Part 2 – Evaluation of the INEEL, Portsmouth, and Savannah River Sites

1. Site Descriptions

1.1 INEEL Site

1.1.1 Site and Vicinity

INEEL is one of nine multiprogram laboratories in the U. S. Department of Energy (DOE) complex. The INEEL site measures approximately 37.5 miles north to south and about 34.8 miles east to west and encompasses 890 square miles. INEEL is located in Idaho on the northwest edge of the Upper Snake River Plain at the southeast foot of the Lost River, Lemhi, and Beaverhead Mountain ranges. Most of the site is located in Butte County, but portions are also in Bingham, Bonneville, Jefferson, and Clark counties.

INEEL was designated as an exclusion area to build, test, and operate various nuclear reactors and associated facilities. The isolated location was chosen to ensure maximum public safety. The portions of the INEEL site boundary nearest to adjacent communities are 29 miles west of Idaho Falls, 32 miles northwest of Blackfoot, 50 miles northwest of Pocatello, and 7 miles east of Arco. INEEL has no permanent residents, and ingress and egress of site personnel for performance of their duties and visiting personnel on official business is strictly controlled. No casual visitations are permitted, except for people driving through INEEL on the public highways and visitors to the Experimental Breeder Reactor Number 1 (EBR-I), a National Historical Monument, which is open to the public during the summer. The only recreational activity allowed within INEEL is limited hunting, and limited grazing is allowed subject to special requirements.

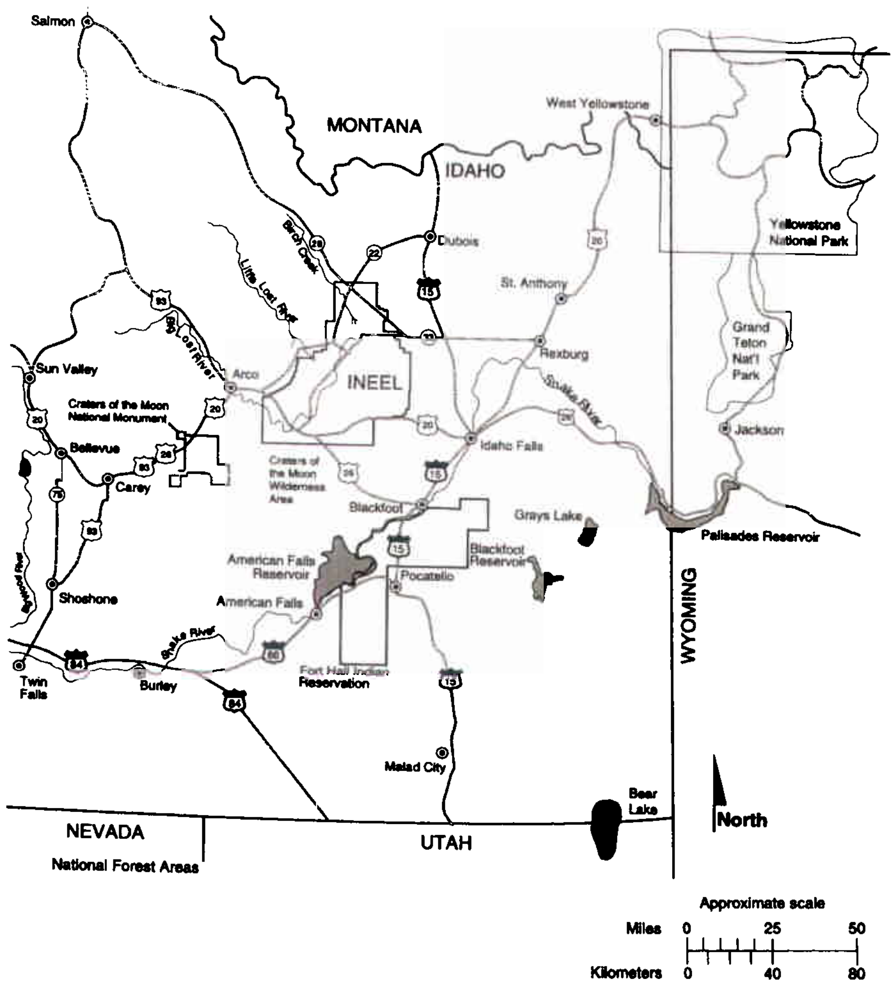
The INEEL site is situated in a broad, mostly flat plain averaging 4865 feet above MSL. The Big Lost River runs through the INEEL site, and this river is the one nearest to the preferred location–about 1.5 miles distant. The section of the river on the INEEL site is a runoff channel from the mountains to the northwest. Water flows intermittently during the spring and winter only, sinking through the basaltic lava rock underlying the INEEL into a huge natural underground reservoir of water known as the Snake River Plain Aquifer, which lies about 450 feet below grade. All surface water entering the INEEL site sinks below the ground surface within the INEEL site boundary.

The principal surface materials at the INEEL site are basalt, alluvium, lakebed or lacustrine sediments, slope wash sediments and talus, silicic volcanic rocks, and sedimentary rocks. The natural plant life consists mainly of sagebrush and various grasses. The site vegetation is limited by soil type, meager rainfall, and extended drought periods. Only a few deciduous trees, found principally along the Big Lost River, exist on the site. The most prominent ground cover is a mixture of vegetation consisting of sagebrush and a variety of grasses. Lanceleaf rabbit brush covers about 80 percent of INEEL and can be found in any given area.

Four major all-weather highways serve the site. The Union Pacific Railroad crosses the southwest corner of the site, and a spur line provides interchange for site facilities. Transmission lines owned by Idaho Power Company and Utah Power & Light Company supply electrical power to the site. There are no oil or gas pipelines passing through the site.

The INEEL site vicinity is shown in Figure 1–1.

Figure 1-1 **Idaho National Engineering and Environmental Laboratory Site Vicinity Map**



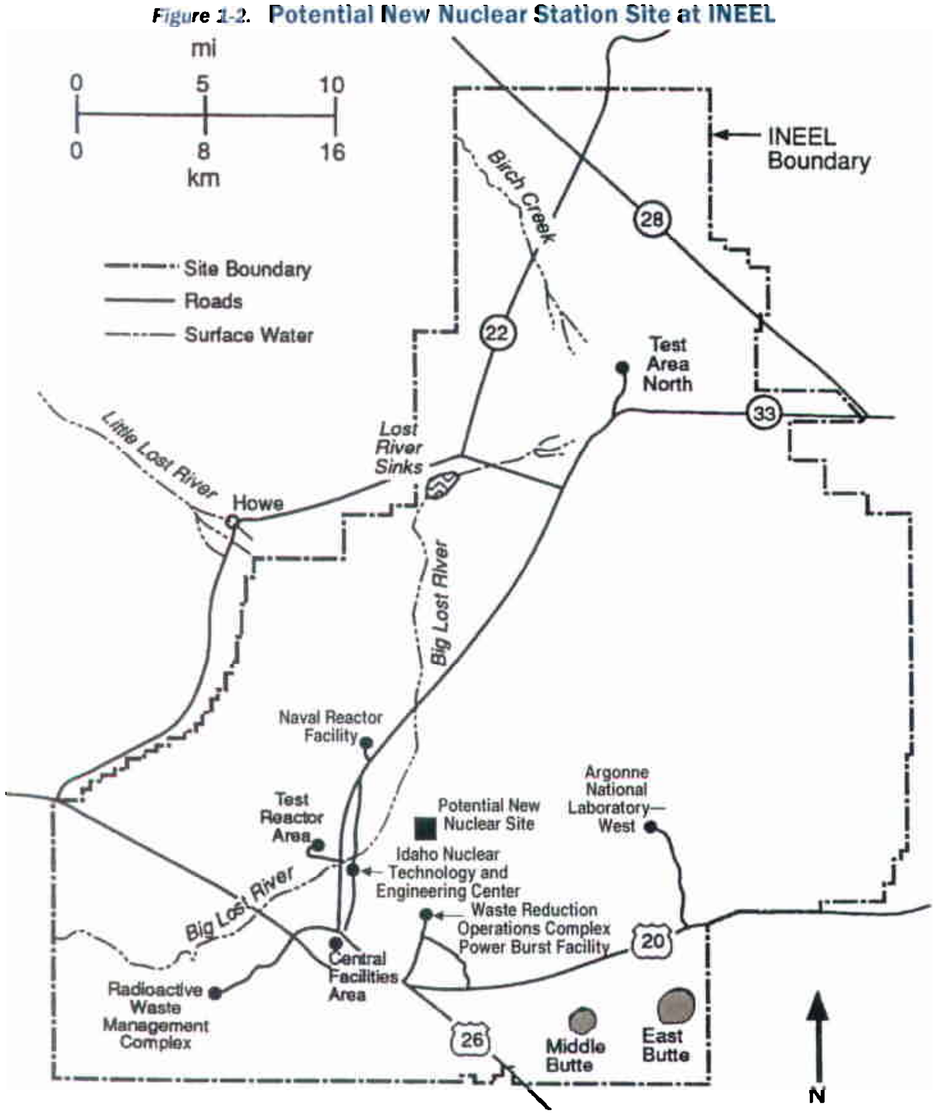
Source: "The Safety Analysis Report for the INEEL TMI-2 Independent Spent Fuel Storage Installation," Docket No. 72-20, Rev. 0, October 1996

1.1.2 Proposed Location of New Nuclear Generating Units

The location evaluated in this report for locating a new nuclear generating station was the preferred site at INEEL for a New Production Reactor (NPR). The site is square and is about 1235 acres in size (approximately 1.9 miles on each side). The site is about 0.5 miles north and 2 miles east of the Idaho Nuclear Technology and Engineering Center facility. The nearest INEEL site boundary is about 9 miles south.

The approximate location of the 1235-acre preferred site is shown in Figure 1-2.

Figure 1-2. Potential New Nuclear Station Site at INEEL



Source: Adapted from "Environmental and Other Evaluation of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity," DOE/NP-0014, September 1992, and INEEL Site Visit Presentation Dated April 29, 2002.

1.1.3 References

1. "The Safety Analysis Report for the INEL TMI-2 Independent Spent Fuel Storage Installation," Docket No. 72-20, Revision 0, October 1996.

2. "Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity," September 1992, DOE/NP-0014.

