 (bioassay), RGs 8.2 and 8.7 (recordkeeping and reporting), RG 8.8 (decontamination, inspection, radiation protection program, and operations), RG 8.13 (training on radiation risks to fetuses), RG 8.27 (radiation protection training), RG 8.29 (training on radiation risks), and NUREG/CR-3343. The radiation protection program is acceptable if it provides for the indoctrination and personnel training and retraining programs. 10 CFR 19.12 requires instruction of personnel on radiation protection, and RGs 1.8, 8.8, 8.10, and 8.27 provide additional guidance. There should be a regular review of the radiation protection program, which should include the updating of procedures, equipment, and facilities where improvements are possible. The program should include regular audits to determine where occupational radiation exposures are occurring and to review possible methods for reducing these exposures.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the radiation protection program for [name of facility] low-level waste disposal facility according to Standard Review Plan 7.4.

On the basis of the following findings, the staff concludes that the program is acceptable and meets 10 CFR 19.12, 10 CFR 20, and 10 CFR 61.

The objectives of the radiation protection program are to provide reasonable assurance that the limits of 10 CFR 20.101, 20.103, and 20.104 will not be exceeded and, in accordance with 10 CFR 20.1(c) and Regulatory Guides

qualifications by discussions with inspection personnel or review of inspection reports.

The staff will then determine, on the basis of the foregoing, the overall acceptability of the applicant's management and technical support organization and staffing plans.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The applicant's description of its resources to deal with safety-related problems associated with the proposed facility should provide contributory evidence on the technical qualifications of the applicant, as required by 10 CFR 61.23(a).

4.2 Regulatory Guidance

There are no regulatory guides that apply to the organizational structure for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

Evaluation criteria pertaining to the areas of review in this SRP are given in the following sections.

4.3.1 Construction

The information is acceptable if the following conditions have been met:

(1) The applicant has identified and functionally described the specific organizational groups responsible for implementing the responsibilities for the project.

(2) The applicant has described the method of implementing its responsibilities for dealing with the safety-related aspects of the design and construction of the project and the transition to operation of the facility, including control of major contractors.

(3) Clear unambiguous management control and communications exist between the organizational units involved in the design and construction of the project.

(4) Substantive breadth and level of experience and availability of personnel exist to implement the responsibility for the project.

(5) The applicant has clearly described the roles and functions of the architect/engineer and contractor during both design and construction and has demonstrated control over the decisions of the architect/engineer and contractor.

(6) The applicant has designated the responsible organizations that will participate in the test program, and early plans indicate reasonable assurance that such designated organizations can collectively provide the necessary level of staffing with suitable skills and experience to develop and conduct the test program.

(7) The applicant plans to use the facility operating and technical staff in the development and conduct of the test program and in the review of test results.

(8) The applicant has identified plans for the organization and staffing to oversee design and construction of the facility.

4.3.2 Operation

The information is acceptable if the following conditions have been met:

(1) The applicant has identified and described the organizational groups responsible for implementing the responsibilities for the initial test program and technical support for the operation of the facility.

(2) The applicant has described the method of implementing its responsibilities regarding the initial test program, technical support, and operation of the facility.

(3) The organizational structure provides for the integrated management of activities that support the operation and maintenance of the facility.

(4) Clear management control and effective lines of authority and communications exist between the organizational units involved in management, operation, and technical support for the operation of the facility.

(5) Substantive breadth and level of experience and availability of personnel exist to implement the responsibility for technical support for the operation of the facility. The need to supplement the corporate structure with additional experienced personnel for the initial years of operation will be determined on a case-by-case basis.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the organizational structure for [name of facility] low-level waste disposal facility according to Standard Review Plan 8.1.

there are many acceptable ways to define and delegate job responsibilities. Variations in staffing may also be expected between applicants who lack experience with waste disposal operation and those who have such experience. It is important that the staff makes certain that applicants in the former category do not underestimate the magnitude of the task. The staff should be alert to the possibility that excessive workloads may be placed on too small a number of individuals.

The structure of onsite technical support and maintenance groups may depend somewhat on headquarters staffing and the division of effort between onsite and offsite personnel.

At the initial application stage, the applicant generally will not have selected persons to fill facility staff positions. The review procedure, therefore, is to examine this section of the SAR for a commitment on the part of the applicant to conform to the stated acceptance criteria.

