

7.0 ENVIRONMENTAL EFFECTS

7.1 Site Preparation and Construction

7.1.1 Areas of Review

The staff should review how construction activities may disturb the existing terrain and wildlife habitats, including the effects of such activities as building temporary or permanent roads, bridges, or service lines; disposing of trash; excavating; and land filling. The staff should also review information on how much land will be disturbed and for how long and whether there will be dust or smoke problems. The staff should review data indicating the proximity of human populations and identifying undesirable impacts on their environment arising from noise; disruption of stock grazing patterns; and inconvenience from the movement of men, material, or machines, including activities associated with any provision of housing, transportation, and educational facilities for workers and their families. Descriptions of any expected changes in accessibility to historic and archeological sites in the region should be assessed. Discussions of measures designed to mitigate or reverse undesirable effects such as erosion control, dust stabilization, landscape restoration, control of truck traffic, and restoration of affected habitats should be reviewed. The staff should also evaluate the beneficial effects of site preparation construction activities, if applicable.

The staff should review the impact of site preparation and construction activities on area water sources and the effects of these activities on fish and wildlife resources, water quality, water supply, aesthetics, as applicable. Reviewers should evaluate measures such as pollution control and other procedures for habitat improvement to mitigate undesirable effects. Staff should consult NUREG-1748 (NRC, 2001) for general procedures for environmental reviews and the environmental assessment process.

The staff should review the resources and ecosystem components cumulatively affected by the proposed action and other past, present, and reasonably foreseeable future actions. The reviewer should examine cumulative impacts by considering whether:

- (1) A given resource is especially vulnerable to incremental effects.
- (2) The proposed action is one of several similar actions in the same geographic area.
- (3) Other activities in the area have similar effects on the resource.
- (4) Effects have been historically significant for this resource.
- (5) Other analyses in the area have identified a cumulative effects concern.

7.1.2 Review Procedures

The staff should determine if the application adequately addresses how site preparation and construction activities may disturb the existing terrain, wildlife habitats, and area water sources in compliance with National Environmental Policy Act Requirements in 10 CFR 51.45 and 51.60. The consequences of these activities to both human and wildlife populations should be

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considered. The descriptions should be adequately supported by site-specific data, well-documented calculations, and accepted modeling studies, as appropriate. The discussion should include those impacts that are unavoidable as well as those that are irreversible. The staff should ensure that the applicant provides information pertaining to how much land will be disturbed and for how long. The staff should confirm that the effects of the following activities and circumstances, where applicable, are addressed: the building of temporary or permanent roads, bridges, or service lines; disposing of trash; excavating and land filling; and the likelihood of dust and smoke problems. The proximity of site activities to nearby human populations should be addressed, as well as anticipated impacts on their environment including noise; disruption of grazing patterns; inconvenience from movement of material and machines; effects arising from additional housing, transportation, and educational facilities for workers and families; and any disruption in access to historic or archeological sites. The staff should ensure that mitigation measures that are adequate to alleviate or significantly reduce environmental impacts are discussed. Examples of mitigation measures include erosion control, dust stabilization, landscape restoration, control of truck traffic, and restoration of affected habitats.

The staff should consider the adequacy of the cumulative impact analysis with respect to past, present, and reasonably foreseeable actions. The staff should determine if the cumulative analysis adequately considered whether and to what extent the environment has been degraded, whether ongoing activities in the area are causing impacts, and trends for activities and impacts in the area. The Council on Environmental Quality has developed guidance (Council on Environmental Quality, 1997) on considering cumulative impacts in the context of National Environmental Policy Act requirements.

The staff should also evaluate any discussion of likely beneficial effects from site preparation and construction to the extent that such might counteract detrimental effects.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.1.3 Acceptance Criteria

The applicant's assessment of the environmental impacts of site preparation and construction is acceptable if it meets the following criteria:

- (1) All environmental impacts from construction activities are adequately described and supported with site-specific data and, where applicable, modeling studies and calculations.

A thorough discussion of all construction activities is provided with associated impacts including the generation and control of wastes; dusts; smoke; noise; traffic congestion; disruption of local public services, routines, and property; and aesthetic impacts.

- (2) The applicant adequately describes all unavoidable and irreversible impacts to both the natural environment and nearby human populations.

- (3) The applicant adequately describes the amount of land to be disturbed and the length of time it will be disturbed.
- (4) The applicant has provided an adequate evaluation of the environmental resources that are vulnerable to the incremented effects from the cumulative impacts of the proposed action and other past, present, and reasonably foreseeable action.
- (5) The applicant recommends reasonable mitigation measures for all significant adverse impacts.
- (6) The applicant demonstrates that land can be restored.

7.1.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the environmental assessment of the site preparation and construction plans, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the plans for site preparation and construction proposed for use at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to conduct the site preparation and construction using the review procedures in standard review plan Section 7.1.2 and the acceptance criteria outlined in standard review plan Section 7.1.3.

The applicant has acceptably identified all environmental impacts from construction activities including waste generation; dusts; smoke; noise; traffic congestion; disruption of public services, routines, and property; and aesthetic impacts. Applicant plans are supported with site-specific data and modeling studies or calculations, where applicable. Identification and assessment of the effects of all unavoidable and irreversible impacts on the natural environment and humans are acceptable. Disturbance of land and the length and nature of the disturbance are acceptably described. The applicant has recommended appropriate mitigation measures for all significant adverse impacts. The applicant has determined that the land can be returned to its original use after cessation of *in situ* leach operations.

Based on the information provided in the application and the detailed review conducted of the site preparation and construction plans for the _____ *in situ* leach facility, the staff concludes that the environmental impacts of the proposed site preparation and construction are acceptable and are in compliance with 10 CFR 40.32(c), which requires the applicant's proposed equipment, facilities, and procedures be adequate to protect health and minimize danger to life or property; 10 CFR 40.32(d), which requires that the issuance of the license will not be inimical to the common defense and security nor to the health and safety of the public; 10 CFR 40.41(c), which requires the applicant to confine source or byproduct material to the location and purposes authorized in the license; and 10 CFR 51.45(c), which requires the applicant to provide sufficient data for the Commission to conduct an independent environmental analysis.

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7.1.5 References

Council on Environmental Quality. "Considering Cumulative Effects Under the National Environmental Policy Act." Washington, DC: Council on Environmental Quality, Executive Office of the President. 1997.

