Appendix E

Evaluation Process for Identifying the Environmental Impacts of Decommissioning Activities

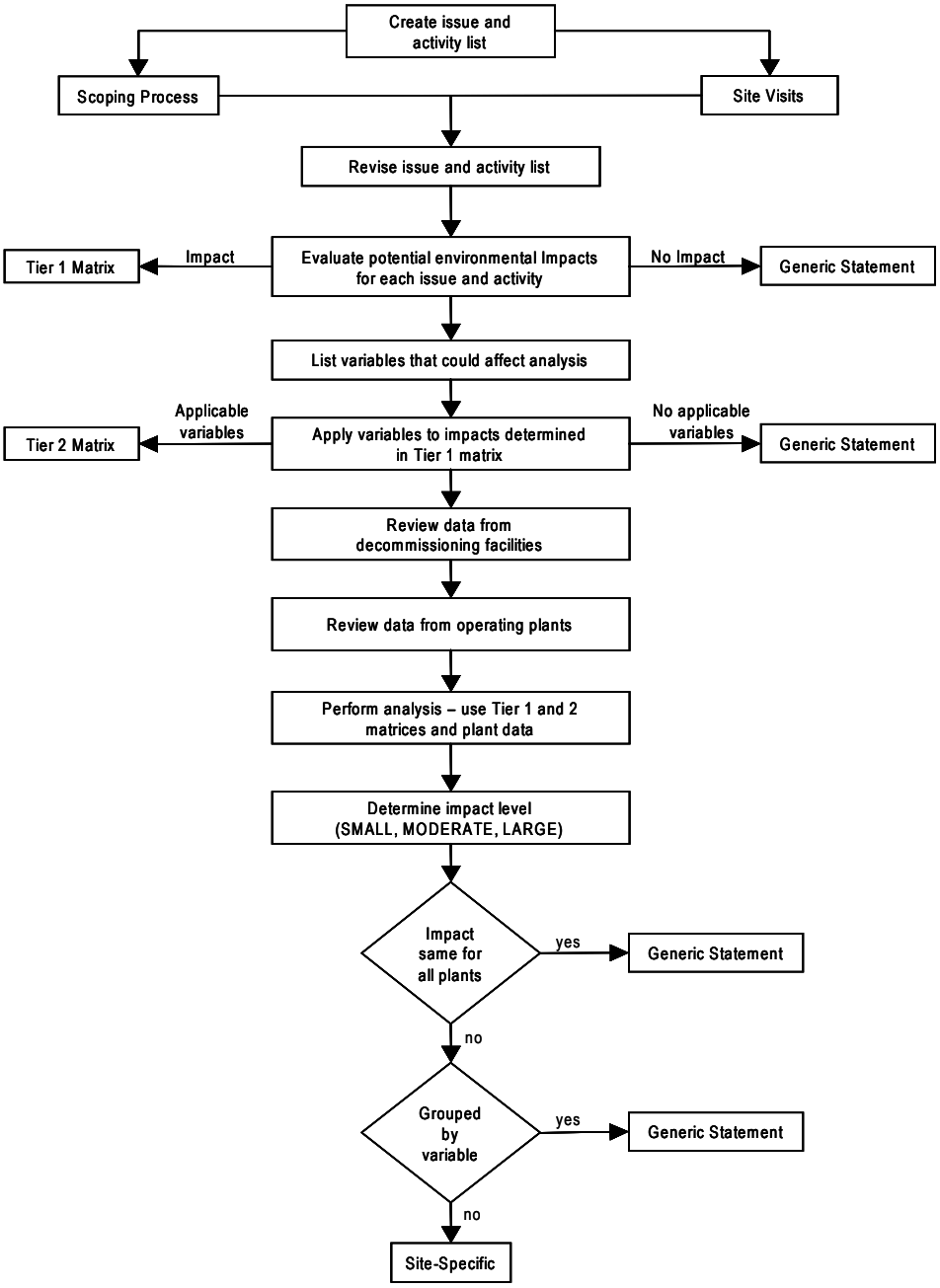
Appendix E

Evaluation Process for Identifying the Environmental Impacts of Decommissioning Activities