"Applicable experience" should be judged in light of the position responsibility. Credit for experience, which may not be entirely applicable, should be weighted to a degree commensurate with its applicability.

In addition, if the applicant, at the time of the review, has had experience in waste disposal operations, the staff may seek independent information on facility staffing and qualifications by consulting with NRC inspection and enforcement personnel or by reviewing inspection reports, or by consulting with State personnel with similar responsibilities.

The staff will then determine, on the basis of the foregoing, the overall acceptablity of the applicant's operating organization and plant staffing plans. This determination necessarily will be somewhat qualitative.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulation applicable to the areas of review of this SRP is

> 10 CFR 61.23, "Standards for Issuance of a License," (a), as it relates to demonstrating in conjunction with other reviews that the applicant is technically qualified to engage in activities licensed under this regulation.

4.2 Regulatory Guidance

There are no regulatory guides that apply to the operating organization for a low-level disposal facility.

4.3 Regulatory Evaluation Criteria

The applicant should demonstrate a commitment to and implementation of plans to staff the operating organization and to define and delegate

responsibilities to provide assurance that the facility can be operated safely by meeting the following evaluation criteria:

(1) The reporting responsibility and authority of the functional areas of radiation protection, quality assurance, and training ensure independence from operating pressures. In most facilities, overall management and technical direction in these areas may be concentrated at corporate headquarters.

(2) Lines of authority to the facility manager are clear.

(3) Responsibility for all activities important to the safe operation of the facility is clearly defined and independent of production operations.

(4) Distinct functional areas are separately supervised and/or managed.

(5) Managers are qualified to provide adequate backup should the incumbent be absent.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the operating organization for [name of facility] low-level waste disposal facility according to Standard Review Plan 8.2.

On the basis of the following findings, the staff concludes that the applicant's operating organization is acceptable and meets 10 CFR 61.23(a).

The applicant has described the assignment of plant operating responsibilities, the reporting chain up through the chief executive officer of the company (applicant), the proposed size of the regular facility staff, the separation of the reporting and decisionmaking responsibilities of the production operations staff and the safety operations staff, the functions and responsibilities of each major facility staff group, the proposed shift crew complement for extended operation, the qualification requirements for members of the facility staff, and personnel résumés for management and principal supervisory and technical positions. The staff has reviewed this information and concludes that the proposed organization is acceptable.

Acceptability of the applicant's operating organization is a significant input to the determination that the applicant is technically qualified as required by 10 CFR 61.23(a) and that the applicant has complied with the organizational requirements for the facility manager and radiation protection manager and those pertaining to the qualifications of facility personnel.

(2) 10 CFR 61.23, "Standards for Issuance of a License," (a), as it relates to training being an integral part of personnel technical qualifications thus contributing to the finding that the applicant is technically qualified to engage in disposal operations

4.2 Regulatory Guidance

There are no regulatory guides that apply to training programs for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

The applicant should demonstrate that the training provided, or to be provided, for each position on the facility staff will be adequate to ensure that all facility staff personnel training requirements will be met at the time needed, that is, before waste operations or before appointment or reappointment to the position.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the training program for [name of facility] low-level waste disposal facility according to Standard Review Plan 8.3.

On the basis of the following findings, the staff concludes that the training for facility staff personnel is acceptable and meets 10 CFR 19.12 and 10 CFR 61.23(a).

The applicant has described the training given to facility personnel and a schedule for that training as related to the applicant's currently scheduled date for receipt of waste.

All training of the facility staff is scheduled to be completed before waste disposal operations.

Meeting the staff's requirements given above provides an acceptable basis for the finding that, insofar as the training of personnel is concerned, the applicant meets the technical qualification requirements of 10 CFR 61.23(a).

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In

addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy." U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to this SRP are

(1) 10 CFR 61.12, "Specific Technical Information," (k), which requires that the applicant describe the radiation safety program as it relates to routine operations and accidents

(2) 10 CFR 61.13, "Technical Analyses," which requires analyses for the protection of individuals during likely accidents

4.2 Regulatory Guidance

There are no regulatory guides that apply to emergency planning for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

The information on emergency planning is acceptable if the following conditions have been met:

(1) The applicant's plans for coping with an emergency meet the requirements in 44 CFR 350.