NRC. NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. 2001.

7.2 Effects of Operations

7.2.1 Areas of Review

The staff should review discussions in the application that address the impact of facility operations on the environment, including surface-water bodies, ground water, air, land, land use, ecological systems, and important plants and animals, as discussed in Section 2.0 of this standard review plan. Staff should consult NUREG-1748 (NRC, 2001) for general procedures for environmental reviews and the environmental assessment process.

7.2.2 Review Procedures

The staff should determine whether the application addresses the impacts of facility operations on the environment, including surface-water bodies, ground water, air, land, land use, ecological systems, and important plants and animals. The staff should determine whether the supporting evidence is based on, and supported by, theoretical, laboratory, onsite, or field studies undertaken for this, or for previous operations.

The staff should determine whether the proposed facility provides for the protection of ground water from the environmental effects of operations. In conducting the review, the staff should focus on (i) characteristics of the hydrological system; (ii) effluent control systems; (iii) spill detection and containment systems in the processing facilities and storage areas; (iv) ground-water monitoring and surface-water monitoring programs, and (v) the ground-water restoration program provided in the application. This information should provide a strong basis for determining the likely overall effects of any impacts to the ground-water system, such as leachant excursions, infiltration from spills, or ruptures of wells.

The staff should ensure that, if surface water exists onsite or is connected to off-site surface-water systems, the likely consequences of impacts of operations on surface water are assessed, and mitigation measures are provided. Likely consequences of impacts might include siltation from disruption of surface ground cover or changes to surface drainage patterns. The staff should also determine whether the applicant has assessed the likelihood for decreased air quality resulting from dust loading from truck traffic on dirt roads and exposure of disturbed surface soils to wind. Radiological impacts to air from operations are assessed in other sections of this standard review plan.

In conducting the review, the staff should consider the applicant's ecological information as reviewed in Section 2.8 of this standard review plan to determine if any endangered or sensitive species of plants and animals exist on site. The level of concern for ecological impacts of operations will be affected by the presence of any such sensitive or endangered species. For most facilities, the ecological impacts are expected to be minimal during this period because of the lack of surface disruption during operations. The staff review should ensure that measures have been taken to restrict terrestrial animals from entering facility grounds by use of fencing and other means. In areas used by migrating waterfowl, additional measures may need to be taken to ensure that any surface impoundments are not used by waterfowl. Local ecological conditions may be such that the facility grounds provide favorable habitat for local wildlife, and efforts to minimize contact between wildlife and contaminated areas should be considered. These efforts will serve to mitigate immediate impacts on local species, but will also serve to limit introduction of contamination into the food chain.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.2.3 Acceptance Criteria

The environmental impacts from operations are acceptable if they meet the following criteria:

- (1) All anticipated significant environmental impacts from facility operations are identified and the applicant provides: (i) mitigation measures for these impacts; (ii) justification for why impacts cannot be mitigated; or (iii) justification for why it is not necessary to mitigate these impacts to protect the local environment.
- (2) At a minimum, the applicant demonstrates that the anticipated impacts on terrestrial and aquatic ecology, air quality, surface- and ground-water systems, land, and land use are environmentally acceptable.

7.2.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the environmental effects of operations, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the effects of operations proposed at the _____ *in situ* leach facility. This review included an evaluation of the effects of operations using the review procedures in standard review plan Section 7.2.2 and the acceptance criteria outlined in standard review plan Section 7.2.3.

The applicant has acceptably described all anticipated significant environmental impacts from facility operations. The applicant has provided acceptable (i) plans to mitigate such impacts; (ii) justification of why impacts cannot be mitigated; or (iii) justification of why it is not necessary to mitigate the impacts to protect the local environment. The applicant has demonstrated that

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anticipated impacts to terrestrial ecology, air quality, surface- and ground-water systems, and land use are environmentally acceptable.

Based on the information provided in the application and the detailed review conducted of the effects of operations on the _____ *in situ* leach facility, the staff concludes that the anticipated effects of operations are acceptable and are in compliance with 10 CFR 40.41(c), which requires the applicant to confine source or byproduct material to the location and purposes authorized in the license; and 10 CFR 51.45(c), which requires the applicant to provide sufficient data for the Commission to conduct an independent analysis.

7.2.5 Reference

NRC. NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. 2001.

7.3 Radiological Effects

7.3.1 Exposure Pathways

The staff should review information on the radiological effects of operations on humans, including estimates of the radiological impacts from all exposure pathways. The staff should evaluate descriptions of the plant operations with special attention to the likely pathways for radiation exposure of humans. The staff should review information on accumulation of radioactive material in specific internal compartments and should ensure that both internal and external doses are included in the analysis. This information can be tabulated using the outline provided in Appendix A of the Standard Format and Content Guide (NRC, 1982).

7.3.1.1 Exposures from Water Pathways

7.3.1.1.1 Areas of Review

The staff should review the estimates of annual average concentrations of radioactive nuclides in receiving water at the site boundary and at locations where water is consumed or is otherwise used by humans or where it is inhabited by biota of significance to human food chains. The review should include the data presented in support of these estimates, including details of models and assumptions used in supporting calculations of total annual whole body and organ doses to individuals in the off-site population from all receiving water exposure pathways as well as any dilution factors used in these calculations. Additionally, the staff should review estimates of radionuclide concentration in aquatic and terrestrial food chains and associated bioaccumulation factors. The staff should evaluate calculations of internal and external doses. If there are no waterborne effluents from the facility, then these analyses are not needed. Details of models and assumptions used in calculations may be provided in an appendix to the application.