This appendix describes the process that the staff used to determine the environmental impacts from decommissioning nuclear power facilities. Figure E-1 is a flowchart showing the evaluation process. The staff first created an initial list of environmental issues and decommissioning activities that this Supplement should address (Table E-1). The initial list of environmental issues was developed from the issues identified in the 1988 GEIS and the list specified in 10 CFR Part 51, Subpart A, Appendix B, for license renewal. The initial list of decommissioning activities was based on experience and the literature discussed in Section 3.2 of this Supplement. The staff used these initial lists of environmental issues and decommissioning activities for discussions during the scoping process (Section 1.3). At the conclusion of the scoping process and six site visits, the staff refined these two lists, based on comments from the public, the industry, the specific sites visited, the States, and other Federal agencies. During the scoping process, the staff visited the sites given in Table E-2 and gathered information about the sites' decommissioning experiences. The sites were chosen to represent a variety of types of sites in various stages of decommissioning.

As a means of documenting the evaluation process, the staff chose to use a two-tier matrix system. In the Tier 1 (Table E-3) matrix, the environmental issues are listed on the horizontal axis and the decommissioning activities are listed on the vertical axis. Each activity in the list is grouped into broad categories meant to include a variety of specific activities. The list of activities is fairly comprehensive and includes new technologies that are being used or considered in this Supplement. It is likely that other innovative decommissioning options or activities not included in this document will be developed by licensees in the future. Any such new activities would then not fall under the conclusions of this Supplement and would need to be analyzed on a site-specific basis.

After compiling the environmental issue and decommissioning activity lists, the staff assessed which activities might have environmental impacts for each of the issues. The Tier 1 matrix (Table E-3) also shows the result of this evaluation. The Tier 1 matrix identifies impacts that occur for issues related to specific activities during the decommissioning process. In developing the Tier 1 matrix, the staff asked, "Does the issue apply to this activity and are there potential environmental impacts?" If the answer was "yes," the staff placed an "X" in the matrix to designate the need for an analysis in the Supplement. For example, the transfer of the



* **Figure E-1**. Environmental Impact Evaluation Process

Table E-1. First- and Second-Tier Matrices Issues and Activities

Issues
Onsite/offsite land use
Water use
Water quality
Air quality
Aquatic ecology
Terrestrial ecology
Threatened and Endangered Species
Radiological
Radiological accidents
Occupational issues
Cost
Socioeconomics
Environmental justice
Cultural impacts
Aesthetic issues
Noise

Activities
Remove fuel
Organizational changes
Stabilization
Post-shutdown surveys
Create nuclear island
Chemical decontamination of primary loop
Large component removal
Storage preparation activities for SAFSTOR
Storage (SAFSTOR)
Decontamination and Dismantlement phases of DECON, SAFSTOR, and ENTOMB1
System dismantlement
Structure dismantlement
Entombment
Low-level waste packaging and storage
Transportation
License termination activities

Table E-2. Site Visits

Nuclear Plant	Description	Plant Type	Thermal Power	Decommissioning Method
Big Rock Point	Single nuclear unit	BWR[a]	240 MW	DECON
Humboldt Bay, Unit 3	Single nuclear plant at multi-unit fossil fuel facility	BWR	200 MW	SAFSTOR
Maine Yankee	Single nuclear unit	PWR[b]	2700 MW	DECON
Rancho Seco	Single nuclear unit	PWR	2772 MW	SAFSTOR
Trojan	Single nuclear unit	PWR	3411 MW	DECON
Zion, Units 1 and 2	Multiple nuclear units	PWR	3250 MW	SAFSTOR