(2) The applicant has established plans for responding to all credible accidents and emergencies of a radiological nature consistent with the proposed method of operations.

(3) The applicant has adequately demonstrated that the offsite release associated with the most severe credible accident consistent with the projected source term will yield an offsite dose equivalent of less than 0.01 rem to the whole body and 0.05 rem to the lungs.

If the maximum potential offsite releases yield dose equivalents greater than the above, the applicant has developed emergency procedures that include interaction with local and State authorities and appropriate notification of affected populations. Further, the applicant's emergency procedures have been developed with the full knowledge, participation, and cooperation of such authorities and affected populations.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the information on emergency planning for [name of facility] low-level waste disposal facility according to Standard Review Plan 8.4.

On the basis of its review of the applicant's plans for coping with emergencies and subsequent consultation with [specify], the staff finds that such emergency plans are acceptable and either meet or exceed the minimum requirements of [specify].

The applicant has established, and this review has confirmed, that the types of accidents given in Table [specify] are credible at the facility.

Table [specify number and title]

Type of accident	Associated releases of radioactivity

It has been determined that the maximum offsite release of radioactivity associated with these accidents is [specify], which is within the limits prescribed in the minimum acceptance criteria.

or

It has been determined that for [type of accident] the maximum possible release of radioactivity is [specify], which is greater than that prescribed in the acceptance criteria for trivial offsite releases. However, the Federal Emergency Management Agency (FEMA) has been consulted with regard to emergency plans dealing with this type of accident and has reviewed State and local emergency response plans. FEMA concludes that State and local preparedness is adequate to cope with such an accident so that offsite exposures will be limited to acceptable levels.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

4.3.2 Independent Review

Provisions for independent review should include the formation of an independent safety review group at the corporate level that should meet the following criteria:

(1) The functions of this group should be independent of those performed to meet items (1) and (2) in Section 2 of this SRP.

(2) The group should (a) examine facility operating characteristics, NRC issuances, and other appropriate sources of information on facility design and operating experience in the area of safety improvement and (b) maintain surveillance of facility operations and maintenance activities to provide independent verification that these activities are performed correctly and that human errors are reduced as far as practicable.

(3) The group should perform independent reviews and audits of facility activities (including maintenance and modifications), operational problems, and operational analysis and aid in the establishment of programmatic requirements for facility activities.

(4) The group should provide to management no less frequently than quarterly a summary of its activities to advise management on the overall quality and safety of operations.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the program for the review and audit of operational activities for [name of facility] low-level waste disposal facility according to Standard Review Plan 8.5.

On the basis of the following findings, the staff concludes that the program is acceptable and contributes to meeting 10 CFR 61.23(a).

The applicant has described the program for the review and audit of operational activities. The program includes reviews by the plant staff organization, reviews of safety-related activities independent of the operating organization, and reviews and assessments of facility activities by an independent group. The staff has reviewed the provisions for these reviews with respect to organizational provisions, qualification requirements of those performing the review, and subject matter to be reviewed. The staff finds that the applicant's program for the review and audit of operational activities is acceptable.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the administrative and operating procedures for [name of facility] low-level waste disposal facility according to Standard Review Plan 8.6.

The staff concludes that the administrative and operating procedures described by the applicant are acceptable and contribute to meeting the applicable requirements of 10 CFR 61.

The applicant has described the program and the procedures that provide administrative controls over activities important to safety.

The applicant has described the operating procedures that provide assurance that operations under routine, abnormal, and emergency conditions will be conducted in a safe manner.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCE

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

U.S. Nuclear Regulatory Commission, NUREG-1199, "Standard Format and Control of a License Application for a Low-Level Radioactive Waste Disposal Facility," Rev. 1, January 1988.

LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 9.1
QUALITY ASSURANCE* DURING THE DESIGN, CONSTRUCTION, AND OPERATION

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Regulatory Branch (WMRB)

1.2 Secondary - Technical Branch (LLTB)

1.3 Supporting - None

2. AREAS OF REVIEW

The staff will review the areas of the SAR given in the following sections as they pertain to the quality assurance (QA) program during the design, construction, and operations phase of the facility. The applicant's QA program description in the SAR should describe the management systems, assignments of responsibility and the organizational structure to accomplish the performance objectives (10 CFR Part 61). A well defined QA program description is the first important step to prevent recurrence of the kind of problems reported in the Ford Amendment Study (NUREG 1055) which reported on quality problems in nuclear power plants. The second important step is, of course, proper implementation of the planned QA program. The staff in its critical review of the QA program description presented in the application should be aware of the root causes of problems reported in the Ford Amendment Study and offer constructive criticism where it appears the same mistakes could be repeated by the applicant.