7.3.1.1.2 Review Procedures

The staff should determine whether the concentration estimates at the site boundary meet the regulatory requirements in 10 CFR 20.1302(b)(2)(i) which specifies limits for annual average concentrations of radionuclides in liquid effluents. The staff should also check to ensure that calculations of concentrations have been done for receiving water at locations where water is consumed or is otherwise used by humans or where it is inhabited by biota of significance to human food chains, to meet public dose limits in 10 CFR 20.1301. If the liquid effluent dose is calculated separately from the air pathway dose, the staff should ensure that the results can be summed with the air pathway dose for the total dose comparison to the limit in 10 CFR 20.1301. The staff should also determine whether these estimates are supported by properly interpreted data, calculations, and model results using reasonable assumptions. The staff should review the parameter selections including the justifications provided for important parameters used in the dose calculation. The staff should check the input data for modeling results, to ensure the parameters discussed in the application are the same as those used in the modeling. Code outputs should be spot-checked to ensure that the results are correctly reported in the application. For simple hand calculations, spot calculations can be used to verify that they were done correctly.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.3.1.1.3 Acceptance Criteria

The exposures from water pathways are acceptable if they meet the following criteria:

- (1) The estimates of individual exposure to radionuclides at the site boundary meet the regulatory requirements in 10 CFR 20.1302(b)(2)(i), which specify limits for annual average concentrations of radioactive nuclides in liquid effluents, or the dose limit in 10 CFR 20.1301.
- (2) Calculations of concentrations of radionuclides in receiving water at locations where water is consumed or is otherwise used by humans or where it is inhabited by biota of significance to human food chains are included in the compliance demonstration for public dose limits in 10 CFR 20.1301.
- (3) For facilities that generate liquid effluents, the relevant exposure pathways are included in a pathway diagram provided by the applicant.
- (4) The conceptual model (scenarios and exposure pathways) is similar to and consistent with the methodology for liquid effluent exposure pathways in 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 (NRC, 1977).
- (5) The conceptual model used for calculating the source term and individual exposures (and/or concentrations of radionuclides) from liquid effluents at the facility boundary is

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representative of conditions described at the site, as reviewed in Section 2.0 of this standard review plan.

- (6) The parameters used to estimate the source term, environmental concentrations, and exposures are applicable to conditions at the site, as reviewed in Section 2.0 of this standard review plan.

7.3.1.1.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the exposure estimates from water pathways, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the radiological effects of exposure from water pathways at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate radiological effects using the review procedures in standard review plan Section 7.3.1.1.2 and the acceptance criteria outlined in standard review plan Section 7.3.1.1.3.

Applicant estimates of individual exposure to radionuclides from water pathways at the site boundary are acceptable since they are less than the requirements in 10 CFR 20.1302 (b)(2)(i) with regard to annual average concentrations in liquid effluents, or they are less than the dose limit in 10 CFR 20.1301. The applicant has demonstrated that the concentrations of radionuclides in receiving water where it is consumed or otherwise used by humans, or where it is inhabited by biota significant to the human food chain are in compliance with the public dose limits in 10 CFR 20.1301. The applicant has included the relevant pathway diagrams in the application. The applicant has used an acceptable representation of the conditions at the site in the determination of the source term for the model calculations. The applicant has acceptable values for parameters used to estimate the source term, environmental concentrations, and exposures, and the parameters are representative of the _____ *in situ* leach site.

Based on the information provided in the application and the detailed review conducted of exposures from water pathways for the _____ *in situ* leach facility, the staff concludes that the exposures from water pathways are acceptable and are in compliance with 10 CFR 20.1302(b)(2)(i), which specifies limits for annual average concentrations of radionuclides in liquid effluents and 10 CFR 20.1301, which specifies dose limits for individual members of the public.

7.3.1.1.5 References

NRC. Regulatory Guide 3.46, "Standard Format and Content of License Applications, Including Environmental Reports, for *In Situ* Uranium Solution Mining." Washington, DC: NRC, Office of Standards Development. 1982.

———. 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." Washington, DC: NRC, Office of Standards Development. 1977.

7.3.1.2 Exposures from Air Pathways

7.3.1.2.1 Areas of Review

The staff should review estimated release rates of airborne radioactivity from facility operations and the atmospheric dispersal of such radioactivity considering applicable meteorological data as reviewed in Section 2.0 of this standard review plan. The staff should then review the estimates of annual total body and organ doses to individuals including (i) at the point of maximum ground level concentration offsite; (ii) at the site boundary in the direction of the prevailing wind; (iii) at the site boundary nearest the emission source; and (iv) at the nearest residence in the direction of the prevailing wind. The applicant can choose to show compliance with a concentration limit or with individual dose limits. Therefore, the staff should initially determine the method of compliance chosen by the applicant and focus the review accordingly. Regardless of which compliance method is chosen, the reviewer should also evaluate an individual dose to the public to verify compliance with the requirements in 10 CFR 20.1301. The staff should review data, models, calculations, and assumptions used in support of these estimates. The review should consider both the source term and exposure pathway components of the calculation and should include deposition of radioactive material on food crops and pasture grass.

7.3.1.2.2 Review Procedures

The staff should determine whether the estimates of annual total body and organ doses to individuals at the point of maximum ground level concentrations offsite; individuals exposed at the site boundary in the direction of prevailing wind; individuals exposed at the site boundary nearest to the sources of emissions; and individuals exposed at the nearest residence in the direction of the prevailing wind, meet the regulatory requirements in 10 CFR 20.1301. The staff should also determine whether these estimates are supported by properly interpreted data, calculations, and model results using reasonable assumptions.

An acceptable computer code that calculates off-site doses to individuals from airborne emissions from *in situ* leach facilities is MILDOS-AREA (Yuan, et al., 1989). This code does not calculate the source term. Therefore, the applicant must provide documentation of the source term calculation that is used as input to MILDOS-AREA (Yuan, et al., 1989), if this code is used. The staff should review the source term equation to ensure that it is an accurate estimation of all significant airborne releases from the facility including, where applicable, yellowcake dust from the dryer stack and radon emissions from processing tank venting and well field releases. If a closed processing loop is used, then radon release from processing is expected to be negligible. If a vacuum dryer is used for yellowcake, then dust emissions from drying may also be assumed to be negligible. The staff should focus attention on the values used for the production flow and the fraction of this flow that is expected to be released during operations. A reasonable estimate of well field radon release is about 25 percent. The staff should also

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ensure that the source term calculation accounts for all material released during startup, production, and restoration activities.

The review of the MILDOS-AREA (Yuan, et al., 1989) calculation should focus on the code input provided by the applicant. The applicant should have provided a list of the relevant parameter information that was used. The information from this list should be compared with the input from the code run to ensure that the correct values have been used. Dose results from the code output should be checked against the tabulated results in the application to ensure that the values have been correctly reported. The staff should also evaluate warning messages that the code provides in the output to identify anomalies in the input data or problems with the run. If reported results appear anomalous, the staff may conduct confirmatory analyses using MILDOS-AREA (Yuan, et al., 1989).