(a) boiling water reactor.
(b) pressurized water reactor.

fuel from the reactor vessel to the spent fuel pool (an activity that occurs inside the facility) would not result in aesthetic or noise issues. On the other hand, this activity would result in a radiation dose to the workers (radiological) and could potentially cause a radiological accident. In some cases, correlation between the activity and the issue was not clear. In these cases, the staff chose to place an "X" in the matrix to ensure further analysis of the impact. This is the case with the issues of water use for the activity of transferring fuel to the spent fuel pool. The water that is used in this process is very small compared to the amount of water used to cool the reactor during operations. However, the staff placed an "X" in the matrix to make sure that the water-use issue is addressed completely in this Supplement.

Typically, environmental impact statements analyze transportation as an issue and not an activity. However, the staff determined that in the case of decommissioning nuclear power reactors, transportation is an activity, not an issue. Because there are several transportation-based impacts related to decommissioning nuclear power facilities, transportation is addressed in its own section (4.3.17) in this Supplement.

After completing the Tier 1 matrix, the next step was to identify the variables that might affect the environmental impact for a specific issue. These variables include some of the obvious differences between reactor facilities such as whether the facility is a pressurized water reactor, boiling water reactor, or other type of reactor, whether it is a multi-unit site and what type of cooling system is used. The staff also looked at variables that would impact a licensee's decision concerning types of activities or how an activity would be conducted. For example, the proximity of the facility to a barge slip or railroad might affect a licensee's decision to remove the steam generator or other large components intact and ship them to a waste site. If the barge slip needs additional dredging or an additional railroad line needs to be installed, then the environmental impacts may change. Table E-4 lists the variables, their abbreviations as they appear in the Tier 2 matrix (Table E-5), and the characteristics, if appropriate, for each variable.

The staff then considered each of the impact areas identified in the Tier 1 matrix, and asked, "When the variables are considered, do the environmental impacts change?" If the answer was "no" for each variable, then the "X" in the box was retained to signify that the variables do not change the analysis. If the answer was "yes," then a second question was considered: "What variables could significantly change the impact for a specific activity and issue?" Variables that could significantly change the impact were listed by their abbreviation in the appropriate box in the matrix (see Table E-3 for the abbreviations). By asking these questions, the staff developed the Tier 2 matrix shown in Table E-5. The staff used the Tier 2 matrix as the starting point for the analysis of the environmental impacts of the decommissioning activities for each of the applicable issues and variables.

The analyses that are presented in the following sections are based on the information in the Tier 2 matrix. The data used in the analyses was obtained from several sources:

- documents such as post-shutdown decommissioning activity reports, final environmental statements, environmental reports, and license termination plans for permanently shutdown and decommissioning facilities
- site visits
- information gathered from permanently shutdown and decommissioning facilities with the assistance of the Nuclear Energy Institute
- currently operating facilities (primarily from NUREG-1437 [NRC 1996]).

The analyses in this Supplement include data from both operating and decommissioning facilities in order to appropriately span the range of impacts so that future decommissioning facilities will be able to use this Supplement. The data from the decommissioning facilities was used to determine whether an activity and associated issue can be considered generic. The reason for including the operating facilities is that they will eventually decommission. Also, many of the plants that have decommissioned were the smaller, older facilities.

E.1 References

10 CFR 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions."

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, NRC, Washington, D.C.