2.1 Organization

(1) organizational description and charts of the lines, interrelationships, and areas of responsibility and authority for all organizations performing quality-related activities, including the applicant's organization and principal contractors (architect/engineer, constructor, and construction manager when other than the constructor)

(2) organizational location, degree of independence from the performing organization, and authority of the individuals assigned the responsibility for performing QA functions

(3) organizational provisions for ensuring the proper implementation of the QA program

2.2 Quality Assurance Program

(1) scope of the QA program

(2) provisions to ensure proper definition of the QA program

*see footnote page 9.1-5

(3) programmatic provisions to ensure proper implementation of the QA program

(4) provisions to ensure the adequacy of personnel qualifications

2.3 Design Control

(1) scope of the QA program for design activities

(2) organizational structure, activity, and responsibility of the individuals or groups responsible for all design activities and supporting analysis

(3) provisions to carry out design activities in a planned, controlled, and orderly manner

(4) provisions to verify or check the technical adequacy of design documents including documentation of all computer codes

(5) provisions to control design changes

2.4 Procurement Document Control

(1) provisions to ensure that applicable regulatory requirements, technical requirements, and QA program requirements are included or referenced in procurement documents

(2) provisions for the review and approval of procurement documents

2.5 Instructions, Procedures, and Drawings

(1) provisions for ensuring that activities affecting quality are prescribed by and accomplished in accordance with documented instructions, procedures, or drawings

(2) provisions for including quantitative and qualitative acceptance criteria in instructions, procedures, and drawings

2.6 Document Control

(1) provisions to ensure that documents, including changes, are reviewed for adequacy, approved for release by authorized personnel, and distributed and used at the location where the prescribed activity is performed

(2) provisions to prevent the inadvertent use of obsolete or superseded documents

2.7 Control of Purchased Material, Equipment, and Services

(1) provisions for the control of purchased material, equipment, and services; for the selection of suppliers; and for the assessment of quality

(2) provisions to ensure that documented evidence of the conformance of material and equipment to procurement requirements is available at the plant site before installation or use

staff is to look for and measure the effectiveness of the QA program design, not just look for the existence of its elements.

Changes to the QA program will be evaluated to ensure at a minimum that such changes have not degraded the previously approved program. Consideration should be given to the current regulatory position in the area of the change in determining acceptability of the change.

4. ACCEPTANCE CRITERIA*

4.1 Regulatory Requirements

The regulation applicable to the areas of review of this SRP are

(1) 10 CFR 61.12, "Contents of Applications; Technical Information," 61.12(j), as it relates to a QA program description in the Safety Analysis Report

4.2 Regulatory Guidance

Regulatory guidance to aid the applicant in addressing the guidelines in Section 4.1 is provided in the following documents:

NUREG-1293, "Quality Assurance Guidance for a Low-Level Radioactive Waste Proposal Facility," Draft November 1987.

*At the current time quality assurance is not a regulatory requirement related to licensing a low-level waste disposal facility. In the promulgation of the final rule, 10 CFR Part 61, quality assurance was inadvertently omitted from 10 CFR 61.12(j). Since the word changes to the final 10 CFR 61.12(j) were unintentional, the staff proposes a rulemaking action to change the terminology back to "quality assurance" as contained in the Part 61 regulation as originally proposed.

Standard Review Plan 9.1 is developed in recognition of the fact that implementation of an adequate quality assurance program is an acceptable method of addressing the quality control requirement of 10 CFR 61.12(j).

4.3 Regulatory Evaluation Criteria

The applicant (and its principal contractors such as the architect/engineer, constructor, and construction manager) must establish a QA program for the design, construction, and operations. The applicant's QA program (including that of its principal contractors) must describe in the SAR how each criterion will be met. The criteria used to evaluate this QA program are listed in Sections 4.3.1 through 4.3.18 of this SRP. The criteria include a commitment to comply with the regulations and NUREG-1293. Thus, the commitment constitutes an integral part of the QA program description and requirements. Exceptions and alternatives to the criteria may be adopted by the applicant provided adequate justification is given; the review allows for considerable flexibility in defining methods and controls while still satisfying pertinent regulations. When the QA program description meets the criteria of this SRP or provides acceptable exceptions or alternatives, the program is considered to be in compliance.