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.3.1.2.3 Acceptance Criteria

The exposures from air pathways are acceptable if they meet the following criteria:

- (1) The estimates of individual exposure to radionuclides at the site boundary meet the regulatory requirements in 10 CFR 20.1302(b)(2)(i) with regard to annual average concentrations of radionuclides in airborne effluents or the dose limit in 10 CFR 20.1301. The estimates of individual exposure to radionuclides (not including radon) indicate that the ALARA constraint on air emissions in 10 CFR 20.1101(d) will be met.
- (2) Calculations of concentrations of radionuclides in air at locations downwind where residents live or where biota of significance to human food chains exist are included in the compliance demonstration for public dose limits in 10 CFR 20.1301. The estimates of individual exposures to radionuclides (not including radon) indicate that the as low as is reasonably achievable constraint on air emissions, in 10 CFR 20.1101(d), will be met.
- (3) Relevant airborne exposure pathways are included in the pathway diagram provided by the applicant.
- (4) The conceptual model used for calculating the source term and individual exposures (and/or concentrations of radionuclides) from airborne effluents at the facility boundary is representative of conditions described at the site as reviewed in Section 2.0 of this standard review plan. The conceptual model is consistent with the methodologies described in Regulatory Guide 3.51, Sections 1–3, “Calculational Models for Estimating Radiation Doses to Man From Airborne Radioactive Materials Resulting From Uranium Mill Operations” (NRC, 1982). The conceptual model for the MILDOS-AREA code (Yuan, et al., 1989) is one acceptable method for performing these exposure calculations. Other methods are acceptable if the applicant is able to satisfactorily demonstrate that the model includes the criteria discussed above.

- (5) The parameters used to estimate the source term, environmental concentrations, and exposures are applicable to conditions at the site as reviewed in Section 2.0 of this standard review plan. Guidance on source term calculations is available in Regulatory Guide 3.59, Sections 1–3, “Methods for Estimating Radioactive and Toxic Airborne Source Terms for Uranium Milling Operations” (NRC, 1987). Additionally, an example source term calculation specifically applicable to *in situ* leach facilities is described in Appendix D.

7.3.1.2.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the radiological effects from air pathways, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the radiological effects of exposure from air pathways at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate radiological effects using the review procedures in standard review plan Section 7.3.1.2.2 and the acceptance criteria outlined in standard review plan Section 7.3.1.2.3.

Applicant demonstrations of individual exposure to radionuclides from air pathways are acceptable since they are less than the limits in 10 CFR 20.1302 (b)(2)(i) with regard to annual average concentrations in airborne effluents or they are less than the dose limit in 10 CFR 20.1301. The applicant has acceptably demonstrated that the concentrations of radionuclides in air at locations where residents live or where biota of significance to human food chains exist are in compliance with the public dose limits in 10 CFR 20.1301 and the as low as is reasonably achievable constraint on air emissions in 10 CFR 20.1101(d). The applicant has included the relevant airborne exposure pathway diagrams in the application. The applicant has used an acceptable representation of the atmospheric conditions at the site in the determination of the source term and individual exposures for model calculations. The applicant has used acceptable values for parameters used to estimate the source term, environmental concentrations, and exposures; and the parameters are representative of the _____ *in situ* leach site.

Based on the information provided in the application and the detailed review conducted of exposures from air pathways for the _____ *in situ* leach facility, the staff concludes that the exposures from air pathways are acceptable and are in compliance with 10 CFR 20.1302(b)(2)(i), which specifies limits for annual average concentrations of radionuclides in airborne effluents; 10 CFR 20.1301, which specifies dose limits for individual members of the public; and the as low as is reasonably achievable constraint on airborne emissions in 10 CFR 20.1101(d).

7.3.1.2.5 References

NRC. Regulatory Guide 3.59, “Methods for Estimating Radioactive and Toxic Airborne Source Terms for Uranium Milling Operations.” Washington, DC: NRC, Office of Standards Development. 1987.

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———. Regulatory Guide 3.51, “Calculational Models for Estimating Radiation Doses to Man From Airborne Radioactive Materials Resulting From Uranium Milling Operations.” Washington, DC: NRC, Office of Standards Development. 1982.

Yuan, Y.C., J.H.C. Wang,, and A. Zielen. “MILDOS-AREA: An Enhanced Version of MILDOS for Large-Area Sources.” Report ANL/ES-161. Argonne, Illinois: Argonne National Laboratory, Energy and Environmental Systems Division. 1989.

7.3.1.3 Exposures from External Radiation

7.3.1.3.1 Areas of Review

The staff should review estimates of maximum annual external dose that would be received by an individual from direct radiation at the nearest site boundary and in off-site populations. The staff should also review data, models, calculations, and assumptions used in support of these estimates.

7.3.1.3.2 Review Procedures

The staff should determine whether the estimates of maximum annual external dose that would be received by an individual from direct radiation at the nearest site boundary meet the limits specified in 10 CFR 20.1301(a)(2). The staff should also determine whether these estimates are supported by properly interpreted data, calculations, and model results using reasonable assumptions. Staff should confirm that the input parameters used for the external dose calculation are consistent with the information provided in the application. The staff should also confirm that the selected parameter values are representative of conditions at the site as reviewed in Section 2.0 of this standard review plan. Staff should check the source term conceptual model and selected parameter values to ensure that they are appropriate for the site conditions described in the application.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.3.1.3.3 Acceptance Criteria

The exposures from external radiation are acceptable if they meet the following criteria:

- (1) The estimates of external radiation exposure at the site boundary meet the regulatory limits in 10 CFR 20.1301(a)(2), in accordance with 10 CFR 20.1302(b).
- (2) The applicant provides an exposure pathway diagram that includes the relevant external exposure pathways.
- (3) The model(s) used for calculating the source term, environmental concentrations, and external exposures at the facility boundary are representative of site conditions reviewed in Section 2.0 of this standard review plan.

- (4) The parameters used to estimate the source term, environmental concentrations, and external exposure are applicable to site conditions as reviewed in Section 2.0 of this standard review plan.

7.3.1.3.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the radiological effects of exposures from external radiation, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the radiological effects of exposure from external radiation at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate radiological effects using the review procedures in standard review plan Section 7.3.1.3.2 and the acceptance criteria outlined in standard review plan Section 7.3.1.3.3.