1.2 Portsmouth Site

1.2.1 Site and Vicinity

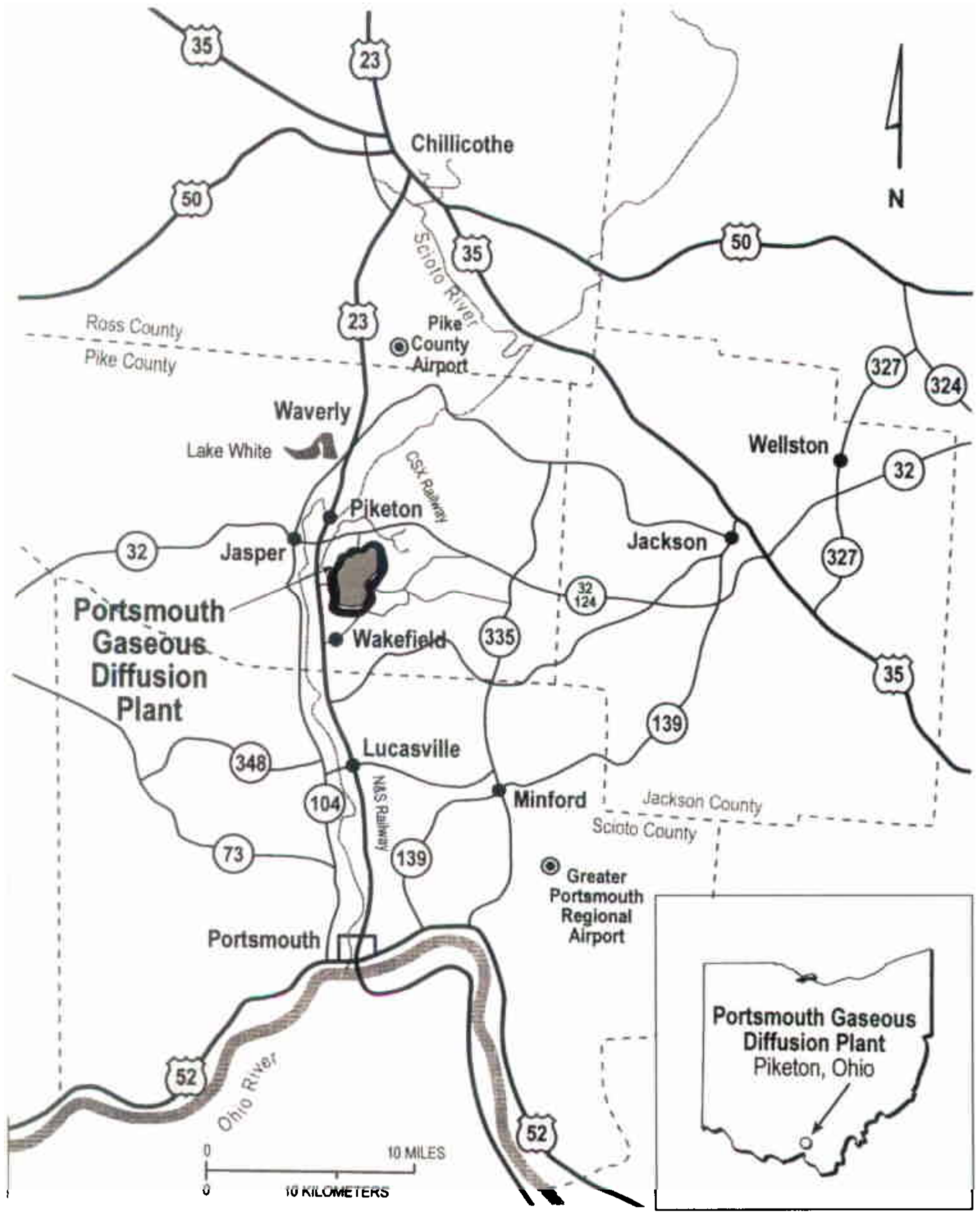
The Portsmouth site is an approximate 3700-acre parcel of DOE-owned land in sparsely populated, rural Pike County in south central Ohio. The area was previously farmland and the watershed for several intermittent streams. The site is about 65 miles south of Columbus, Ohio, and 75 miles east of Cincinnati, Ohio, the two closet metropolitan areas. The cities of Portsmouth and Chillicothe, Ohio, are situated about 20 miles from the site. The nearest residential center is Piketon, which is about 5 miles north of the site. The county's largest community, Waverly, Ohio, is about 10 miles north of the site. The terrain surrounding the site, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River floodplain is farmed extensively, particularly with grain crops.

Approximately 190 buildings are situated on the site, as are utility structures. The industrialized portion of the site encompasses approximately 1000 acres. A perimeter road surrounds a 1200-acre centrally developed area. Most of the site improvements associated with the gaseous diffusion plant are within a 500-acre fenced area inside the developed area. The gaseous diffusion plant nominal elevation is 670 feet above MSL. Within the fenced area are three large process buildings and auxiliary facilities. A second, large developed area covering about 300 acres contains the facilities built for the Gas Centrifuge Enrichment Plant. These areas are largely devoid of trees, with grass and paved roadways dominating the open space. The remaining area within the perimeter road has been cleared and is essentially level. The land outside the perimeter road is used for a variety of purposes, including a water treatment plant, holding ponds, sanitary and inert landfill, and open and forested buffer areas. Controlled access exists within the limited security area as well as within the closed sites.

Public roads connect to access roads that serve the site. Two rail lines serve the site—CSX and Norfolk & Southern. Electricity is provided by the Ohio Valley Electric Corporation. Natural gas is supplied to the site from a DOE-owned pipeline.

The Portsmouth site vicinity is shown in Figure 1–3.

Figure 1-3. Portsmouth Gaseous Diffusion Plant Site Vicinity Map



Source: *"Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio," DOE/EA-1346, February 2002*

1.2.2 Proposed Location of New Nuclear Generating Units

The area evaluated in this report for locating new nuclear generating units is a 340-acre parcel previously evaluated and slated for transfer from DOE to the Southern Ohio Diversification Initiative (SODI) for possible reindustrialization. The parcel is irregular in shape and is located in the northeastern-most portion of the Portsmouth site. At its widest points, the parcel spans about 5700 feet in the north–south direction and about 5900 feet in the east–west direction. The parcel is in a mostly undisturbed part of the Portsmouth site. The closest disturbed land is used by security personnel for training and as a firing range. The firing range is outside of the proposed site, but is adjacent to its boundary lines.

The location of the approximate 340-acre parcel is shown in Figure 1–4.

1.2.3 References

1. “Safety Analysis Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, Volume 1,” POEF-LMES-89/V1 & R1.

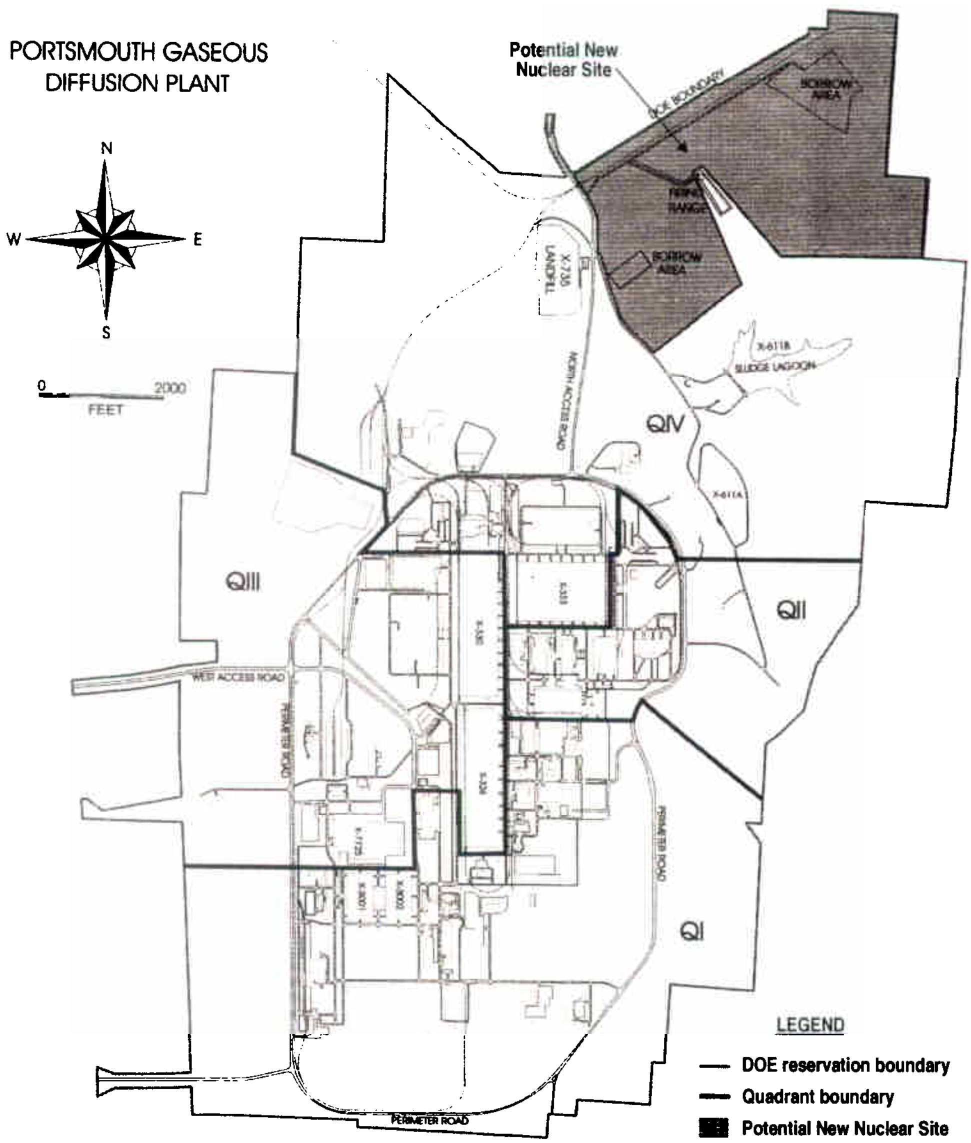
2. “Safety Analysis Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, Volume 2,” POEF-LMES-89/V2 & R1.

3. “Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, February 2002,” DOE/EA-1346.

4. “Evaluation of Site Conditions for 340 Acres of Department of Energy Land, Northeast Portion of the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, January 2002,” DOE/OR/11-3082&D3.

5. Pro2Serve Drawing, Figure 2, “Proposed Northeast Property Transfer Area and Archeological Sites to be Protected,” October 5, 2001 drawing date.

***Figure 1-4.* Potential New Nuclear Station Site at Portsmouth**



Source: Adapted from "Evaluation of Site Conditions for 340 Acres of Department of Energy Land, Northeast portion of the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio," DOE/OR/11-3082&D3, January 2002.

1.3 Savannah River Site

1.3.1 Site and Vicinity

The Savannah River Site (SRS) is an approximately circular tract of land occupying 310 square miles in the Aiken, Barnwell, and Allendale counties in southwestern South Carolina. All of the area in a 5-mile radius from the center of SRS is government-owned property. The center of SRS is approximately 25 miles southeast of the city limits of Augusta, Georgia; 100 miles from the Atlantic Coast; and about 110 miles south-southeast of the North Carolina border. The SRS is bounded along its southwest border by the Savannah River for about 35 river miles.

SRS occupies approximately 198,000 acres in a generally rural area. Administrative, production, and support facilities occupy 5 percent (approximately 17,000 acres) of the total SRS area. The remaining land, approximately 181,000 acres, is forestland and swamp managed by the U.S. Forest Service under an interagency agreement with DOE. Approximately 14,000 acres of SRS have been set aside exclusively for nondestructive environmental research in accordance with the designation of SRS as a National Environmental Research Park.

The largest nearby population centers are Aiken, South Carolina, and Augusta, Georgia. The only towns within 15 miles of the center of SRS are New Ellenton, Jackson, Barnwell, Snelling, and Williston, South Carolina.

Prominent geographical features within 50 miles of SRS are Thurmond Lake (formerly called Clarks Hill Reservoir) and the Savannah River. Thurmond Lake, operated by the U.S. Army Corps of Engineers, is the largest nearby public recreational area. This lake is an impoundment of the Savannah River and is located about 40 miles northwest of the center of SRS.

The principal surface-water body associated with SRS is the Savannah River, which flows along the site's southwest border. Six principal tributaries to the Savannah River can be found on SRS: Upper Three Runs Creek, Beaver Dam Creek, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek.

The SRS is above sea level and ranges from 80 feet MSL at the Savannah River to approximately 400 feet MSL about 1 mile south of the intersection of Highways 19 and 278. Two distinct physiographic subregions are represented at SRS. They are the Pleistocene Coastal Terraces, which are below 270 feet MSL in elevation, and the Aiken Plateau, which is above 270 feet MSL in elevation. The lowest terrace is the present floodplain of the Savannah River. The higher terraces have level to gently rolling topography. The Aiken Plateau subregion is hilly and cut by small streams.