Table E-3. Tier 1 Matrix - Decommissioning Activities and Issues

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Radiological Accidents	Occupational	Cost	Socioeconomic	Environmental Justice	Cultural Impacts	Aesthetic issues	Noise	Irretrievable Resources
1. Remove Fuel																	
- Transfer fuel to spent fuel pool		X	X					X	X								
- Drain primary system			X					X	X		X						
- Process liquid			X						X		X						
2. Organizational Changes																	
- Reduce staff		X						X			X	X	X				
- Employ contractor or other additional staff		X		X				X			X	X	X				
- Adjust site training								X			X						
- Changes to licensing basis - site-specific											X						
3. Stabilization																	
- Drain and flush system			X					X	X		X						
- Isolate systems, structures, and components that are no longer required								X			X						
- Rewiring of site to eliminate unneeded electrical circuits						X	X	X		X	X			X			
4. Post-Shutdown Surveys																	
- Baseline surveys for the decontamination work								X			X						
- Continual surveys								X			X						
5. Create Nuclear Island																	
- Install electrical power supply to spent fuel pool								X		X	X						
- Reduce the security area to just that around the fuel											X						
- Change security function											X						
- Install or modify chemistry controls																	

"X" indicates where there may be an impact from decommissioning activities.

Table E-3. (contd)

Activities	Issues																	
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Radiological Accidents	Occupational	Cost	Socioeconomic	Environmental Justice	Cultural Impacts	Aesthetic issues	Noise	Irretrievable Resources
- Move old or install new security-related equipment								X		X	X						
6. Chemical Decontamination of primary loop																	
- Cutting, chemicals in, chemicals out, cleanup/decon								X	X	X	X						
7. Large Component Removal																	
- Remove reactor vessel and internals intact or cut up	X	X				X	X	X	X	X	X			X			
- Steam generator and other large components removed intact or cut up	X					X	X	X	X	X	X			X			
8. Storage Preparation Activities for SAFSTOR																	
- Establish a reactor coolant system vent pathway				X				X			X						
- Establish containment vent pathway				X				X			X						
- De-energize systems, put in monitors where they are needed								X		X	X						
- Perform a radiological assessment								X			X						
9. Storage (SAFSTOR)																	
- Monitor systems and radiation levels etc.								X			X						
- Do preventive and corrective maintenance on SSCs								X			X						
- Maintain the security system											X						
- Maintain effluent and environmental monitoring programs				X							X						

"X" indicates where there may be an impact from decommissioning activities.

Table E-3. (contd)

Activities	Issues																	
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Radiological Accidents	Occupational	Cost	Socioeconomic	Environmental Justice	Cultural Impacts	Aesthetic issues	Noise	Irretrievable Resources
10. Decontamination and Dismantlement phases of DECON, SAFSTOR, and ENTOMB 1																	
- Chemical decontamination (surface/specific components)								X	X		X						
- Decontamination of piping inside walls								X	X	X	X						
- High-pressure water sprays of surface		X	X					X	X		X						
- Remove contaminated soil from specific areas						X	X	X		X	X			X			
- Do preventive and corrective maintenance on SSCs								X			X						
- Maintain the security system											X						
- Maintain effluent and environmental monitoring programs				X							X						
11. System Dismantlement																	
- Cut out radioactive piping								X	X		X						X
- Remove large and small tanks or other radioactive components from the facility								X	X		X						X
12. Structure Dismantlement																	
- Rubblization	X	X	X	X				X		X	X				X	X	X
- Remove structures that are necessary for plant operation	X	X		X	X			X	X	X	X				X	X	X
13. Entombment																	
- Install engineered barriers				X				X		X	X				X	X	
- Disconnect operational systems (e.g. electrical and fire protection)								X		X	X						

"X" indicates where there may be an impact from decommissioning activities.

Table E-3. (contd)

Activities	Issues																	
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Radiological Accidents	Occupational	Cost	Socioeconomic	Environmental Justice	Cultural Impacts	Aesthetic issues	Noise	Irretrievable Resources
- Remove all radioactive material that is outside of containment								X		X	X					X	
- Place material inside containment								X		X	X						
- Lower containment ceiling (optional)		X		X				X	X	X	X						
- Entomb facility in concrete		X		X						X	X				X	X	
14. LLW packaging and storage	X							X	X		X						X
15. Transportation																	
- Large components				X				X	X		X		X				X
- LLW				X				X	X		X		X				X
- Equipment into site				X							X						
- Backfill trucked into site				X							X						X
- Nonradioactive waste				X							X						X
16. License Termination Activities																	
- Complete final radiation survey								X			X						
- Partial site release																	
"X" indicates where there may be an impact from decommissioning activities.																	