Applicant demonstration of individual exposure to radionuclides from external radiation is acceptable and meets the limits in 10 CFR 20.1301(a)(2) in accordance with the requirements of 10 CFR 20.1302 (b). The applicant has provided an acceptable exposure pathway diagram that includes all relevant external pathways. The applicant has used an acceptable representation of the external exposures at the site in the determination of the source term, environmental concentrations, and individual exposures for the model calculations. The applicant has used acceptable values for parameters used to estimate the source term, environmental concentrations, and exposures; and the parameters are representative of the _____ *in situ* leach site.

Based on the information provided in the application and the detailed review conducted of exposures from external radiation for the _____ *in situ* leach facility, the staff concludes that the exposures from external radiation are acceptable and are in compliance with 10 CFR 20.1301(a)(2), which specifies limits for radiation doses in unrestricted areas from external sources in accordance with the methods contained in 10 CFR 20.1302(b).

7.3.1.3.5 References

None.

7.3.1.4 Total Human Exposures

7.3.1.4.1 Areas of Review

The staff should review estimates of the maximum annual dose that could be received via all pathways described above by an individual at the site boundary and at the nearest residence. The staff should also review data, models, calculations, and assumptions used in support of these estimates. Much of this review will already have been completed for the pathway-specific calculations, and the total dose will be the sum of these results.

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7.3.1.4.2 Review Procedures

The staff should determine whether estimates of the maximum annual dose that could be received via all pathways described above by an individual at the site boundary and at the nearest residence meet regulatory requirements in 10 CFR 20.1301. These calculations can be effectively executed by the MILDOS-AREA code (Yuan, et al., 1989). The staff should also determine whether these estimates are supported by properly interpreted data, calculations, and model results using reasonable assumptions. After the pathway-specific calculations have been reviewed, staff should check to ensure that the doses have been correctly summed to determine the total dose. Also, staff should ensure the population dose is compared with a meaningful reference dose, such as that which is expected for the exposure to the same population from background radiation sources.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.3.1.4.3 Acceptance Criteria

The total human exposure is acceptable if it meets the following criteria:

- (1) The estimates of individual exposure to radionuclides at the site boundary meet the regulatory requirements in 10 CFR 20.1302(b)(2)(i) with regard to annual average concentrations of radioactive nuclides in airborne and liquid effluents or the dose limit in 10 CFR 20.1301.
- (2) Calculations of the maximum individual whole body and organ doses at the site boundary and for the nearest downwind resident and where biota of significance to human food chains exist are included in the compliance demonstration for public dose limits in 10 CFR 20.1301.
- (3) The exposure pathway diagram provided by the applicant includes pathways relevant to all effluents expected from facility operations.
- (4) The models used for calculating the source terms and individual exposures (and/or concentrations of radionuclides) from all effluents at the facility boundary are representative of conditions described at the site as reviewed in Section 2.0 of this standard review plan. The conceptual models are acceptable as described in Sections 7.3.1.1, 7.3.1.2, and 7.3.1.3 of this standard review plan.
- (5) The parameters used to estimate source terms, concentrations, and exposures are representative of conditions described at the site as reviewed in Section 2.0 of this standard review plan.

7.3.1.4.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the radiological effects from total human exposures, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the radiological effects of total human exposures at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate radiological effects using the review procedures in standard review plan Section 7.3.1.4.2 and the acceptance criteria outlined in standard review plan Section 7.3.1.4.3.

Applicant determination of total human exposure to radionuclides at the site boundary is acceptable since it meets the requirements in 10 CFR 20.1301. The applicant has provided an exposure pathway diagram that includes all relevant external pathways. The applicant has used an acceptable representation of the external exposures at the site in the determination of the source term, environmental concentrations, and individual exposures for the model calculations. The applicant has used acceptable values for parameters used to estimate the source term, environmental concentrations, and exposures; and the parameters are representative of the _____ *in situ* leach site.

Based on the information provided in the application and the detailed review conducted of total human exposures for the _____ *in situ* leach facility, the staff concludes that the total human exposures are acceptable and are in compliance with 10 CFR 20.1301 which specifies dose limits for individual members of the public.

7.3.1.4.5 Reference

Yuan, Y.C., J.H.C. Wang, and A. Zielen. "MILDOS-AREA: An Enhanced Version of MILDOS for Large-Area Sources." Report ANL/ES-161. Argonne, Illinois: Argonne National Laboratory, Energy and Environmental Systems Division. 1989.

7.3.1.5 Exposures to Flora and Fauna

7.3.1.5.1 Areas of Review

The staff should review estimates of maximum radionuclide concentrations that may be present in important local flora and local and migratory fauna. The staff should also review data, bioaccumulation factors, models, calculations, and assumptions used in support of these estimates.

7.3.1.5.2 Review Procedures

The staff should determine whether estimates of maximum radionuclide concentrations that may be present in important local flora and local and migratory fauna are calculated such that environmental impacts from facility operations can be assessed to address the requirements of 10 CFR Part 51. Particular attention should be paid to impacts to threatened and endangered

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species. The staff should also determine whether these estimates are supported by properly interpreted data, reasonable bioaccumulation factors, approved calculations, and model results using reasonable assumptions. Detailed biosphere modeling is not necessary for these calculations. Output from MILDOS-AREA (Yuan, et al., 1989) provides ground level concentrations of radionuclides that can then be converted to plant and animal concentrations by use of simple conversion equations that include deposition, uptake factors, plant interception fractions, and animal consumption rates obtained from the literature. The staff should spot-check parameter values against known sources to ensure that they are within expected ranges. The tabulation of bioaccumulation factors and their sources can be presented in an appendix to the application. Provided these concentrations are protective of human health, they would not be expected to adversely affect native plants and animals (Barntouse, 1995).

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.3.1.5.3 Acceptance Criteria

The exposures to flora and fauna are acceptable if they meet the following criterion:

- (1) The model and parameter values used for calculation of concentrations of radionuclides in important local flora and fauna are consistent with generally accepted health physics practice and are applicable to the species identified at the site, as reviewed in Section 2.0 of this standard review plan.

7.3.1.5.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the radiological effects from exposures to flora and fauna, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the radiological effects of exposures to flora and fauna at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate radiological effects using the review procedures in standard review plan Section 7.3.1.5.2 and the acceptance criteria outlined in standard review plan Section 7.3.1.5.3.