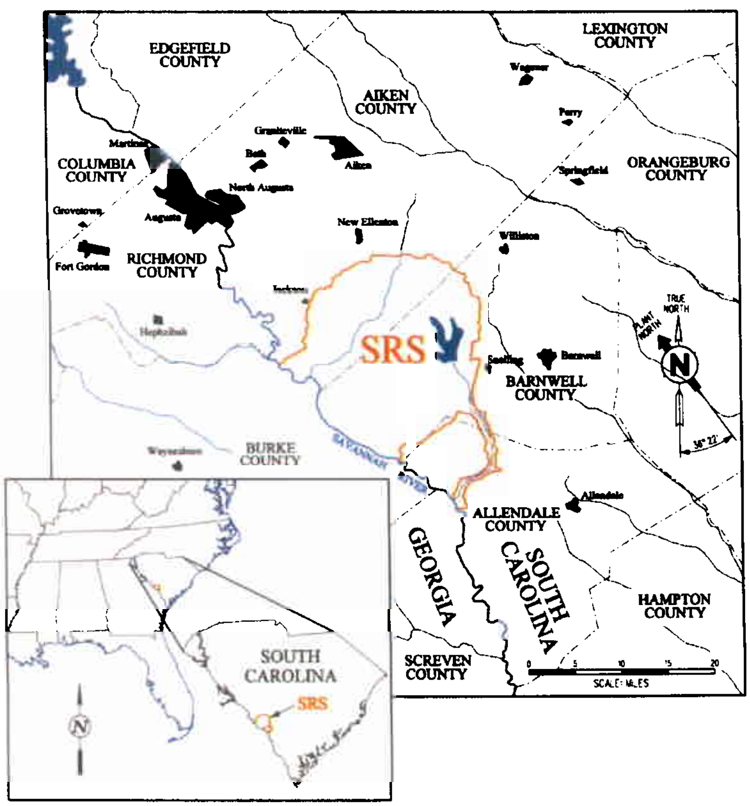
The site is not open to the public, but specific access is permitted for guided tours, controlled deer hunts, and environmental studies. In addition, the public can traverse portions of the site along established transportation corridors. These include a rail line for CSX Transportation Inc. Railroad, and road traffic along South Carolina State Route (SR) 125 (SRS Road A), U.S. Route 278, and SRS Road 1 near the northern edge of the site. SRS highways connect with state highways leading northward to Interstate Routes 20, 26, and 85 and eastward to Interstate Routes 26 and 95.

SRS has its own railroad system, which services all major facilities. The rail network includes a main line of the CSX Railroad and the site wide DOE-owned rail system. Rail traffic on the site is separated into two distinct categories according to ownership of the track: CSX operations and SRS operations. The CSX Railroad has a through line between Augusta, Georgia, and Yemassee, South Carolina, and terminates in Port Royal, South Carolina. In 1989, a second line from SRS to Florence, South Carolina, was abandoned by CSX beyond Snelling, South Carolina. CSX maintains service, as required, to the Dunbarton Station for SRS deliveries/pickups and a spur line into the Chem-Nuclear site near Snelling, South Carolina.

The electrical grid on SRS operates at 115 kV and draws power from two transmission lines on separate rights-of-way from the South Carolina Electric and Gas (SCE&G) Urquhart Station and a third line from the 230-kV tie line between the Sumner and Canadys stations of SCE&G. SRS also has a tie-in line to the Vogtle Electric Generating Plant. There are no natural gas or oil pipeline networks at SRS.

The Savannah River site vicinity is shown in Figure 1–5.

Figure 1-5. **Savannah River Site Vicinity Map**



Source: "Natural Phenomena Hazards (NPH) Design Criteria and Other Characterization Information for the Mixed Oxide (MOX) Fuel Fabrication Facility at Savannah River Site (U)," WSRC-TR-2000-00454, Rev. 0, November 2000

1.3.2 Proposed Location of New Nuclear Generating Units

SRS has an expansive amount of undeveloped land potentially suitable for use as new nuclear generation sites. For example, eight sites were identified, evaluated, and prioritized for potential development sites at the SRS for the construction and operation of an Accelerator for the Production of Tritium (APT) facility. The APT required about 250 acres and an approximate footprint of 6560 feet long by 1640 feet wide. Six of the eight sites satisfied exclusion criteria. Exclusion criteria defined conditions that would result in unacceptable impacts to high quality environmental resources or conditions that would provide unacceptable circumstances during construction or operation of the APT.

The six remaining sites were scored against multiple criteria in four general categories: ecology, geology/hydrology, human health, and engineering. The highest-scored site was designated the preferred site and the second highest was designated the alternate site; however, all six were deemed acceptable. To establish the largest site size at the preferred location that still satisfies the exclusion criteria, SRS personnel reviewed the site selection data and determined that a minimum of 500 acres could be dedicated for the site at that location.

The APT preferred site is approximately 6.5 miles from the SRS boundary, 3 miles northeast of the Tritium Loading Facility, and north of Roads F and E. The site, which is divided by the Aiken-Barnwell County line, is bordered on the southwest by a 115 kV transmission line, a buried super control and relay cable, and Monroe Owens Road. Three other secondary roads cross the site. The elevation of the site is 300 – 330 feet above MSL.

The location of the approximate 250-acre preferred site is shown in Figure 1–6.

1.3.3 References

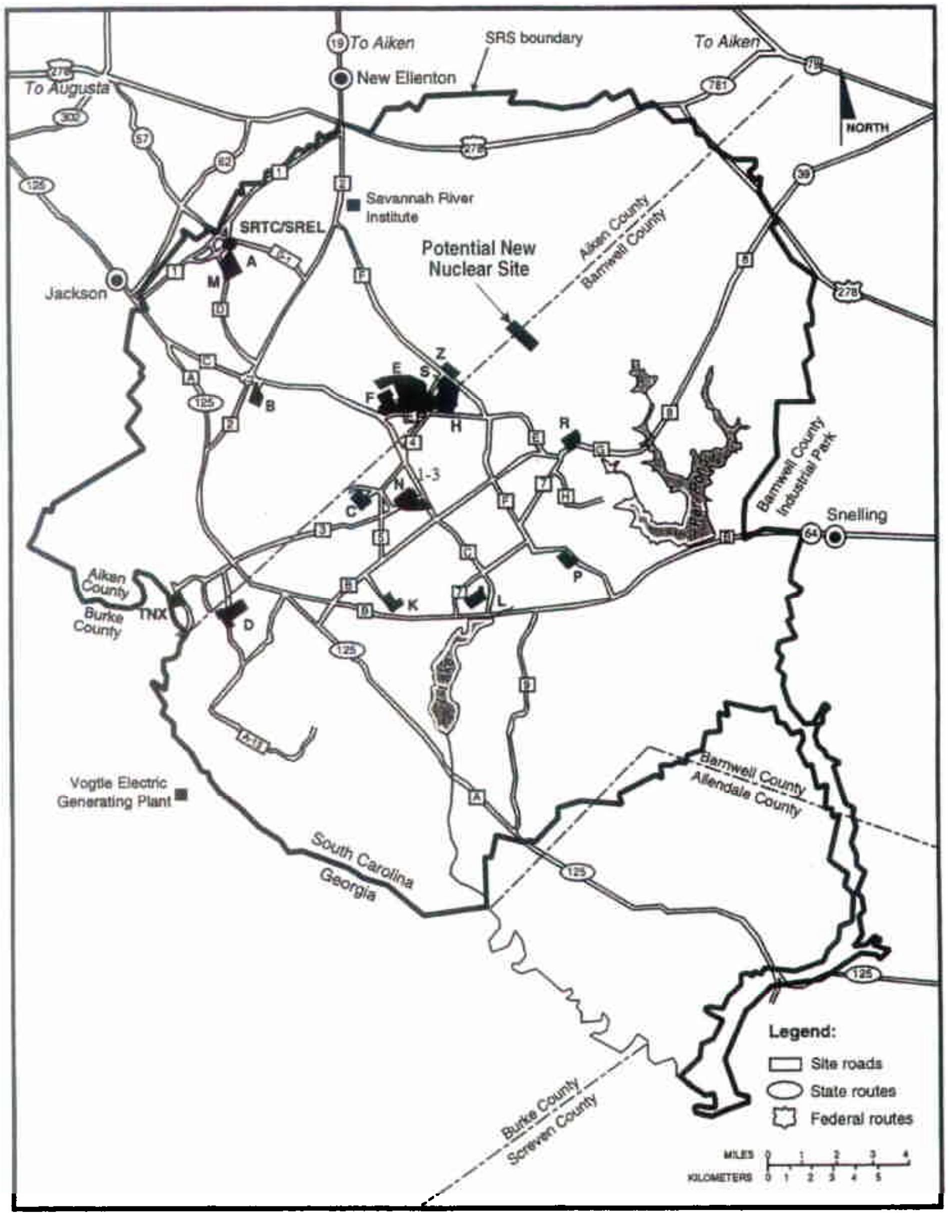
1. “Natural Phenomena Hazards (NPH) Design Criteria And Other Characterization Information for the Mixed Oxide (MOX) Fuel Fabrication Facility at Savannah River Site (U),” November 2000, WSRC-TR-2000-00454 Rev. 0.

2. “Draft Environmental Impact Statement: Accelerator Production of Tritium at the Savannah River Site,” December 1997, DOE/EIS-0270.

3. “Site Selection for the Accelerator for Production of Tritium at the Savannah River Site,” October 9, 1996, WSRC-TR-96-0279, Rev. 1.

4. Telephone communication, W. T. Hickerson, Bechtel, to L. A. Salomone, Westinghouse Savannah River Co., June 24, 2002.

Figure 1-6. Potential New Nuclear Station Site at SRS



Source: *Adapted from "Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site," DOE/EIS-0270D Draft, December 1997.*

2. Economic Criteria

2.1 Electricity and Service Market Projections

This section evaluates the following criteria related to electricity and service market projections at the INEEL, Portsmouth, and Savannah River sites:

- Need for power
- Generation mix
- Anticipated market pricing

The final ranking is the average of the applicable sub-criteria scores.

In support of the study, EPRI performed a "Power Market Assessment for New Nuclear Generation." A copy of the assessment is included in Appendix B.

2.1.1 Evaluation of the INEEL Site

The need for new local supply in the INEEL site area is limited. Idaho Power appears to have adequate supply margin for the foreseeable future. Additionally, the western portion of the country seems highly interested in new coal base-load and is still highly regulated. It is therefore not clear that a merchant nuclear plant of large size could be supported or is needed. As discussed in Section 2.2, the reality of a new transmission line from Idaho to the Western Grid, which would allow power to be delivered to more lucrative markets such as Las Vegas and California, appears limited and not likely to happen in the 2010–2015 timeframe. This market does potentially support a smaller sized prototype plant such as a modular gas-cooled reactor. A ranking of 2 is assigned for Need for Power and Generation Mix.

Anticipated market pricing is substantially lower (about 15 percent lower) in Idaho than in the eastern portions of the United States, and even lower when compared to isolated pockets such as California. INEEL is ranked 1 for Anticipated Market Pricing.

Based on the above evaluation, a ranking of 1.7 is assigned for all reactor types and the Bounding Plant.