Table E-4. Tier 2 Matrix Variables

Variable Abbreviation	Variable	Variable Characteristics
Type	Type of plant	PWR, BWR, HTGR, FBR
Size	Size of plant	Based on the facility thermal power capability
Loc	Population characteristics	Rural, urban
Env	Environmental features	Coastal, desert, lake, river shoreline, other
Cool Sys	Cooling system type	Closed cycle, once-through cooling
Cool	Cooling water source	Reservoir, lake, river or creek, ocean, canal, bay, pond, canal, sewage treatment plant
Grdwater	Groundwater usage/proximity to groundwater	
Fuel Loc	Fuel location - as a function of time	Spent fuel pool, ISFSI, away from reactor
Ops	Off-normal radiological operational events	Failed or leaking fuel, contaminated soil
Interim Time	Time between last shutdown and initiation of decommissioning	
Decom Opt	Decommissioning option	SAFSTOR, DECON, ENTOMB
Store Time	Duration of storage period for plants in deferred DECON/SAFSTOR	
Struct	Disposition of structures during decommissioning	Remain onsite, sent to a LLW site or vendor, entombed, landfill, rubblized
LLW	Distance traveled for disposal of LLW	
Gas Emissions	Method used to control gaseous radioactive effluents	
Land Mass	Land mass (footprint) of the site	
Culture	Cultural resources	Known/unknown, present/absent
Multi-Unit	Single unit versus multi-unit sites with other operating units	
Trans Prox	Proximity of barge/train transportation	

Table E-5. Tier 2 Matrix - Decommissioning Activities, Issues, and Variables

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occupational Issues	Cost	Socioeconomic	Environmental Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
1. Remove fuel																	
Transfer fuel to spent fuel pool		X	X					Ops; Interim Time	Ops; Interim Time								
Drain primary system			X					Ops; Interim Time; Decom Opt; Store Time	Ops; Interim Time; Decom Opt; Store Time		Interim Time; Decom Opt; Store Time						
Process liquid			X						Ops; Interim Time		Type; Size						
2. Organizational changes																	
Reduce staff		X						Type; Size			Type; Size; Decom Opt; Store Time	Size; Loc; Multi-Unit	Size; Loc; Multi-Unit				
Employ contractor or other additional staff		X		Size Loc; Decom Opt				Type; Size; Decom Opt; Store Time			Type; Size; Decom Opt; Store Time	Type; Size; Loc; Multi-Unit	Type; Size; Loc; Multi-Unit				

"X" indicates that none of the variables change the analysis.

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
Adjust site training								Type; Size; Decom Opt; Store Time			Type; Size; Decom Opt; Store Time						
Changes to licensing basis - site-specific											Type; Size; Decom Opt; Store Time						
3. Stabilization																	
Drain and flush system			X					Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Ops; Interim Time; Decom Opt; Store Time		Type; Size; Ops; Interim Time; Decom Opt; Store Time						
Isolate systems, structures, and components that are no longer required								Type; Size; Ops; Interim Time; Decom Opt; Store Time			Type; Size; Ops; Interim Time; Decom Opt; Store Time						
"X" indicates that none of the variables change the analysis.																	

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
Rewiring of site to eliminate unneeded electrical circuits						Loc; Env; Land Mass	Loc; Env; Land Mass	Type; Size; Ops; Interim Time; Decom Opt; Store Time		Type; Size; Decom Opt	Type; Size; Ops; Interim Time; Decom Opt; Store Time			Loc; Land Mass			
4. Post-shutdown surveys																	
Baseline surveys for the decontamination work								Type; Size; Ops; Interim Time; Decom Opt; Land Mass			Type; Size; Ops; Interim Time; Decom Opt; Land Mass						
Continual surveys								Type; Size; Ops; Interim Time; Decom Opt; Store Time; Land Mass			Type; Size; Ops; Interim Time; Decom Opt; Land Mass						
"X" indicates that none of the variables change the analysis.																	