The applicant forecasts that the off-site radiological impacts of operation will be minimal. Flora and fauna in the areas surrounding the project site are similar to those onsite and are common in the region. Since calculated human exposures are protective of human health, they would not be expected to adversely affect the native plants and animals, and as such, are acceptable.

Based on the information provided in the application and the detailed review conducted of exposures to flora and fauna for the _____ *in situ* leach facility, the staff concludes that the exposures to flora and fauna are acceptable and are in compliance with 10 CFR Part 51 which requires that environmental impacts from facility operations be assessed.

7.3.1.5.5 References

Barnthouse, L.W. "Effects of Ionizing Radiation on Terrestrial Plants and Animals, A Workshop Report." ORNL/TN-13141. Oak Ridge, Tennessee: Oak Ridge National Laboratory. 1995.

Yuan, Y.C., J.H.C. Wang, and A. Zielen. "MILDOS-AREA: An Enhanced Version of MILDOS for Large-Area Sources." Report ANL/ES-161. Argonne, Illinois: Argonne National Laboratory, Energy and Environmental Systems Division. 1989.

7.4 Non-Radiological Effects

7.4.1 Areas of Review

The staff should review estimates of concentrations of nonradioactive constituents in effluents at the points of discharge as compared with natural ambient concentrations and with applicable discharge standards. The review should include the projected effects of the effluents for both acute and chronic exposure of the biota (including any long-term buildup in soils and sediments and in the biota). The staff should evaluate discussions of dilution and mixing of discharge into the receiving environs, and estimates of concentrations at various distances from the point of discharge. The effects on terrestrial and aquatic environments from chemical wastes that contaminate ground water should also be examined.

The staff should also review discussions of any likely consequences of the proposed operation that do not clearly fall under any specific topic previously addressed. These may include changes in land and water use at the project site; sanitary and other recovery plant waste systems; interaction of the facility with other existing or projected neighboring facilities; effects of ground-water withdrawal on ground-water resources in the vicinity of the well field(s) and recovery plant(s); effects of construction and operation of roads, transmission corridors, railroads, et cetera; effects of changes in surface-water availability on biotic populations; and disposal of other solid and liquid wastes.

7.4.2 Review Procedures

The staff should determine whether the estimated concentrations of nonradioactive constituents in effluents at the point of discharge and the projected effects for both acute and chronic exposure of the biota are adequately quantified in accordance with the National Environmental Policy Act requirements in 10 CFR 51.45 and 51.60. Where applicable, the staff should determine whether these estimates are supported by properly interpreted data, reasonable bioaccumulation factors, calculations, and model results using reasonable assumptions.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

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7.4.3 Acceptance Criteria

The non-radiological effects are acceptable if they meet the following criteria:

- (1) The estimated concentrations of nonradioactive wastes in effluents at the point of discharge and the projected effects for both acute and chronic exposure of the biota are adequately quantified in accordance with the National Environmental Policy Act of 1969 requirements in 10 CFR 51.45 and 51.60.

7.4.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the nonradiological effects, the following conclusions may be presented in the environmental assessment.

NRC has completed its review of the nonradiological effects at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate nonradiological effects using the review procedures in standard review plan Section 7.4.2 and the acceptance criteria outlined in standard review plan Section 7.4.3.

The applicant has acceptably described anticipated significant nonradiological environmental impacts from facility operations. The estimated effects of nonradioactive wastes in effluents at the point of discharge and the projected effects for both acute and chronic exposure of biota are acceptable.

Based on the information provided in the application and the detailed review conducted of nonradiological effects for the _____ *in situ* leach facility, the staff concludes that the nonradiological effects are acceptable and are in compliance with 10 CFR Part 51.45 which specifies the content of environmental reports.

7.4.5 References

None.

7.5 Effects of Accidents

7.5.1 Areas of Review

The NRC has evaluated the effects of accidents at *in situ* leach facilities [NUREG-0706 (NRC, 1980); Center for Nuclear Waste Regulatory Analyses, 2001]. These analyses demonstrate that, for most credible potential accidents, consequences are minor so long as effective emergency procedures and properly trained personnel are used. Specific areas where NRC (1980) and Center for Nuclear Waste Regulatory Analyses (2001) indicated that consequences could be significant are (i) radon releases from process streams; (ii) yellowcake dryer explosions; (iii) lixiviant leaks in buried piping between the well fields and the processing facility; and (iv) chemical accidents.

Applicants whose facilities are consistent with the operating assumptions, site features, and designs examined in these NRC analyses need not conduct independent accident analyses. For these applicants, the staff review should focus on accident response procedures and personnel training in their use. Personnel training is evaluated using Section 5.5 of this standard review plan. If an applicant's operating assumptions, site features, and designs are not consistent with these analyses, the applicant must conduct independent accident analyses. In that case, the staff review should evaluate the adequacy of these independent analyses. The scope of this review includes radiological, nonradiological, and transportation accidents. This review should verify that the accident analyses address a spectrum of accidents ranging in severity from trivial to significant, including a characterization of the occurrence rate or probability and likely consequences.

For all applicants, the reviewers should examine standard operating and accident procedures and the training programs for ensuring that personnel can execute them properly. *In situ* leach facility training programs are reviewed using Section 5.5 of this standard review plan.

7.5.2 Review Procedures

For applications that contain independent accident analyses, the staff should determine whether accident scenarios described in the application are reasonable based on descriptions of the facility and operations reviewed in Sections 3.0, 4.0, and 5.0 of this standard review plan and are sufficiently complete to determine environmental impacts of operations pursuant to National Environmental Policy Act requirements. The staff should determine whether these scenarios and estimates are supported by properly interpreted data, calculations, and model results using reasonable assumptions. If consequences cannot be quantified, a qualitative description of the impacts should be reviewed for adequacy. The staff should confirm that uranium extraction industry experience is used to support any accident analyses, including consideration of plant design and specific components that are prone to failure or are known to have failed at other facilities.

For independent analyses of transportation accidents, the staff need not review all operational aspects of transportation activities, as these will be addressed through inspections relevant to the general transportation license requirements.