2.1.2 Evaluation of the Portsmouth Site

The need for new local supply is small. The local area has limited growth prospects and American Electric Power (AEP) has significant margin. In addition, the area may be better suited for coal plant development with its access to local mining. This would suggest higher levels of competition to a new baseload nuclear entry. As discussed in Section 2.2, transmission access at the site is good. Further evaluation would be needed to determine how easily major markets such as Chicago and the north-east can be accessed and what costs would be added to reach these more valuable markets. This market does potentially support a smaller sized prototype plant such as a gas reactor. A ranking of 2.5 is assigned for Need for Power and Generation Mix.

Anticipated market pricing is lower (about 5 percent lower) in Ohio than in PJM or other parts of the east. A ranking of 2.5 is assigned for Anticipated Market Pricing.

Based on the above evaluation, a ranking of 2.5 is assigned for all reactor types and the Bounding Plant.

2.1.3 Evaluation of the Savannah River Site

The Savannah River site resides in the VACAR (the Virginia-Carolina Subregion of the Southeastern Electric Reliability Council) market. The need for new local supply appears to be quite high during the 2010–2015 period. Studies of VACAR indicate the need for approximately 10,000 MWe of additional generation, while Southern Company has indicated the need for 1,000 MWe per year after 2010 to support new growth and replace aging facilities. Additionally, the ability to potentially feed the Florida area, which has some of the region's highest growth rates, adds support to an optimistic view of the potential future demand at this site. Additionally, the more limited coal capabilities and reliance on new gas generation support a competitive entry by nuclear. The major concern here is the state of deregulation and further study is needed to resolve whether difficulties to entry exist. A ranking of 4 is assigned for Need for Power and Generation Mix.

Anticipated market pricing is approximately equal with that seen overall in the east and southeast regions of the U.S. A ranking of 3 is assigned for Anticipated Market Pricing.

Based on the above evaluation, a ranking of 3.7 is assigned for all reactor types and the Bounding Plant.

2.2 Transmission System

The objective of this section is to evaluate the connection of new nuclear units to the transmission system grid and to determine if the capacities of the existing transmission lines and switchyards are adequate to handle the additional power.

2.2.1 Evaluation of the INEEL Site

The transmission system feeding the INEEL site consists of 138 kV transmission lines from Utah Power & Light's Antelope substation. The Antelope substation is fed from an Idaho Power Company 230 kV line, a Utah Power & Light 161 kV line, and a Montana Power 230 kV line. The onsite transmission system consists of multiple 138 kV transmission lines forming a ring network around the site. The onsite 138 kV transmission system is rated 124 MVA.

Interconnection of 2000 MW (2352 MVA @ 0.85 pf)

To transmit 2000 MW from the site, various interconnection scenarios could be considered:

- Export all power over a 500 kV tie to the Borah substation

A single circuit 500 kV line could carry the entire output (approximately 2800 amps) using multiple conductors per phase; however, it would be recommended to have two circuits equally sharing the load with each circuit sized to carry the entire plant to ensure export capability with one circuit out. A second source (138 kV) would also be required to provide power for construction, plant startup, and auxiliary loads. The 500 kV Borah substation is approximately 80 miles from the site. The transmission line route would cross over many counties and towns and would require a significant effort to obtain right-of-ways and permits that could have a major impact on the overall project cost and schedule.

- Export all power over a 345 kV tie to the Goshen substation

A single circuit 345 kV line could carry the entire output (approximately 4000 amps) using multiple conductors per phase; however, it would be recommended to have two circuits equally sharing the load with each circuit sized to carry the entire output to ensure export capability with one circuit out. A second source (138 kV) would also be required to provide power for construction, plant startup, and auxiliary loads. The 345 kV Goshen substation is approximately 55 miles from the site. The transmission line route would cross over many counties and towns and would require a significant effort to obtain right-of-ways and permits that could have a major impact on the overall project cost and schedule.

Interconnection of 6000 MW (7058 MVA @ 0.85 pf)

To transmit 6000 MW from the site, various interconnection scenarios could be considered:

- Export all power over 500 kV ties to the Borah substation

Three circuits of 500 kV lines could carry the entire output (approximately 8150 amps) using multiple conductors per phase; however, it would be recommended to have four circuits equally sharing the load with each circuit sized to carry one-third of the entire plant to ensure export capability with one circuit out. A second source (138 kV) would also be required to provide power for construction, plant startup, and auxiliary loads. The 500 kV Borah substation is approximately 80 miles from the site. The transmission line route would cross over many counties and towns and would require a significant effort to obtain right-of-ways and permits that could have a major impact on the overall project cost and schedule.

- Export all power over 345 kV ties to the Goshen substation

A triple circuit 345 kV line could carry the entire output (approximately 11,800 amps) using multiple conductors per phase. However, it would be recommended to have four circuits equally sharing the load with each circuit sized to carry one-third of the entire output to ensure export capability with one circuit out. A second source (138 kV) would also be required to provide power for construction, plant startup, and auxiliary loads. The 345 kV Goshen substation is approximately 55 miles from the site.

The transmission line route would cross over many counties and towns and would require a significant effort to obtain right-of-ways and permits that could have a major impact on the overall project cost and schedule.

* * *

The existing onsite transmission system is not capable of evacuating the power from a new commercial nuclear power facility. The existing system could be used for back feeding of construction power and plant auxiliary loads and sending a small amount of power to the site and local utility loads.

A new 500 kV switchyard would be required at the plant site, with a secondary voltage level of 138 kV. Sufficient space exists for the switchyard at the preferred site. The physical arrangement of the 500 kV switchyard would have space for the new units, two lines for export power, and two transformers to a lower voltage level. The lower voltage level switchyard would require space for two lines and two transformers. The switchyard would have its own control building, AC/DC station service for switchyard loads (without any major modification of the switchyard), grounding, raceway, lighting, lightning protection, etc.

The existing relay system for protection of the 138 kV lines would need to be upgraded for the new connection scheme.

The above interconnection evaluations are preliminary. All schemes would require detailed system studies to evaluate utility grid impacts for short circuit, load flows, and stability to determine if any upgrades are necessary to the existing lines and substations. In addition, DOE's National Transmission Grid Study (Reference 1) indicates that there is major congestion of the transmission system from the western states of Utah and Wyoming to the west and southwest. Locating a new nuclear power generating facility in the Idaho/Montana/Wyoming area would add to the power over the already overburdened lines going to Nevada and California.

The ability to transmit large quantities of power from this site is limited. While many years ago there were plans to connect the INEEL area to the Western Grid with a large transmission line, those plans appear to have been discarded. New 345 kV or 500 KV lines would be needed to support large-scale commercial production and would change the dynamics of the power market by potentially being able to supply more lucrative markets such as Las Vegas and California. However, the reality of a new transmission line from Idaho to the Western Grid appears limited and not likely to happen in the 2010–2015 timeframe. The ability to support a smaller sized prototype plant is reasonable given the existing transmission capabilities.

Based on the above evaluation, a ranking of 1 is assigned for all reactor types and the Bounding Plant. There is a relatively large area available for the plant and switchyard facilities. However, a significant disadvantage is the lack of a higher voltage substation onsite to minimize the transmission lines to connect to the grid. If the transmission lines are connected to the existing substations (55 miles for 345 kV and 80 miles for 500 kV), the right-of-way and permit efforts could be significant and time consuming to obtain.

2.2.2 Evaluation of the Portsmouth Site

The transmission system on the Portsmouth site consists of multiple 345 kV transmission lines forming a ring network around the site. Two main substations (X-530 and X-533) for the 345 kV transmission lines feed the various area loads.

Both substations (X-530 and X-533) have two lines from the Ohio Valley Electric Corporation (OVEC) Kyger Creek substation (which is connected to AEP) and two lines from the OVEC Pierce substation (which is connected to Cincinnati Gas & Electric). There is also a line to the OVEC Don Marquis 345 kV/765 kV substation (located on site) that has a connection to the AEP 765 kV system. All of the site substations are arranged in a breaker and a half with open space for future expansion. The X-533 substation has 2000 amp, 63 kA equipment, while the X-530 substation has 1600 amp, 25 kA equipment.

During previous full power operations of the enrichment facility, the site has imported approximately 1900 MW of power with a reported system capacity of approximately 2260 MW.

Interconnection of 2000 MW (2352 MVA @ 0.85 pf)

To transmit 2000 MW from the site, various interconnection scenarios could be considered:

- Export all power over a new 345 kV tie to the X-533 substation

A single circuit 345 kV line could carry the entire output (approximately 4000 amps) using multiple conductors per phase. A single circuit would not normally carry this amount of power but this would be a short line (approximately 3000 feet) and losses would be minimized. However, it would be recommended to have two circuits equally sharing the load with each circuit sized to carry the entire output to ensure export capability with one circuit out. This would dump all the power into the Portsmouth X-533 substation with export to the grid via existing lines. According to OVEC representatives, each of the 345 kV lines coming into the site is capable of 600 MW (conservative value) and the five lines into X-533 would be capable of exporting the power.

- Export all power over a 345 kV tie to OVEC and the X-533 substation

A new 345 kV switchyard could be built at the power plant site, with one circuit of the double circuit line from Kyger Creek to X-533 and one circuit of the double circuit line from Pierce to X-533 routed into the new switchyard. In addition, a line from the new switchyard would be brought into the X-533 substation. Therefore, the new switchyard would have a direct connection to the Kyger Creek, X-533, and Pierce substations with the connection to X-533 allowing alternative routing for the power to be exported with the five lines more than capable of handling the power.

- Export all power over a 345 kV tie to OVEC, the X-533 substation, and ECAR via the Don Marquis substation

Same interconnection as above but an additional line from the plant switchyard would provide a direct connection to ECAR (the East Central Area Reliability Coordination Agreement of the North American Electric Reliability Council) via the Don Marquis 345 kV/765 kV substation on site.

Interconnection of Approximately 6000 MW (7059 MVA @ 0.85 pf)

To transmit approximately 6000 MW from the site, various interconnection scenarios could be considered:

- Export all power over a new 345 kV tie to the X-533 substation

A triple circuit 345 kV line could carry the entire output (approximately 11,800 amps) using multiple conductors per phase. However, it would be recommended to have four circuits equally sharing the load with each circuit sized to carry the entire output to ensure export capability with one circuit out. This would dump all the power into the X-533 substation with export to the grid via existing lines. According to OVEC representatives, each of the 345 kV lines coming on site is capable of 600 MW (conservative value) and the five lines into X-533 would be capable of exporting approximately half the power. Additional lines would be required to connect the X-533 and X-530 substations to allow the export of the remaining power over the lines from X-530 to the grid.

- Export all power over a 345 kV tie to OVEC and the X-533 substation

A new 345 kV switchyard could be built at the power plant site, with one circuit of the double circuit line from Kyger Creek to X-533 and one circuit of the double circuit line from Pierce to X-533 routed into the new switchyard. In addition, lines from the new switchyard would be brought into the X-533 substation. Therefore, the new switchyard would have a direct connection to the Kyger Creek, X-533, and Pierce substations with the connection to X-533 allowing alternative routing for the power to be exported. According to OVEC representatives, each of the 345 kV lines coming on site is capable of 600 MW (conservative value) and the lines into X-533 would be capable of exporting approximately half the power. Additional lines would be required to connect the X-533 and X-530 substations to allow the export of the remaining power over the lines from X-530 to the grid.

- Export all power over a 345 kV tie to OVEC, the X-533 substation, and ECAR via the Don Marquis substation

The same interconnection as above but with an additional line(s) from the plant switchyard would provide a direct connection to ECAR via the 345 kV/765 kV substation onsite and reduce the number of lines into the X-533 and X-530 substations. Alternatively, a 765 kV line could be built, but this would require extension of the 765 kV substation and would be much more expensive. A single 765 kV line could handle most of the power exported but since there is only one line to ECAR, a backup export means needs to be available if that line is ever out of service.