The staff will ascertain if the commitments and the description of how the commitments are implemented, to the extent necessary, are objective and stated in inspectable terms.

4.3.1 Organization*

The organizational elements responsible for the QA program are acceptable if:

(1.1) The responsibility for the overall program is retained and exercised by the applicant.

(1.2) The applicant identifies and describes the major delegation of work involved in establishing and implementing the QA program or any part thereof to other organizations.

(1.3) When major portions of the applicant's program are delegated:

(a) The applicant describes how responsibility is exercised for the overall program. The extent of management supervision should be given, including the location, qualifications, and criteria for determining the number of personnel performing these functions.

(b) The applicant evaluates the performance of work by the delegated organization (frequency and method are stated - once per year

*The designation for each criterion in this section is related to the designation for each area of review listed in the corresponding section in Section 2.

4.3.18 Audits*

Activities related to audits are acceptable if:

(1.1) Audits and surveillances are performed in accordance with pre-established written procedures or checklists and conducted by trained personnel not having direct responsibilities for the achievement of quality in the areas being audited.

(1.2) Audit and surveillance results are documented and then reviewed with management having responsibility in the area audited.

(1.3) Provisions exist such that appropriate follow-up corrective action to audit and surveillance reports is undertaken by responsible management. Auditing organizations schedule and conduct appropriate follow-up to assure that the corrective action is effectively accomplished.

(1.4) Both technical and QA programmatic audits and surveillances are performed to:

(a) Provide a comprehensive independent verification and evaluation of procedures and activities affecting quality.

(b) Verify and evaluate suppliers' QA programs, procedures and activities.

(c) Ensure that performance objectives of 10 CFR Part 61 and design bases are accomplished.

(1.5) Audits and surveillances are regularly scheduled on the basis of the status and the importance to accomplishment of the performance objectives of 10 CFR Part 61 and the design bases of the activities being performed and are initiated early enough to assure an effective QA program during the design, procurement and contracting activities.

(1.6) Audits and surveillances objectively assess the effectiveness and proper implementation of the QA program and address the technical adequacy of the activities being conducted.

(1.7) Provisions are provided such that audits and surveillances are required to be performed in all areas where the requirements of the QA program are applicable.

(2.1) Audits are led by appropriately qualified and certified audit personnel from the QA organization. The audit team membership includes personnel (not necessarily QA organization personnel) having technical expertise in the areas being audited. Surveillances are conducted by qualified, but not necessarily certified, personnel.

*The designation for each criterion in this section is related to the designation for each area of review listed in the corresponding section in Section 2.

(2.2) Audit and surveillance deficiency data are analyzed and trended. Resultant reports, which indicate quality trends and the effectiveness of the QA programs, are given to management for review, assessment, corrective action and follow up.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the quality assurance (QA) program during the design and construction phase for [name of facility] low-level waste disposal facility according to Standard Review Plan 9.1.

The organizations and persons performing QA functions have the required independence and authority to effectively carry out the QA program without undue influence from those directly responsible for costs and schedules.

[Provide a brief description of the applicant's QA program highlighting the more important aspects of the program.]

The QA program covers any activities, structures, systems, and components important to safety as identified in the Safety Analysis Report important to meeting the performance objectives of 10 CFR Part 61.

Accordingly, the staff concludes that the applicant's description of the QA program complies with applicable NRC regulations and industry standards and can be implemented for the [specify] phases of [specify application].

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

(5) A statement of anticipated cash flow, including provisions during the construction period and the first three full years of operation for paying interest and dividends and for retiring debt issues.

(6) A statement showing, over the life of each issue, the annual amount of securities the applicant expects to retire through a sinking fund or other extinguishment of indebtedness.

(7) Comparative pro forma balance sheets and income statement for the construction period and each of the first three full years of operation giving the effect of the proposed construction and financing of the project.

(8) Pro forma statements for each of the first three full years of operation showing (a) annual revenues subdivided by type of service to be provided and (b) annual operating expenses including property and labor costs, depreciation, depletion, taxes, rate of return on net investment, including working capital. In the case of an application who is a public authority, similar data and amortization interest schedules for the life of each bond issue related to the facility.