The staff should ensure the applicant has procedures in place to detect and respond to postulated accident conditions and to mitigate consequences. The reviewers should pay particular attention to procedures related to monitoring, identification, and response to accidents related to: (i) radon release; (ii) yellowcake dryer operations; (iii) leaks in buried lixiviant piping and (iv) chemical releases as they might affect radiological accidents.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

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7.5.3 Acceptance Criteria

The independent analyses of consequences of accidents are acceptable if they meet the following criteria:

- (1) The applicant has provided analyses of credible accident consequences that are consistent with the facility design and planned operations and are sufficient to identify likely environmental impacts from operations.
- (2) Analyses of accident consequences include mitigation measures, as appropriate.
- (3) Analyses of accidents include results from operating experience at similar facilities.
- (4) For radiological accidents, the applicant's response program provides for notification to NRC in compliance with the requirements of 10 CFR 20.2202 and 20.2203.

Adequate procedures to respond to and mitigate or remediate the likely consequences of accidents are identified or referenced in the application.

7.5.4 Evaluation Findings

If the staff's review, as described in this section, results in acceptance of the applicant's description of the effects of accidents, the following conclusions may be presented in the technical evaluation report.

NRC has completed its review of the applicant's description of the effects of accidents for the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate the effects of accidents using the review procedures in standard review plan Section 7.5.2 and the acceptance criteria outlined in standard review plan Section 7.5.3.

The applicant has acceptably described all likely significant effects of accidents from facility operations. The applicant has provided an acceptable analysis of probable accidents and their consequences, if necessary, consistent with facility design, site features, and planned operations. If appropriate, the applicant has confirmed that facility design, site features, and planned operations are consistent with previous NRC accident analyses. The applicant has identified likely environmental impacts from such accidents and has included mitigation measures. Any accident analyses have considered past operating experience from similar facilities. Adequate response and remediation procedures have been identified or referenced, and the facility personnel will be qualified to implement them. The applicant's response program for radiological accidents will comply with the notification requirements of 10 CFR 20.2202 and 20.2203.

Based on the information provided in the application and the detailed review conducted of the effects of accidents for the _____ *in situ* leach facility, the staff concludes that the effects of accidents are acceptable and are in compliance with 10 CFR Part 51.45, which

specifies the content of environmental reports; 10 CFR 40.32(c), which requires that the applicant's proposed equipment, facilities, and procedures be adequate to protect health and minimize danger to life or property; and 10 CFR 20.2202 and 20.2203, which define response program requirements for radiological accidents.

7.5.5 References

Center for Nuclear Waste Regulatory Analyses. NUREG/CR-6733, "A Baseline Risk-Informed, Performance-Based Approach for *In Situ* Leach Uranium Extraction Licenses." San Antonio, Texas: Center for Nuclear Waste Regulatory Analyses. 2001.

NRC. NUREG-0706, "Final Generic Environmental Impact Statement on Uranium Milling—Project M-25." Washington, DC: NRC. September 1980.

7.6 Economic and Social Effects of Construction and Operation

The staff should review descriptions in the application related to the likely economic and social effects of construction and operation of the proposed facility. These impacts should be discussed in separate sections covering benefits, costs, and resources committed.

7.6.1 Benefits

7.6.1.1 Areas of Review

The staff should review social and economic benefits from the proposed *in situ* leach operations that affect various political jurisdictions or public and private interests. Some of these reflect transfer payments or other values that may partially, if not fully, compensate for certain services as well as external or environmental costs, and this fact should be reflected in the designation of the benefit. Some examples of benefits to be reviewed include:

- (1) Tax revenues to be received by local, state, and federal governments.
- (2) Temporary and permanent new jobs created and the associated payroll.
(value-added concept)
- (3) Incremental increases in regional productivity of goods and services.
- (4) Enhancement of recreational values.
- (5) Environmental enhancement in support of the propagation or protection of wildlife and the improvement of wildlife habitats.
- (6) Creation and improvement of local roads, waterways, or other transportation facilities.

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- (7) Increased knowledge of the environment as a consequence of ecological research and environmental monitoring activities associated with plant operation and technological improvements from applicant research programs

The staff should also review discussions of significant benefits that may be realized from construction and operation of the proposed facility, including expressions in monetary terms, discounted to present worth, of who is likely to be affected and for how long. In the case of aesthetic impacts that are difficult to quantify, the staff should review photographs or pictorial drawings of structures or environmental modifications visible to the public.

7.6.1.2 Review Procedures

The staff should determine whether sufficient detail is presented to evaluate significant economic and social benefits that may be realized from construction, operation, restoration, reclamation, and decommissioning of the proposed facility. The staff should determine whether the likely benefits are reasonable and supported by properly interpreted data, calculations, and model results, using reasonable assumptions. The staff should determine to what extent likely benefits can serve to offset adverse effects and costs of construction and operation of the facility. The Standard Format and Contents of License Applications, Including Environmental Reports (NRC, 1982) provides a list of the types of benefits to be included in the application. The NRC has also provided guidance in NUREG-1748 (NRC, 2001) for compliance with requirements of the National Environmental Policy Act.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.6.1.3 Acceptance Criteria

The economic and social effects of construction and operation are acceptable if they meet the following criteria:

- (1) The applicant's analyses of economic and social benefits that may be realized from construction, operation, restoration, reclamation, and decommissioning of the proposed facility are supported by properly interpreted data, calculations, and model results.
- (2) For each benefit identified, the applicant identifies who is affected and the duration of the impact.
- (3) For special case environmental assessments (e.g., those that have substantial public interest, decommissioning costs involving on-site disposal, decommissioning/decontamination cases that allow radioactivity in excess of release criteria, or cases where environmental justice issues have been previously raised) the applicant has provided sufficient data to assess environmental justice issues in accordance with NUREG-1748 (NRC, 2001).

7.6.1.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the effects of the economic and social benefits of construction and operation, the following conclusions may be presented in the environmental assessment.

NRC has completed its review of the economic and social benefits of construction and operation proposed at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate effects of economic and social benefits of construction and operation using the review procedures in standard review plan Section 7.6.1.2 and the acceptance criteria outlined in standard review plan Section 7.6.1.3.