* * *

The existing control houses were not available for inspection. However, the addition of new nuclear power generating units would require additional relay protection to be installed and, therefore, the control houses might need to be expanded if room was not available. The addition of the new nuclear plants would require the modification/expansion of some service systems such as grounding, raceway, lighting, AC/DC station service of the existing 345 kV substation, lightning protection, etc., but these modifications should not present major problems. The fenced areas of the substations include room for additional bays; thus, only additional equipment and bus extensions would be required.

The existing relay system for protection of the lines and bus is of the older type and may not be available to be matched. Therefore, if new nuclear generating units are added, the existing relay system may need to be upgraded.

A new 500 kV switchyard would be required at the plant, with a secondary voltage level of either 230 kV or 115 kV. Sufficient space exists for the switchyard at the plant site location. The physical arrangement of the 500 kV switchyard would have space for the new units, two lines for export power, and two transformers to a lower voltage level. The lower voltage level switchyard would require space for two lines and two transformers. The switchyard would have its own control building, AC/DC station service for switchyard loads (without any major modification of the switchyard), grounding, raceway, lighting, lightning protection, etc.

The existing relay system for protection of the 115 kV or 230 kV lines would need to be upgraded for the new connection scheme.

All new transmission lines and rerouted transmission lines would be located on site and be short (all about 3000 feet). Routing of these lines on site should not create any right-of-way or permit issues. The existing onsite lines were reported to be able to import 2000 MW of power required for the enrichment plant operation when it was operating at full capacity.

The X-533 and X-530 substations may require upgrades, as the short circuit levels will be increased with the addition of new power generating facilities. The X-533 substation has 63 kA, 2000 amp equipment that may not require upgrades, but the X-530 substation has 25 kA, 1600 equipment that will require upgrades. The equipment at the OVEC substation may also require upgrades. The X-530 and X-533 substations have enough room for the extensions required.

The above interconnection evaluations are preliminary. All schemes would require detailed system studies to evaluate utility grid impacts for short circuit, load flows, and stability to determine if any upgrades are necessary to the existing lines and substations. In addition, DOE's National Transmission Grid Study (Reference 1) indicates that there is major congestion of the transmission system from the Midwest to the Mid-Atlantic region. Locating a new nuclear power generating facility in the Midwest (such as at the Portsmouth site) would add to the power transmitted over the already overburdened lines going to Virginia/North Carolina and other Mid-Atlantic states, and the congestion between the Midwest to the Mid-Atlantic and the Southeast (Florida) would remain.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant. There is relatively easy transmission line access into the switchyard and space for the area of the switchyard. In addition, the onsite capacity of the transmission system and power export capability to the grid is excellent. A disadvantage is that some of the existing substation facilities would have to be upgraded.

2.2.3 Evaluation of the Savannah River Site

The transmission system on the Savannah River site consists of multiple 115 kV transmission lines forming a ring network around the site. Three switching stations for the 115 kV transmission lines exist around the site to feed the different area loads. These switching stations are named 51, 52, and 53. The 115 kV system for the SRS is fed from SCE&G. Switching stations 51 and 52 are fed from the SCE&G Urquhart 115 kV substation. Switching station 53 is fed from the SCE&G 230/115 kV on-site substation. The SCE&G 230/115 kV substation is fed from 230 kV lines from the Graniteville 230 kV substation, Canadys 230 kV substation, and Georgia Power 230 kV substation at the Vogtle nuclear plant across the Savannah River. The site therefore is powered from several independent sources.

The onsite 115 kV transmission lines are rated 85 MVA. The SCE&G 230 kV line is rated for 320 MVA.

A single 115 kV transmission line runs along the edge of the preferred site. The 230 kV line from Graniteville runs parallel to the 115 kV line at the edge of the preferred site.

Interconnection of 2000 MW (2352 MVA @ 0.85 pf)

To transmit 2000 MW from the site, various interconnection scenarios could be considered:

- Export all power over a 500 kV tie to the Vogtle nuclear plant

A single circuit 500 kV line could carry the entire output (approximately 2800 amps) using multiple conductors per phase; however, it would be recommended to have two circuits equally sharing the load with each circuit sized to carry the entire output to ensure export capability with one circuit out. The route would follow the routing of the SCE&G 230 kV circuit that crosses the plant site in the southeast area of the site where the 230 kV line terminates into the SRS 230/115 kV substation. The new 500 kV circuits would have to cross over the 230 kV and 115 kV lines in this area. A 230 kV circuit from this substation also goes across the river to the Vogtle substation, and the new 500 kV route could parallel it. A second source (115 kV or 230 kV) would also be required to provide power for construction, plant startup, and auxiliary loads.

- Export all power over a 500 kV tie to a 500 kV line approximately 60 miles to the west

A single circuit 500 kV line could carry the entire output (approximately 2800 amps) using multiple conductors per phase; however, it would be recommended to have two circuits equally sharing the load with each circuit sized to carry the entire output to ensure export capability with one circuit out. The 500 kV line crossing approximately 60 miles west of the site would be cut and brought into a switchyard accounting for two circuits. The transmission line route would cross over many counties and towns and would require a significant effort to obtain right-of-ways and permits that could have a major impact on the overall project cost and schedule. A second source (115 kV or 230 kV) would also be required to provide power for construction, plant startup, and auxiliary loads.

- Export all power over a 230 kV tie to the Vogtle nuclear plant

Five or six circuits of 230 kV lines could carry the entire output (approximately 5900 amps) using multiple conductors per phase; however, it would be recommended to have an additional circuit with all equally sharing the load and each circuit sized to carry a percentage of the entire plant to ensure export capability with one circuit out. The SCE&G line that crosses the site would be cut and brought into a switchyard accounting for two circuits. Additional circuits would be provided running to either the SCE&G 230 kV/115 kV substation on site or to Vogtle with the route following the routing of the SCE&G 230 kV circuit that crosses the plant site and also goes across the river to the Vogtle substation. A 230 kV line would also provide power for construction, plant startup, and auxiliary loads.

- Export all power over a 115 kV tie

Export of this amount of power (approximately 11,800 amps) over 115 kV lines would be impracticable since approximately 10 lines would be required. However, use of the 115 kV system from SRS in combination with the above options would provide power to SRS (50 MVA site load) and a second power source for construction, plant startup, and auxiliary loads.

Interconnection of 6000 MW (7058 MVA @ 0.85 pf)

To transmit 6000 MW from the site, various interconnection scenarios could be considered:

- Export all power over a 500 kV tie to the Vogtle nuclear power plant

Three circuits of 500 kV lines could carry the entire output (approximately 8150 amps) using multiple conductors per phase; however, it would be recommended to have four circuits equally sharing the load with each circuit sized to carry the one-third of the output to ensure export capability with one circuit out. The route would follow the routing of the SCE&G 230 kV circuit that crosses the plant site to the southeast, where the line terminates into the SRS 230 kV/115 kV substation. A 230 kV circuit from this substation also goes across the river to the Vogtle substation and the new 500 kV route would parallel it. A second source (115 kV or 230 kV) would also be required to provide power for construction, plant startup, and auxiliary loads.

- Export all power over a 500 kV tie to a 500 kV line approximately 60 miles to the west

Same as above for the 2000 MW case but a third circuit, including a location for termination of the third line, would be needed.

- Export all power over a 230 kV or 115 kV ties

Export of this amount of power over 230 kV (approximately 17,700 amps) or 115 kV (approximately 35,440 amps) would be impractical because of the number of lines that would be required. However, use of the 230 kV system from SCE&G or the 115 kV line from SRS in combination with the above options would provide power to SCE&G and/or SRS (50 MVA site load) and a second power source for construction, plant startup, and auxiliary loads.

* * *

The existing onsite transmission systems (both the 115 kV and 230 kV) would not be capable of evacuating the power from a new nuclear power facility. The existing system could be used for back feeding of construction power and plant auxiliary loads and sending a small amount of power to the site and local utility loads.

A new switchyard at the plant would be required at 500 kV with a secondary voltage level of either 230 kV or 115 kV. Sufficient space exists for the switchyard at the APT site location. The physical arrangement of the 500 kV switchyard would have space for the new units, two or four lines for export power (depending on the scheme chosen), and two transformers to a lower voltage level. The lower voltage level switchyard would require space for two lines and two transformers. The switchyard would have its own control building, AC/DC station service for switchyard loads (without any major modification of the switchyard), grounding, raceway, lighting, lightning protection, etc.

The existing relay system for protection of the 115 kV or 230 kV lines would need to be upgraded for the new connection scheme.

The above interconnection evaluations are preliminary. All schemes would require system studies to evaluate utility grid impacts for short circuit, load flows, and stability to determine if any upgrades are necessary to the existing lines and substations. In addition, DOE's National Transmission Grid Study (Reference 1) indicates that there is major congestion of the transmission system from the Midwest to the Mid-Atlantic. Locating a new power production facility in the Mid-Atlantic area (such as the Savannah River site) would relieve some of the transmission congestion; however, the congestion between the Mid-Atlantic to the Southeast (Florida) would remain.

Based on the above evaluation, a ranking of 2 is assigned for all reactor types and the Bounding Plant. There is relatively easy access from the transmission lines into the switchyard and space for the area of the switchyard. Transmission line routing would be all on the SRS site property or the Vogtle site property, with permit or right-of-ways required only for the river crossing. If the 500 kV transmission line is connected to the existing line approximately 60 miles west, right-of-way and permits may be excessive and time consuming to obtain. A disadvantage is not having a higher voltage substation on site to minimize transmission line connection to the grid.

2.2.4 References

1. National Transmission Grid Study, U.S. Department of Energy, May 2002.

2.3 Stakeholder Support

Stakeholder support is defined as the degree of acceptance that can be expected from the general population to a proposed siting of a large industrial complex. This can be determined by assessing three influential aspects of stakeholder support:

- Political climate

Political climate is an assessment of the local and state positions on potential siting of nuclear generation plants. This assessment considers historical utility-political relationships, the existence of current generating plants, and the existence of influential "pro- or anti-" nuclear pressure groups.

- Public opinion

Public opinion represents the aspect of perceived power needs and economic value as well as environmental considerations.

- Legislative and regulatory climate

Legislative and regulatory climate considers the ease of attaining permits and licenses given current legislative regulations and implications pertaining to achieving environmental compliance goals.

Each of these subcriteria is discussed and evaluated below.

2.3.1 Evaluation of the INEEL Site

Political climate

INEEL is ranked 3 for political climate for all reactor types and the Bounding Plant.

Elected officials support nuclear power, there has been substantial "anti-nuclear" sentiment, and there is a historic relationship with the community.

INEEL enjoys political support at the federal, state, and local level. U.S. Senators Craig and Crapo support the President's National Energy Policy, which includes an expanded role for nuclear energy. U.S. Representative Simpson supports the continued use of the INEEL facility.

Idaho Governor Kempthorne is supportive of continuing missions at the INEEL facility.

Two opposition groups, the Snake River Alliance and Nuclear-Free Yellowstone, are active. The latter group appears to be particularly well funded and can take advantage of several highly visible and well-known personalities as spokespersons. They were successful in affecting INEEL's proposed incinerator facility.

Public Opinion

Public opinion is ranked 5 at INEEL for all reactor types and the Bounding Plant.

The current INEEL missions are substantially remedial in nature. Employment on site indicates a decreasing trend. A new major mission at the INEEL facility such as envisioned under this study has a strong perceived economic value to the community.

Editorial support by local newspapers has been exhibited over time.