Table E-5. (contd)

Activities	Issues																	
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
5. Create nuclear island																		
Install electrical power supply to spent fuel pool								Ops; Interim Time		Size	X							
Reduce the security area to just that around the fuel											X							
Change security function											X							
Install or modify chemistry controls																		
Move old or install new security-related equipment								Ops; Interim Time		Size; Land Mass	X							
6. Chemical decontamination of primary loop																		
Cutting, chemicals in, chemicals out, cleanup/ decontamination								Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Decom Opt	Type; Size; Ops; Interim Time; Decom Opt; Store Time							
"X" indicates that none of the variables change the analysis.																		

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
7. Large component removal																	
Remove reactor vessel and internals intact or cut up	Env; Land Mass	X				Trans Prox	Trans Prox	Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Decom Opt	Type; Size; Ops; Interim Time; Decom Opt; Store Time; Trans Prox			Trans Prox			
Steam generator and other large components removed intact or cut up	Env; Land Mass					Trans Prox	Trans Prox	Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Decom Opt	Type; Size; Ops; Interim Time; Decom Opt; Store Time; Trans Prox			Trams Prox.			
8. Storage preparation activities for SAFSTOR																	
Establish a reactor coolant system vent pathway				Gas Emissions				Type; Size; Ops; Interim Time; Store Time			Type; Size; Ops; Interim Time; Store Time						

"X" indicates that none of the variables change the analysis.

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
Establish containment vent pathway				Gas Emissions				Type; Size; Ops; Interim Time; Store Time			Type; Size; Ops; Interim Time; Store Time						
De-energize systems, put in monitors where they are needed								Type; Size; Ops; Interim Time; Store Time		Type; Size	Type; Size; Ops; Interim Time; Store Time						
Perform a radiological asessment								Type; Size; Ops; Interim Time; Store Time			Type; Size; Ops; Interim Time; Store Time						
9. Storage (SAFSTOR)																	
Monitor systems and radiation levels, etc.								Type; Size; Interim Time; Store Time			Type; Size; Store Time						
"X" indicates that none of the variables change the analysis.																	

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
Do preventive and corrective maintenance on SSCs								Type; Size; Interim Time; Store Time			Type; Size; Store Time						
Maintain the security system											Store Time; Multi-Unit						
Maintain effluent and environmental monitoring programs				Gas Emissions							Store Time; Multi-Unit						
10. Decontamination and Dismantlement phases of DECON, SAFSTOR, and ENTOMB1																	
Chemical decontamination (surface/specific components)								Type; Size; Ops; Interim Time; Store Time	Type; Size; Ops; Interim Time; Store Time		Type; Size; Ops; Interim Time; Store Time						
Decontamination of piping inside walls								Type; Size; Ops; Interim Time; Store Time	Type; Size; Ops; Interim Time; Store Time	Type; Size	Type; Size; Ops; Interim Time; Store Time						
"X" indicates that none of the variables change the analysis.																	

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
High pressure water sprays of surface		X	X					Type; Size; Ops; Interim Time; Store Time	Type; Size; Ops; Interim Time; Store Time		Type; Size; Ops; Interim Time; Store Time						
Remove contaminated soil from specific areas						Loc; Env; Land Mass	Loc; Env; Land Mass	Type; Size; Ops; Interim Time; Store Time		Type; Size	Type; Size; Ops; Interim Time; Store Time			Loc; Land Mass			
Do preventive and corrective maintenance on SSCs								Type; Size; Ops; Interim Time; Store Time			Type; Size; Ops; Interim Time; Store Time						
Maintain the security system											Type; Multi-Unit						

"X" indicates that none of the variables change the analysis.