(9) A statement of the proposed rates to be charged for the services to be rendered at the facility, including all charges for closure and long term care.

(10) A statement explaining the type and amount of property and liability insurance that will be obtained for the facility, along with copies of such policies and any attached riders.

(11) Any additional data and information on sources on which the applicant proposes to rely, showing the adequacy and availability of resources for financing the proposed project.

(12) All aspects of a license applicant's business activities that contribute at least 10% to its gross revenues should be enumerated. Information of a proprietary nature should be so indicated.

(13) A listing and description of the qualifications of the principal officers of the license applicant, including relevant work experience of the management team proposed for the licensed facility. For newly formed entities, detailed resumes of the proposed principal staff should be provided.

3.2.3 Other Applicable Information

The staff will verify that the applicant has provided the following:

(1) if the applicant has a parent or holding company, copies of any fiduciary guarantees provided by parent or holding company with regard to this project. If a parent company's or other corporate affiliate's assets are

used as a source of funds for any portion of the project or its activities, provide financial information of the type described in 3.2.2 should be submitted for the parent company or other corporate affiliate

(2) if the applicant is required to submit Form 10K or Form 10Q to the SEC, provide copies of these reports for the last five years

(3) if the applicant's company is evaluated by a bond rating service such as Moody's Investors Service, Inc. or Standard and Poor's Corporation, provide copies of these ratings for the last 3 years

(4) a brief description of any litigation in which the applicant is involved that might have a negative economic effect on the operation of the facility

(5) if the applicant has ever filed or been forced by creditors to file for bankruptcy, provide specific details of these actions, including details of any corporate restructuring resulting from the bankruptcy

3.3 Requests for Additional Information

The staff may request additional information after conducting its review if the information provided was not adequate. Alternative proposed by the applicant must meet all the terms and conditions of the regulations.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulation applicable to this SRP is Subpart E, "Financial Assurance," to 10 CFR Part 61.

4.2 Regulatory Guidance

There are no regulatory guides that apply to the review of the financial qualifications of an applicant for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

The financial information provided by the applicant should be specific, complete, and consistent and should provide evidence of the applicant's financial qualifications.

4.3.1 Conditions for a Positive Finding of Financial Qualification

(1) Qualifications of key personnel will be evaluated to determine whether they have expertise and experience sufficient to provide reasonable assurance that the licensed activity will be conducted such that health and safety will not be adversely affected.

(2) Costs incurred or projected to be incurred for personnel, equipment and material will be evaluated to determine that such costs are reasonably consistent with those incurred by operators of similar facilities.

(3) Revenues obtained or projected to be obtained from operation of the licensed facilities will be evaluated to determine that such revenues are reasonably consistent with those obtained by operators of similar facilities.

(4) Analyses of financial statements (i.e., income statement, balance sheet, and statement of sources and uses of funds) submitted by the license applicant will be performed. Financial statements submitted by license applicants shall be certified without qualification by an independent Certified Public Accountant as accurate and consistent with Generally Accepted Accounting Principles. Measures used to determine financial soundness will include the following:

(a) An analysis of net income achieved and projected. Net income should be positive for the years provided. Although a license applicant would not be required to show a profit in every year to be found financially qualified, a pattern of non-profitability would be of serious concern to NRC staff reviewers.

(b) Commensurate with item a, an analysis of return on equity that is reasonably consistent with that obtained by other firms in the industry. The staff will normally find unacceptable a return on equity that is or projected to be consistently below that needed to attract capital necessary for the operation of the plant. However, the staff will consider mitigating circumstances such as a relatively low debt-to-equity ratio (i.e., less than 1.2) or where a significant portion of equity is held by the licensee's management.

(c) An evaluation of short-term solvency by measures such as the current ratio (i.e., current assets divided by current liabilities. Current assets normally consist of cash on hand, marketable securities, and accounts receivable. Current liabilities normally consist of accounts payable, short-term debt, currently accruing long-term debt, accrued income taxes and other accrued short-term expenses such as wages and salaries.)

Generally, the current ratio should be at 2 or above and certainly no less than 1.5 unless special circumstances are manifest.