Legislative and Regulatory Climate

Legislative and regulatory climate is ranked 4 for all reactor types and the Bounding Plant.

INEEL maintains open communication with the public and state regulators. The primary state agency that exercises regulatory authority over INEEL is the Idaho Environmental Protection Agency. Compliance issues arise in the course of operations and are resolved in an effective and professional manner. The state regulators were characterized as cooperative and focused on identifying and implementing methods to achieve desired goals in compliance with regulations. There are no local permitting authorities.

2.3.2 Evaluation of the Portsmouth Site

Political climate

Portsmouth is ranked 4 for political climate for all reactor types and the Bounding Plant.

Elected officials support nuclear power, there has been limited substantial "anti-nuclear" sentiment, and there is a historic relationship with the community. Ohio is also the home of two commercial nuclear power reactors, Perry and Davis-Besse.

Portsmouth enjoys political support at the federal, state, and local level. U.S. Senators Voinovich and DeWine support the administration's national energy policy, which includes an expanded role for nuclear energy. U.S. Representatives Strickland and Portman support the continued use of the Portsmouth facility.

Ohio Governor Taft is supportive of continuing missions at the Portsmouth facility.

A small local opposition group, Piketon Portsmouth Residents for Environmental Safety and Security (PRESS), has shown limited activity over time. There are no organized and currently active pro-nuclear groups in the community.

Public Opinion

Public opinion is ranked 5 at Portsmouth for all reactor types and the Bounding Plant.

The current Portsmouth site missions are remedial in nature. The production facilities are being shut down. Employment on site indicates a decreasing trend. A new major mission at the Portsmouth site, such as envisioned under this study, has a strong perceived economic value to the community.

Local newspapers have exhibited editorial support over time.

Legislative and Regulatory Climate

Legislative and regulatory climate is ranked 4 for all reactor types and the Bounding Plant.

Portsmouth maintains open communication with the public and state regulators. The primary state agency that exercises regulatory authority over Portsmouth is the Ohio Environmental Protection Agency. Compliance issues arise in the course of operations and are resolved in an effective and professional manner. The state regulators were characterized as cooperative and focused on identifying and implementing methods to achieve desired goals in compliance with regulations. There are no local permitting authorities.

Portsmouth is currently affected by a U.S. EPA consent decree, issued in 1989, and amended, as well as an Ohio EPA consent decree, issued in 1989, that specify certain remediation activities on site.

2.3.3 Evaluation of the Savannah River Site

Political climate

The Savannah River site is ranked 5 for political climate for all reactor types and the Bounding Plant.

Elected officials strongly support nuclear power, there has been no substantial "anti-nuclear" sentiment, and there is a strong historic relationship with the community.

SRS enjoys strong two-state (Georgia and South Carolina) bipartisan legislative support at the federal, state, and local level. U.S. Senator Thurmond and U.S. Representative Graham have submitted bills supporting the President's National Energy Policy. Both are outspoken advocates of the continued use of SRS to support national nuclear energy programs.

South Carolina Governor Hodges is supportive of the proposed "energy park" concept at SRS. Such an energy park could include a number of new nuclear plants.

Public Opinion

Public opinion is ranked 5 at SRS for all reactor types and the Bounding Plant.

The communities surrounding the SRS site have a positive relationship with SRS. Part of that is based on the significant positive economic impact the site has had on the affected South Carolina and Georgia communities. The other part is founded in the genesis of SRS in the 1950s. During the height of the Cold War, several communities willingly abandoned their towns to make way for the site because of its perceived importance to national defense. That supportive and positive attitude toward SRS has persevered over decades and across generations of families who have been positively impacted by the continued existence of SRS.

Particularly noteworthy at SRS is the level of organized public support. The SRS area is home to Citizens for Nuclear Technology Awareness, the largest pro-nuclear organization of its kind in the country. Many community groups, such as SRS-Citizen's Advisory board, Savannah River Regional Diversification Initiative, Citizens for Nuclear Technology Awareness, chambers of commerce, and economic development organizations, work with SRS to provide input to policies, priorities, and programs. In contrast, although there are a limited number of individuals, there does not appear to be any organized "anti-nuclear" groups local to SRS.

Strong editorial support by local newspapers has been exhibited over time.

Most SRS employees are college educated. They are also actively involved in local politics. A survey of SRS employees showed that more than 50 held elected offices in county and municipal governments. More than 250 others held leadership positions in civic, cultural, youth, religious, or political organizations.

Legislative and Regulatory Climate

The primary state agencies that exercise regulatory authority over SRS are the Georgia Department of Natural Resources and the South Carolina Department of Health and Environmental Control. (At the "facility" level within SRS, the site authority is autonomous.)

SRS maintains open communication with the public and state regulators. Compliance issues arise in the course of operations and are resolved in an effective and professional manner.

Legislative and regulatory climate is ranked 5 for the SRS site for all reactor types and the Bounding Plant.

2.4 Site Development Costs

The objective of this section is to evaluate site development costs for potential new nuclear generation at the INEEL, Portsmouth, and Savannah River sites. The Site Evaluation Process outlines a quantitative approach to ranking for this criterion. However, because a detailed cost analysis was not included as part of the current study, the qualitative approach presented in Table 2-1 was used to assign the site rankings.

Table 2-1. Site Development Costs

Site Development Cost Factors	Discussion
Transmission Facilities and Interconnections	• Costs for transmission facilities and interconnections would likely be highest for INEEL, followed by Savannah River and Portsmouth. Transmission is a significant cost factor. • At INEEL, transmission lines would be needed to either the Borah or Goshen substations, approximately 80 and 55 miles from the site, respectively. • At Savannah River, transmission connections could be made to the nearby Vogtle plant or to 500kV transmission lines running approximately 60 miles west of the site. • At Portsmouth, transmission connections would be mainly performed on site. • See Section 2.2 for additional information.
Site Preparation (Earthwork; site improvements; access for equipment and materials; worker access and facilities; onsite relocations, demolitions, cleanup; major component delivery)	• Costs for site preparation would likely be highest for INEEL and Savannah River, followed by Portsmouth. • For INEEL, some upgrades to the onsite and offsite rail systems may be needed for equipment and large component receipt. New access roads to the preferred site would need to be built. Rock removal by blasting would be required. • For Savannah River, site preparation activities would include extension of the existing rail spur, new access roads from US 278, earthwork to establish flat power island areas, some dewatering, and possible remedial action for building settlements. • For Portsmouth, clearing and leveling would be required to establish flat power island areas. Removal of rock and dewatering would be needed. • Based on the depth of excavation, site preparation costs for the different reactor types would rank in the following order from highest to lowest: (1) GT-MHR, (2) ABWR and PBMR, (3) AP1000 and IRIS. • See Sections 3.2, 3.14, 3.16, and 3.17 for additional information.

Table 2-1. Site Development Costs

Site Development Cost Factors	Discussion
Plant Cooling and Water Supply	• Costs for plant cooling and water supply would likely be highest for INEEL and Portsmouth, followed by Savannah River. Once-through cooling is not viable at any of the three sites. Plant cooling and water supply is a significant cost factor. • At INEEL and Portsmouth, air-cooled condensers would be required. The UHS would be a closed system such as a mechanical draft cooling tower with an enclosed storage basin. INEEL has an abundant supply of groundwater. • At Savannah River, a closed cycle cooling system (wet cooling towers, mechanical draft cooling towers, or natural draft cooling towers) could be considered with makeup water from the Savannah River. Air-cooled condensers could also be considered. The UHS would be a closed system such as a mechanical draft cooling tower with an enclosed storage basin. • See Section 3.22 for additional information.
Engineering and Project Management	• Costs for engineering and project management would likely be about the same for all three sites.
Land Cost/Property Taxes	• Costs for land and property taxes would likely be about the same for all three sites.
Licensing and Permitting	• Costs for licensing and permitting would likely be about the same for all three sites. See Section 3.10 for additional information.
Community Relations	• Costs for community relations would likely be about the same for all three sites. See Section 2.3 for additional information.
Contingencies	• Costs for contingencies would likely be about the same for all three sites.
Insurance	• Costs for insurance would likely be about the same for all three sites.
Financing	• Costs for financing would likely be about the same for all three sites.

Based on the above evaluation, total site development costs would likely be highest for INEEL, followed by Savannah River and Portsmouth.

For INEEL, a ranking of 2 is assigned for the ABWR, AP1000, IRIS, and PBMR reactors. A ranking of 1 is assigned for the GT-MHR reactor and the Bounding Plant.

For Portsmouth and Savannah River, a ranking of 2.5 is assigned for the ABWR, AP1000, IRIS, and PBMR reactors. A ranking of 1.5 is assigned for the GT-MHR reactor and the Bounding Plant.

3. Engineering Criteria

3.1 Site Size

This section evaluates the space available at the INEEL, Portsmouth, and Savannah River sites for possible new nuclear units. The space required for the main power block and supporting structures, plant cooling systems, storage tanks, radwaste storage, switchyard, and onsite spent fuel storage is considered. Detailed site layout evaluations should be performed to confirm that adequate area is available and to determine the optimum location of new facilities.

The available space at each site is described in Sections 1.1.2, 1.2.2, and 1.3.2. The size requirements for the different reactor types are provided in Table 3–1.

Table 3-1. Plant Size Requirements

	Plant Area (Note 1)	Mechanical Draft Cooling Towers (Note 2)	Ultimate Heat Sink (Spray Pond) (Note 3)
ABWR			
1 Unit (1350 MWe)	787 ft x 1312 ft 23.7 acres	808 ft x 808 ft 15 acres	590 ft x 590 ft 8 acres
2 Units (2700 MWe)	1574 ft x 1312 ft 47.4 acres	808 ft x 1616 ft 30 acres	590 ft x 1180 ft 16 acres
AP1000			
1 Unit (1117 MWe)	530 ft x 790 ft 9.6 acres	808 ft x 808 ft 15 acres	None. The passive cooling design of the AP1000 does not require a separate safety-grade UHS.
2 Units (2234 MWe)	530 ft x 1580 ft 19.2 acres	808 ft x 1616 ft 30 acres	
GT-MHR			
4 Modules (1144 MWe)	1200 ft x 1660 ft 44 acres	808 ft x 808 ft 15 acres	590 ft x 590 ft 8 acres
8 Modules (2288 MWe)	1200 ft x 3320 ft 91 acres	808 ft x 1616 ft 30 acres	590 ft x 1180 ft 16 acres
IRIS			
3 Modules (1005 MWe)	733 ft x 1167 ft 19.6 acres	808 ft x 808 ft 15 acres	None. The passive cooling design of the IRIS plant does not require a separate safety-grade UHS.
6 Modules (2010 MWe)	800 ft x 1267 ft 23.3 acres	808 ft x 1616 ft 30 acres	

Table 3-1. Plant Size Requirements

	Plant Area (Note 1)	Mechanical Draft Cooling Towers (Note 2)	Ultimate Heat Sink (Spray Pond) (Note 3)
PBMR			
8 Modules (1280 MWe)	180 ft x 1804 ft 7.5 acres	808 ft x 808 ft 15 acres	None. The passive cooling design of the PBMR plant does not require a separate safety-grade UHS.
16 Modules (2560 MWe)	360 ft x 1804 ft 15 acres	808 ft x 1616 ft 30 acres	

Notes:

1. *The plant areas assumed for the GT-MHR and IRIS are conservative but should be considered preliminary because the plant and site layouts have not been finalized or optimized for these reactor designs.*
2. *See the discussion in Section 3.22 for cooling water source. The area assumed for mechanical draft cooling towers is based on the ABWR plant layout and is conservative, particularly for the GT-MHR and PBMR designs that have higher plant efficiencies and, therefore, lower heat rejection rates.*
3. *The area identified for the UHS assumes a spray pond is used. This area could be significantly reduced if, for example, mechanical draft cooling towers with enclosed storage basins are used.*

3.1.1 Evaluation of the INEEL Site

As described in Section 1.1.2, approximately 1235 acres of space is available. Based on the available space and the plant sizes identified in Table 3–1, the following rankings are assigned for the different reactor types:

- ABWR

A ranking of 5 is assigned. The approximately 1235 acres available is adequate to install at least two ABWR units (47 acres) plus cooling towers and allows for construction of several additional units in the future.