The applicant has acceptably described anticipated economic and social benefits of construction and operation of the facility covering the affected environment and the full extent of activities discussed in Sections 2.0, 3.0, 4.0, 5.0, and 6.0 of the standard review plan. The applicant has provided an acceptable analysis of probable benefits consistent with the facility design and industrywide experience. The applicant has included analyses of: (i) tax revenues; (ii) creation of temporary and permanent jobs and accrued payroll; (iii) incremental increases in regional productivity of goods and services; (iv) enhancement of recreational values; (v) environmental enhancement and increased knowledge of the environment through ecological research and environmental monitoring programs; and (vi) creation and improvement of infrastructure (e.g., roads, waterways, water and power supply, and other transportation facilities). The applicant has acceptably identified for each benefit who is affected and the expected duration of the beneficial effect. Overall, the applicant has demonstrated that the analysis of the economic and social benefits from the construction, operation, restoration, reclamation, and decommissioning of the proposed *in situ* leach facility are supported by properly interpreted data, calculations, and model results.

Based on the information provided in the application and the detailed review conducted of economic and social benefits of construction and operation for the _____ *in situ* leach facility, the staff concludes that the economic and social benefits of construction and operation are acceptable and are in compliance with 10 CFR Part 51.45(c) which requires an analysis that balances the impacts of proposed actions.

7.6.1.5 References

NRC. Regulatory Guide 3.46, "Standard Format and Content of License Applications, Including Environmental Reports, for *In Situ* Uranium Solution Mining." Washington, DC: NRC, Office of Standards Development. 1982.

———. NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. 2001.

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7.6.2 Socioeconomic Costs

7.6.2.1 Areas of Review

The staff should review information presented concerning the ground-water quality restoration, surface reclamation, and plant decommissioning costs; and research and development costs, including postoperational monitoring requirements. The applicant should discount these costs to present worth. Resource commitments are addressed in Section 7.6.3 of this standard review plan.

The staff should also review information on external costs, including the probable number and location of the population group is adversely affected, the estimated economic and social impact, and any special measures taken to alleviate the impact. Environmental justice considerations are presented in NUREG-1748 (NRC, 2001).

Temporary external costs should also be evaluated including housing shortages; inflationary rentals or prices; congestion of local streets and highways; noise and temporary aesthetic disturbances; overloading of utilities, water supply, and sewage treatment facilities; crowding of local schools, hospitals, or other public facilities; overtaxing of community services; and disruption of people's lives or of the local community caused by acquisition of land for the proposed site.

Finally, the staff should review information regarding long-term external costs including: (i) impairment of recreational values (e.g., reduced availability of desired species of wildlife and sport animals, or restrictions on access to land or water areas preferred for recreational use); (ii) deterioration of aesthetic and scenic values; (iii) restrictions on access to areas of scenic, historic, or cultural interest; (iv) degradation of areas having historic, cultural, natural, or archeological value; (v) removal of land from present or contemplated alternate uses; (vi) reduction in quantities of regional products because of displacement of persons from the land proposed for the site; (vii) lost income from recreation or tourism that may be impaired by environmental disturbances; (viii) lost income attributable to environmental degradation; (ix) decrease in real estate values in areas adjacent to the proposed facility; and (x) increased costs to local governments for the services required by the permanently employed workers and their families. In discussing these costs, the applicant should indicate, to the extent practical, who is likely to be affected, to what degree, and for how long.

7.6.2.2 Review Procedures

The staff should determine whether sufficient detail is presented to evaluate significant economic and social internal and external costs that may be incurred during construction, operation, restoration, reclamation, and decommissioning of the proposed facility. The assessment of costs should be reviewed in the context of the information provided in other chapters of the application as reviewed in Sections 2.0, 3.0, 4.0, 5.0, and 6.0 of this standard review plan to ensure consistency and completeness. The staff should review any data, models, calculations, and assumptions used in support of these projections. The staff should ensure the applicant has identified who it is that will bear the cost, the number of such people,

the duration of the impacts, and what measures will be taken to mitigate the impacts. Costs should be discounted to present worth. The NRC has provided guidance in NUREG-1748 (NRC, 2001) for compliance with the socioeconomic requirements of the National Environmental Policy Act.

For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications.

7.6.2.3 Acceptance Criteria

The costs of the *in situ* leach operations are acceptable if they meet the following criteria:

- (1) The analyses of economic and social costs that may be realized from construction, operation, restoration, reclamation, and decommissioning of the proposed facility are supported by properly interpreted data, calculations, and model results.
- (2) For each cost identified, the applicant identifies who is affected, the duration of impacts, and any mitigation measures necessary to alleviate or reduce impacts.
- (3) Costs are discounted to present worth.

7.6.2.4 Evaluation Findings

If the staff review, as described in this section, results in the acceptance of the effects of the economic and social costs of construction and operation, the following conclusions may be presented in the environmental assessment.

NRC has completed its review of the effects of economic and social costs of construction, operation, restoration, reclamation, and decommissioning operations proposed at the _____ *in situ* leach facility. This review included an evaluation of the methods that will be used to evaluate effects of economic and social costs of construction and operation using the review procedures in standard review plan Section 7.6.2.2 and the acceptance criteria outlined in standard review plan Section 7.6.2.3.

The applicant has acceptably described all anticipated economic and social costs of construction and operation of the facility covering the affected environment and the full extent of activities discussed in Sections 2.0, 3.0, 4.0, 5.0, and 6.0 of this standard review plan. The applicant has provided an acceptable analysis of probable costs consistent with the facility design and industrywide experience. The applicant has included analyses of (i) impairment of recreational values; (ii) restriction on access to water or land for recreational use; (iii) restriction on access to areas of scenic, historic, or cultural interest; (iv) deterioration of aesthetic and scenic values; (v) degradation of areas having historic, cultural, natural, or archeological values; (vi) removal of land from present or contemplated alternative uses; (vii) reductions in quantities of regional products; (viii) lost income from recreation or tourism that may be impaired by environmental disturbances; (ix) lost income attributable to environmental degradation;

(x) decrease in real estate values adjacent to the proposed facility; and (xi) increased costs to local governments for increased services and infrastructure. The applicant has identified for each cost who is affected, to what extent, and the expected duration of the effect. Overall, the applicant has demonstrated that the analysis of the economic and social costs from the construction, operation, restoration, reclamation, and decommissioning of the proposed *in situ* leach facility is supported by acceptably interpreted data, calculations, and model results.

Based on the information provided in the application and the detailed review conducted of economic and social costs of construction and operation for the _____ *in situ* leach facility, the staff concludes that the economic and social costs of construction and operation are acceptable and are in compliance with 10 CFR Part 51.45(c) which requires an analysis that balances the impacts of proposed actions.

7.6.2.5 Reference

NRC. NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. 2001.