(d) As indicated in item b above, a relatively low debt-to-equity ratio will be viewed positively as an indication of a license applicant's ability to attract unsecured capital. However, because little or no debt can be an indication of either strong financial health or inability to attract capital from lenders, very low debt-to-equity ratios will be evaluated closely.

(5) Other criteria that will be used include: a general evaluation of the health of the industry; general news in the financial press that may have either a positive or negative impact on a license applicant's financial health; and the business and labor climate in the license applicant's geographic area.

4.3.2. Conclusion

Reviews of finacial qualifications are of necessity subjective. Although financial ratios and other objective factors provide a general indication of a license applicant's financial health, mitigating or exacerbating factors may alter conclusions that are based only on a narrowly-focused analysis of objective measures. Additionally, the licensee applicant's financial ability to conduct activities under the license (i.e., construction and operation of the facility) will be reviewed in conjunction with the financial assurance mechanisms it intends to provide for site closure and monitoring.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the financial assurance documentation submitted by the applicant for [name of facility] low-level waste disposal facility according to Standard Review Plan 10.1. The staff finds that the documentation demonstrates to a reasonable degree of assurance that the applicant possesses the necessary funds to cover the estimated cost of conducting all licensed activities over the planned operating life of the project, including the costs of construction and disposal. The staff, therefore, concludes that the documentation provided by the applicant complies with the requirements established in 10 CFR 61.61.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

The staff suggests a two-step adjustment procedure because of an inherent time delay (of 9 to 18 months) that exists in the publication of a historical annual implicit price deflator for gross national product (AIPD-GNP) by the U.S. Department of Commerce. The procedure will use both the latest published historical figure for AIPD-GNP as well as the latest forecast of AIPD-GNP.

(f) If the current cost estimates exceeds the coverage because of inflationary increases or changes in plans, the applicant should arrange to increase coverage and submit evidence of the increase to the NRC within 60 days after the cost estimates increase. If cost estimates decrease, the applicant may apply to the NRC for approval of a decrease in coverage.

(11) An applicant should obtain additional financial assurance coverage in the event of bankruptcy of the institution acting as trustee or issuing the financial instrument.

(12) The applicant should inform the NRC within 10 days after it or the organization issuing the financial instrument is named as a debtor in a bankruptcy proceeding.

(13) If ownership or operating responsibility for the activities is transferred, the NRC will not allow the applicant to terminate the original financial instrument until such time as the new applicant has obtained an acceptable assurance.

(14) An issuer of a financial instrument should notify both the applicant and the NRC by certified mail of its intent to cancel the financial instrument. The financial instrument should ensure that the instrument is not cancelled during the 120 days beginning with the date the notice was received by both the NRC and the applicant as evidenced by the return receipts

(15) The applicant should be responsible for obtaining another financial assurance mechanism if the financial institution or corporate guarantor gives notice that it intends to cancel.

(16) The applicant may change the financial assurance mechanisms in use with prior written approval from the NRC. The new mechanism, if approved, should become effective before or at the time the previous mechanism expires. If a letter of credit or a surety bond is used, the applicant should also establish a standby trust fund.

(17) The instrument should clearly state the terms and conditions under which the applicant may cancel the instrument and should provide for notification and approval by the appropriate State or Federal authority before cancellation by the company.

(18) The instrument should be established so that the applicant will have the financial assurance released after the NRC has agreed that all license conditions for closure and postclosure care have been met. The NRC will

send written notification to the applicant allowing termination of the financial assurance mechanism and a return of any funds held.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff has reviewed the financial assurance documentation submitted by the applicant for [name of facility] low-level radioactive waste disposal facility according to Standard Review Plan 10.2. The staff has determined that the financial assurance mechanisms submitted by the applicant are sufficient to ensure that funds will be available to close and stabilize the disposal site so that, following transfer of the disposal site to the site owner, the need for ongoing active maintenance is eliminated to the extent practicable, and only minor custodial care, surveillance, and monitoring are required. The staff, therefore, concludes that the financial assurance mechanisms comply with 10 CFR 61.62.

6. IMPLEMENTATION

This SRP provides guidance to the NRC in its technical review of the SAR low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the method described herein.

7. REFERENCES

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

Council of Economic Advisors, Economic Indicators, U.S. Government Printing Office, Washington, DC, published monthly.