- AP1000

A ranking of 5 is assigned. The approximately 1235 acres available is adequate to install at least two AP1000 units (19 acres) plus cooling towers and allows for construction of several additional units in the future.

- GT-MHR

A ranking of 5 is assigned. The approximately 1235 acres available is adequate to install at least eight GT-MHR modules (91 acres) plus cooling towers and allows for construction of several additional modules in the future.

- IRIS

A ranking of 5 is assigned. The approximately 1235 acres available is adequate to install at least six IRIS modules (23 acres) plus cooling towers and allows for construction of several additional modules in the future.

- PBMR

A ranking of 5 is assigned. The approximately 1235 acres available is adequate to install at least 16 PBMR modules (15 acres) plus cooling towers and allows for construction of several additional modules in the future.

- Bounding Plant

A ranking of 5 is assigned consistent with the ranking of each reactor type.

3.1.2 Evaluation of the Portsmouth Site

As described in Section 1.2.2, approximately 340 acres of space is available. Additional space is potentially available in the area of the firing range.

Based on the available space and the plant sizes identified in Table 3–1, the following rankings are assigned for the different reactor types:

- ABWR

A ranking of 3 is assigned. The approximately 340 acres available appears adequate to install at least two ABWR units (47 acres) plus cooling towers and allow for construction of one or two additional units in the future.

- AP1000

A ranking of 4 is assigned. The approximately 340 acres available appears adequate to install at least two AP1000 units (19 acres) plus cooling towers and allows for construction of more than two additional units in the future.

- GT-MHR

A ranking of 3 is assigned. The approximately 340 acres available appears adequate to install at least eight GT-MHR modules (91 acres) plus cooling towers and allows for construction of one or two additional modules in the future.

- IRIS

A ranking of 4 is assigned. The approximately 340 acres available appears adequate to install at least six IRIS modules (23 acres) plus cooling towers and allows for construction of more than two additional modules in the future.

- PBMR

A ranking of 4 is assigned. The approximately 340 acres available appears adequate to install at least 16 PBMR modules (15 acres) plus cooling towers and allows for construction of more than two additional modules in the future.

- Bounding Plant

A ranking of 3 is assigned consistent with the ABWR and GT-MHR.

3.1.3 Evaluation of the Savannah River Site

As described in Section 1.3.2, various sites are potentially available at SRS for new nuclear generation. For example, six sites have already been shown to satisfy the exclusion criteria established for potential development sites of an APT facility. The preferred APT site consists of approximately 250 acres.

Based on the extensive amount of land potentially available and the plant sizes identified in Table 3-1, the following rankings are assigned for the different reactor types:

- ABWR

A ranking of 5 is assigned. The six sites suitable for an APT and additional potential sites are adequate to install at least two ABWR units (47 acres) plus cooling towers and allow for construction of several additional units in the future.

- AP1000

A ranking of 5 is assigned. The six sites suitable for an APT and additional potential sites are adequate to install at least two AP1000 units (19 acres) plus cooling towers and allow for construction of several additional units in the future.

- GT-MHR

A ranking of 5 is assigned. The six sites suitable for an APT and additional potential sites are adequate to install at least eight GT-MHR modules (91 acres) plus cooling towers and allow for construction of several additional modules in the future.

- IRIS

A ranking of 5 is assigned. The six sites suitable for an APT and additional potential sites are adequate to install at least six IRIS modules (23 acres) plus cooling towers and allow for construction of several additional modules in the future.

- PBMR

A ranking of 5 is assigned. The six sites suitable for an APT and additional potential sites are adequate to install at least 16 PBMR modules (15 acres) plus cooling towers and allow for construction of several additional modules in the future.

- Bounding Plant

A ranking of 5 is assigned consistent with the ranking of each reactor type.

3.2 Site Topography

The objective of this section is to evaluate the topography at each site to determine the suitability for nuclear power generation facilities. The presence of mountains or steep terrain effectively precludes the siting of a plant because of significant costs associated with earth moving activities to establish a flat plant grade. Steep slopes can also be unstable and produce damage to safety-related facilities because of landslides.

The sites are also investigated for the presence of large-scale topographic features within the site area that may also preclude siting a power plant. Typically, these are features that feasibly cannot be relocated or altered, such as stream channels, deep incised valleys, knobs, sinkholes, abandoned mines, etc.

3.2.1 Evaluation of the INEEL Site

A site visit was conducted on April 29, 2002 to observe the topography of the site. Additionally, the USGS topographic map for the site area was reviewed. The selected new power generation site is situated about one mile east of the Big Lost River in the south-central portion of the INEEL site. The general topography of the entire area is low-lying flat terrain with an average elevation of about 4920 ft NGVD.

The proposed site consists of open grass-covered rangeland with no current development. The drainage across the site is generally from east to west towards the Big Lost River. With annual rainfall between 8 and 10 inches per year at the site, there are no existing drainage channels through the proposed site. For most of the year, there also is no flow in the Big Lost River. Flows generally occur during the spring snowmelt and after intense storms. The existing terrain contains slopes less than 2 percent and is suitable to the construction of nuclear power generation facilities. The proposed site grade may require fill in some areas to raise it above potential flooding that may occur (see Section

3.20). Regardless of the reactor type selected, the proposed site will not require significant earthmoving activities.

From the site visit and topographic map examination, it is evident no steep terrain and no large-scale topographic features are in the site area that would preclude the construction of new nuclear power reactors. Additionally, there appears to be no topographic indicators of geologic or hydrologic hazards in proposed site area. Based on these observations a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.2.2 Evaluation of the Portsmouth Site

The preferred new power generation site at Portsmouth is an undeveloped parcel of land situated northeast of the existing plant facilities. A site visit was made on June 5, 2002 to observe the topography. USGS topographic maps of the proposed site were also obtained to determine the site topography.

The site is along a gently sloping tract of land that slopes from the south to the north. Slopes range from about 2 percent to 5 percent. The average elevation of the site is about 675 ft NGVD. Site drainage can be directed to drainage features that exist along the northwestern and southeastern boundaries of the site. The site is currently tree- and grass- covered.

The topography criteria for all reactor types in the study are the same. A flat power island area is desired. The Portsmouth site can provide this feature with some earthwork to level the slopes. Additionally, there are no topographic indicators of geologic or hydrologic hazards in the proposed site area. Based on these observations, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.2.3 Evaluation of the Savannah River Site

The SRS preferred power generation site is in an undeveloped area of the SRS site. It is situated along the Aiken and Barnwell County border near an existing transmission line. A site visit was made on May 14-15, 2002, to observe the site topography. USGS topographic maps of the proposed site were also obtained to determine the site topography.

The site is situated on top of a broad drainage divide that is fairly flat on top. In general, the overall slopes of the area are less than 2 percent, but can be as much as 5 percent in some small local areas. The average elevation is about 310 ft NGVD. The existing site is currently wooded with no significant drainage features. The existing drainage slopes away from the site to the northeast and southwest.

The topography criteria for all reactor types in the study are the same. A flat power island area is desired. The SRS site will provide this feature with some earthwork. Additionally, there are no topographic indicators of geologic or hydrologic hazards in the proposed site area. Based on these observations, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.2.4 References

1. U.S. Geological Survey, 7.5 Minute Topographic Map, Ryegrass Flat, Idaho, 1995.
2. U.S. Geological Survey, 7.5 Minute Topographic Map, Waverly South, Ohio, 1992.
3. U.S. Geological Survey, 7.5 Minute Topographic Map, New Ellington, SE, South Carolina, 1989.

3.3 Environmentally Sensitive Areas

Environmental laws and regulations have been developed to protect air, water, fish, wildlife, plants, and cultural resources from degradation. These laws and regulations typically address new projects or modifications to existing facilities and specify the applicable approval and permitting processes. Depending on the extent of impacts, environmentally sensitive areas regulated under these laws and regulations should either be excluded from further consideration or avoided in the siting of new commercial nuclear power plants.

3.3.1 Evaluation of the INEEL Site

The INEEL area measures about 37.5 miles north to south and about 34.8 miles east to west. Most of the INEEL site is in Butte County, but portions are also within Bingham, Bonneville, Jefferson, and Clark counties. The INEEL site has nine primary facility areas spreading out over a wide area of otherwise undeveloped, high-desert terrain. The site is remote from major population centers, waterways, and interstate transportation routes.

The EBR-I facility at INEEL is no longer in operation, and has been designated a National Historic Monument. Recreational uses of the site include public tours of general facility areas and EBR-I and controlled hunting, which is generally restricted to half a mile within the INEEL site boundary. Grazing is not allowed within 2 miles of any nuclear facility, and dairy cattle are not permitted.

INEEL is approximately 100 miles from Grand Teton and Yellowstone National Parks. A Class-I area, Craters of the Moon National Monument, is about 30 miles west-southwest of the preferred site. Because of the physical separation, no impact on Class I areas is expected. No designated wetland exists in the preferred site area.

Two federally listed endangered and threatened species—the bald eagle and the gray wolf—have been identified by the U.S. Fish and Wildlife Service as potentially occurring on the INEEL site. Bald eagles are observed only in the remote areas of INEEL about 20 miles north of the Test Area North and near Howe. However, no threatened or endangered species were found at the preferred site. No paleontological localities have been identified within the preferred site.

There are four Idaho Indian reservations (http://www.hanksville.org/sand/contacts/tribal/ID.html). The closest is the Fort Hall Indian Reservation situated about 38 miles south-southeast of the preferred site. No significant impacts from future site activities would be expected.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.3.2 Evaluation of the Portsmouth Site

The Portsmouth site is an approximately 3700-acre parcel of DOE-owned land in sparsely populated rural Pike County in south central Ohio. The area was previously farmland and the watershed for several intermittent streams. The facility is about 65 miles south of Columbus, Ohio, and 75 miles east of Cincinnati, Ohio, the two closest metropolitan areas. The cities of Portsmouth, and Chillicothe, Ohio, are located about 20 miles from the site. The Scioto River valley runs 1 mile west of the facility. With the exception of the Scioto River floodplain, which is farmed extensively, the area around the Portsmouth site consists of marginal farmland and forested hills. The preferred site is situated in the northeast portion of the site.

There is one federally listed endangered species and one proposed species that potentially could be found on the site, the Indiana bat and the timber rattlesnake, respectively. However, based on surveys conducted between 1994 and 1996, these species were not found at the site.

There are no wild and scenic rivers in the immediate vicinity of the Portsmouth site. As listed in 40 CFR 81, there are no Class I areas in Ohio. There are no state or national parks, forests, conservation areas, or other areas of recreational, ecological, scenic, or aesthetic importance within the immediate vicinity of the site. No National Register of Historic Places (NRHP) properties are located on the DOE reservation. No national landmarks are reported near the site. The nearest is Buzzardroost Rock and Lynx Prairie in Adams County, about 30 miles southeast of the site.