Table E-5. (contd)

	Issues																	
Activities	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
Maintain effluent and environmental monitoring programs				Gas Emissions							Type; Multi-Unit						
11. System dismantlement																	
Cut out radioactive piping								Type; Size; Ops; Interim Time; Decom Opt; Store Time; Struct	Type; Size; Ops; Interim Time; Decom Opt; Store Time; Struct		Type; Size; Ops; Interim Time; Decom Opt; Store Time; Struct						
Remove large and small tanks or other radioactive components from the facility								Type; Size; Ops; Interim Time; Decom Opt; Store Time; Struct	Type; Size; Ops; Interim Time; Decom Opt; Store Time; Struct		Type; Size; Ops; Interim Time; Decom Opt; Store Time; Struct						
"X" indicates that none of the variables change the analysis.																	

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
12. Structure Dismantlement																	
Rubblization	Size	Size	Grd-water	Size; Loc; Land Mass				Type; Size; Loc; Ops; Interim Time; Decom Opt; Store Time		X	Size				X	X	X
Remove structures that are necessary for plant operation	Size; Loc; Land Mass	Size; Struct		Type; Size; Struct	Size; Loc			Type; Size; Loc; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Loc; Ops; Interim Time; Decom Opt; Store Time	Size; Decom Opt; Land Mass	Type; Size; Loc; Ops; Interim Time; Decom Opt; Store Time				Size; Loc	Size; Loc	Size; Decom Opt
13. Entombment																	
Install engineered barriers				Size				Size		X	Size				X	X	
Disconnect operational systems (e.g., electrical and fire protection)								Size		X	Size						
"X" indicates that none of the variables change the analysis.																	

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
Remove all radioactive material that is outside of containment								Type; Size		X	Type; Size					Type; Size; Land Mass	
Place material inside containment										X	Size						
Lower containment ceiling (optional)		X		Type; Size				Type; Size; Ops; Interim Time	Type; Size; Ops; Interim Time	X	Size						
ENTOMB facility in concrete		X		Type; Size				Type; Size; Ops; Interim Time		X	Size				X	X	
14. LLW packaging and storage and disposal	X							Type; Size; Ops; Interim Time; Decom Opt; Store Time	Type; Size; Ops; Interim Time; Decom Opt; Store Time		Type; Size; Ops; Interim Time; Decom Opt; Store Time						Type; Size; Ops; Interim Time; Decom Opt; Store Time

"X" indicates that none of the variables change the analysis.

Table E-5. (contd)

	Issues																	
Activities	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
15. Transportation																	
Large components				Size; Loc; Env; Decom Opt				LLW; Trans Prox	LLW; Trans Prox		LLW; Trans Prox		LLW; Trans Prox				X
LLW				Trans Prox; Size; Loc; Env; Decom Opt; LLW				LLW	LLW		LLW		Size; Loc; Env				X
Equipment into site				Decom Opt; Trans Prox							Trans Prox						
Backfill trucked into site				Size; Decom Opt							Size; Decom Opt; Land Mass; Trans Prox						X
"X" indicates that none of the variables change the analysis.																	

Table E-5. (contd)

Activities	Issues																
	Onsite/Offsite Land Use	Water Use	Water Quality	Air Quality	Aquatic Ecology	Terrestrial Ecology	Threatened and Endangered Species	Radiological	Rad Accidents	Occ Issues	Cost	Socioeconomic	Env Justice	Cultural Impacts	Aesthetic Issues	Noise	Irretrievable Resources
Nonradioactive waste				Size; Loc; Env; Struct; Decom Opt; Trans Prox							Type; Size; Decom Opt						X
16. License Termination Activities																	
Complete final radiation survey								X			Size; Type; Decom Opt; Land Mass						
Partial site release																	
"X" indicates that none of the variables change the analysis.																	