International Chamber of Commerce, Uniform Customs and Practice for Documentary Credits, Paris, France, 1983.

U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, U.S. Government Printing Office Washington, DC 02230, Monthly.

LOW-LEVEL WASTE DISPOSAL LICENSING PROGRAM

STANDARD REVIEW PLAN 11
LICENSE CONDITIONS

1. RESPONSIBILITY FOR REVIEW

1.1 Primary - Operations Branch (LLOB)

1.2 Secondary - Technical Branch (LLTB) and Regulatory Branch (LLRB)

1.3 Support - Office of the Executive Legal Director (OGC)

2. AREAS OF REVIEW

In the SAR the applicant will have, either explicitly or by implication, developed terms and conditions under which it feels it is qualified to hold a license and against which it feels its performance should be judged. These conditions will be included as part of Sections 4-10 of the SAR. They may or may not be highlighted by the applicant with regard to their degree of restriction pursuant to 10 CFR 61.25.

3. REVIEW PROCEDURES

Having reviewed the individual sections in the SAR and drawn conclusions about their acceptability and completeness in individual portions of the Safety Evaluation Report, the staff will develop additional requirements and conditions and associated categorical restrictions that it deems necessary to promote the common defense and security and protect health or minimize danger to life or property. These conditions may (1) supplement the SAR, (2) clarify restrictions under which certain changes can be made, or (3) summarize a requirement(s) for the benefit of others who will be affected by the license. The applicant will be provided an opportunity to review and comment on the proposed license conditions.

4. ACCEPTANCE CRITERIA

4.1 Regulatory Requirements

The regulations applicable to this SRP are:

(1) 10 CFR 61.23, "Standards for Issuance of a License"
(2) 10 CFR 61.24, "Conditions of Licenses"
(3) 10 CFR 61.25, "Changes"

4.2 Regulatory Guidance

There are no regulatory guides that apply to license conditions for a low-level waste disposal facility.

4.3 Regulatory Evaluation Criteria

Any suggestions with regard to supplemental license conditions by the applicant will be considered preliminary in nature and proffered solely to facilitate the licensing process. The responsibility for developing additional requirements and conditions falls primarily on the Commission staff. Therefore, with respect to the SAR, as tendered by the applicant, there are no evaluation criteria pursuant to this SRP.

5. EVALUATION FINDINGS

5.1 Introduction

The staff's review should verify that sufficient information has been provided in the SAR to satisfy the 10 CFR Part 61 requirements and that the information is consistent with the guidance in this SRP. On the basis of this information, the staff should be able to conclude that this evaluation is complete. The staff can document its review as follows.

5.2 Sample Evaluation Findings

The staff, having completed its technical review of the SAR for [name of facility] low-level waste disposal facility, pursuant to conclusions documented in Section(s) [and __] of this SER, finds the need for the following license condition(s) in addition to the SAR tendered by the applicant.

Condition(s)	Reason for need

The staff has reviewed and discussed the license condition(s) with the applicant who agrees with its(their) inclusion in the SAR.

6. IMPLEMENTATION

This SRP provides guidance to the NRC staff in its technical review of an SAR for a near-surface low-level radioactive waste disposal facility. In addition, it may be used as guidance by applicants and licensees regarding the NRC's plans for performing such a technical review.

Except when the applicant proposes an acceptable alternative method for complying with the Commission's regulations, the staff will use the methods described herein.

7. REFERENCE

Code of Federal Regulations, Title 10, "Energy," U.S. Government Printing Office, Washington, DC, revised annually.

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U.S. NUCLEAR REGULATORY COMMISSION

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Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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Same as 8. above.

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

The Standard Review Plan (SRP) is prepared for the guidance of staff reviewers in the Office of Nuclear Material Safety and Safeguards in performing safety reviews of applications to construct and operate a low-level waste disposal facility. The principal purpose of the SRP is to assure the quality and uniformity of staff reviews and to present a well-defined base from which to evaluate proposed changes in the scope and requirements of reviews. It is also a purpose of the SRP to make information about regulatory matters widely available and to improve communication and understanding of the staff's review process by interested members of the public and the nuclear industry. NUREG-1200 consists of 11 chapters containing approximately 60 individual SRP sections. Each section identifies who performs the review, the matters that are reviewed, the basis for review, how the review is performed, and the conclusions that are sought.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

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