A web search (www.hanksville.org/sand/contacts/tribal/OH.html) indicates that there is only one Indian site in Ohio—the Shawnee Nation (United Remnant Band)—which is situated near Urbana, about 100 miles north-northwest of the site. It is state recognized, but not a federally recognized Indian tribe.

No significant recreational areas are on the site. Offsite recreational areas include the Brush Creek State Forest and Lake White State Park. Brush Creek State Forest is at least 5 miles south-southwest of the preferred site, while Lake White State Park is about 5 miles north of the preferred site.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.3.3 Evaluation of the Savannah River Site

SRS covers an approximately 310 square mile site adjacent to the Savannah River in Aiken, Barnwell, and Allendale counties of South Carolina. It is bounded on the southwest by the Savannah River, and its center is about 25 miles southeast of Augusta, Georgia, and 19.5 miles south of Aiken, South Carolina.

Facilities account for approximately 5 percent of the SRS area; with the exception of facilities, land cover is a wide variety of natural vegetation types. DOE has set aside 30 areas covering about 14,230 acres to protect rare, threatened, and endangered species and unique habitats.

The preferred site at SRS is the APT preferred site. There are no wetlands on the preferred site. Several threatened and endangered species exist at SRS and research has been conducted at the site on the wood stork, red-cockaded woodpecker, bald eagle, shortnose sturgeon, and smooth purple coneflower. However, no designated critical habitat or any listed threatened or endangered species are on the preferred site.

The two main bodies of water on site, Par Pond and L-Lake, are manmade. Par Pond, which was constructed to provide cooling water for, and to receive heated cooling water from, P-Reactor and R-Reactor, has a surface area of about 2700 acres. The 1000-acre L-Lake was constructed to receive heated cooling water from L-Reactor. SRS is bounded on its southwest border by the Savannah River for about 35 river miles. Five major SRS streams feed into the river.

The closest Class I area—Cape Romain National Wildlife Refuge Wilderness Area, South Carolina—is about 100 miles east-southeast of SRS. Santee National Wildlife Refuge is about 65 miles east-northeast of SRS. Sumter National Forest is situated about 70 miles northwest of the site.

In 1966, the NRHP listed 101 properties in the region of influence. However, no historic properties are within the preferred site and no SRS facilities have been nominated for the National Register. Archaeologists have divided the SRS into three zones. The preferred site is in Zone 3, which includes areas of low archaeological site density. Activities in this zone have a low probability of encountering archaeological sites and virtually no chance of encountering large sites with more than three prehistoric components; the need for site preservation is low.

A web search (www.hanksville.org/sand/contacts/tribal/SC.html) indicates there are seven Indian tribes and villages in South Carolina. The closest is situated in Holly Hill, about 65 miles to the east of the preferred site.

There are three federal outdoor recreation facilities in or near the region of influence. The closest is the Santee National Wildlife Refuge, about 65 miles east-northeast of SRS. There are five state parks in the region of influence; the closest is Redcliffe Plantation State Park about 10 miles northwest of the preferred site.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.3.4 References

1. U.S. DOE Environmental Report – Independent Spent Fuel Storage Installation (ISFSI) License for the Three Mile Island Unit Two (TMI-2) Fuel.

2. DOE/NP-0014 (1992), Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operation New Production Reactor Capacity.

3. An Orientation of Facilities and the NOR Site, INEEL, September 5, 2001.

4. Idaho Indian Reservations, http://www.rootweb.com/indreserv/.

5. DOE/EA-1346, Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, 2002.

6. ERDA-1549, Portsmouth Gaseous Diffusion Plant Expansion, Final Environmental Statement, 1977.

7. Tribes and Villages of Ohio, http://www.hanksvill.org/sand/contacts/trib al/OH.html.

8. Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, 2002.

9. Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the SRS, 1997.

10. DOE/EIS-0270D, Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site, Draft December 1997.

11. WSRC-TR-97-0223, Savannah River Site, Ecology, 1997.

12. WSRC-TR-2000-00328, Savannah River Site Environmental Report for 2000.

13. Tribes and Villages of South Carolina, http://www.hanksvill.org/sand/contacts/tribal/SC.html

3.4 Emergency Planning/Population Density

This section assesses site suitability regarding the surroundings and population distribution for the development of adequate site-specific emergency plans in the site areas being evaluated. The Emergency Planning Zones (EPZs) defined in 10 CFR Part 50 are a 10-mile plume exposure pathway EPZ and a 50-mile ingestion pathway EPZ.

The criteria being evaluated are:

- 10 CFR Part 100, Subpart B, requires that the physical characteristics of the site should not present significant impediments to the development of the emergency plan.
- Regulatory Guide 4.7 states that the preferred population density at the time of initial operations and within about 5 years should not exceed 500 people per square mile out to 20 miles.

The most recent and readily available relevant licensing documents, topographic and transportation maps, and the U.S. Bureau of Census data was reviewed in conjunction with a site visit to examine the regional environment and the physical characteristics of the site. In many cases, 1990 census data were the most recent. Data developed by federal and state agencies for the years other than those of the 10-year U.S. census were also considered; they are estimates based on agency survey and trends.

3.4.1 Evaluation of the INEEL Site

The INEEL site occupies about 890 square miles of dry, cool desert in southeastern Idaho. It is situated in the eastern Snake River Plain and west of the Snake River. Most of the site consists of open land.

The INEEL site is served by more than 230 miles of roadways consisting of principal arterial and major collector routes. There are 139 miles of DOE-owned and –controlled paved roads on site. Ninety miles of paved federal and state highways that are open for public use pass through the site. U.S. Route (US) 20 and US 26 cross the southern portion of the site, while Idaho State Route (SR) 22, SR 28, and SR 33 cross the northeastern part.

The preferred location is in the south central portion of the INEEL site. The nearby population-centers are Idaho Falls (42 miles southeast), Blackfoot (36 miles south-southeast), Pocatello (56 miles south), and Arco (20 miles west-northwest). The population of Idaho has remained stable since 1985. The reported 1987 population for Arco was 1,200. The 1987 populations of Blackfoot and Idaho Falls were 1,100 and 43,400, respectively. Almost 60 percent of INEEL employees live in Idaho Falls. Because INEEL dominates local employment, county-level population projections depend on the workforce projected for INEEL. The total population in the region is projected to nearly double between 1990 and 2040. The nearest National Park with significant tourists is more than 100 miles to the northeast.

There are no schools, hospitals, prison, beaches, parks, industrial or commercial complexes, etc., within 5 miles of the preferred site.

There are eight reactors and the TMI-2 Independent Spent Fuel Storage Installation (ISFSI) located on site, along with various other facilities. More than 90 percent of the area within 10 miles of the preferred site is under DOE control.

Emergency planning at INEEL is provided under existing site programs.

Based on the information presented above, it is concluded that there are no physical characteristics or significant surrounding population that would present impediments to any emergency response. A ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.4.2 Evaluation of the Portsmouth Site

The Portsmouth site is situated on approximately 3,700 acres with an 800-acre central developed area surrounded by a perimeter road in Pike County, Ohio. The general location is an area of steep to gently rolling hills, with average elevations of 120 feet above the Scioto River Valley. The steep hills characteristically are forested, while the rolling hills provide marginal farmland. With the exception of the Scioto River and its floodplain, the floodplains and valleys are narrow and are occupied by small farms. The area adjacent to the site is largely (90 percent) agricultural and forest land. The remaining 10 percent is taken up by industrial, commercial, and residential land use.

The preferred site location is in the northeast section of the site in a 340-acre area where no prior industrial activities have occurred and that is upslope from the industrialized area. The eastern area has steep forested slopes, while the central and western area has fairly flat areas of grassland.

Roadways in the fenced limited access or protected areas of the site consist of several miles of paved surface. Several paved roads branch out from the site to the perimeter road that surrounds the site. The west access to the site extends form US 23 to the perimeter road. Shyville Road connects US 32 to the north of the site, Big Run Road leads to the south side of the site, and Dutch Run Road enters the area from the east side of the site.

The Portsmouth site is in a rural, low-population area. The site is well separated from high-density, high-growth rate areas that might complicate emergency planning efforts. Nearby cities and their approximate distance from the site include Chillicothe (population 21,923), 25 miles north; Portsmouth (population 22,249), 22 miles south; Waverly (population 4,500), about 10 miles north; and Jackson (population 6,144), 26 miles east. All population statistics reported above are for year 1990. Communities closest to the site include the unincorporated towns of Piketon, Beaver, and Lucasville.

The permanent residential population of Pike County was 24,249 in 1990. The population density in the county was approximately 55 people per square mile in 1995 (U.S. Bureau of Census). The expected growth rate for 2000–2010 is less than 1 percent (Ohio Data Users Center). Population growth has occurred largely in the unincorporated areas of the county.

The total onsite population was 2477 as of January 1995 but has been significantly reduced in the last several years. The total population within 2 miles of the site is about 90. The 1990 population within 5 miles of the site is approximately 6,780 or 86.3 people per square mile. The projected population density for years 2010 and 2030 are 104.4 and 125.9 people per square mile, respectively. The total population within 50 miles of the site was approximately 600,000 people in 1990.

There are institutional, transient, and seasonal populations in the area. Within 5 miles of the site, there are four schools with combined enrollment (including faculty and staff) of 2,155 in 1995, two daycare facilities licensed to accommodate 140 children, and three nursing homes with a combined licensed capacity of 269 beds. The closest hospital is approximately 7.5 miles north of the site. Recreational facilities in the area include Brush Creek State Forest with an extremely light usage of about 20 people a year. Use of Lake White State Park, situated approximately 7.5 miles north of the site, is occasionally heavy and is concentrated on the 107 acres of land closest to the lake. The number of visitors in 1992 was 55,876 with a daily average of 153.

A site-wide Emergency Plan is in place to protect the health and safety of the public and workers at the Portsmouth site.

Based on the information presented above, it is concluded that there are no physical characteristics or significant surrounding population that would present impediments to any emergency response. However, there are several county and professional schools, daycare centers, and nursing homes within 5 miles of the preferred site. Consequently, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.4.3 Evaluation of the Savannah River Site

The SRS covers approximately 310 square miles and is bounded on the southwest by the Savannah River. It is approximately 25 miles southeast of Augusta, Georgia, and 19.5 miles south of Aiken, South Carolina. Most of the site (61.3%) is in Barnwell County and the region of influence includes Aiken, Allendale, Bamberg, Columbia, and Richmond counties.

In 1994, the population of the six-county region of influence was estimated to be 457,824. More than 89 percent of this population lived in three counties: Aiken, Columbia, and Richmond. Augusta was the largest city, with a population of 43,459.

In 1990, the population density of the region of influence was almost twice the national density and one-sixth to one-fifth higher than that in the two states. However, the annual growth rate for this influence region was less than 1 percent between 1990 and 1994. In 1994, the average number of people/square mile in the region of influence was 151. Population densities were highest in the cities of Aiken, Augusta, and North Augusta. Each had more than 1,000 people per square mile.

There are three federal recreation facilities in or near the region of influence and the Santee National Wildlife Refuge is approximately 65 miles east-northeast of SRS. There are also five state parks in the region of influence with the closest, Redcliffe Plantation State Park, situated 10 miles northwest of the preferred site.

With the exception of travelers on through highways, the only people on the limited-access SRS are members of the site workforce. The current onsite workforce is approximately 13,000. There are no permanent residents within the SRS.

The preferred site is approximately 6 miles from the nearest SRS site boundary to the north. The Vogtle nuclear plant is approximately 16 miles southwest of the preferred site across the Savannah River.

The SRS is served by more than 200 miles of primary roads and more than 1000 miles of unpaved roads. Two interstate highways serve the SRS area. I-20 provides a primary east-west corridor in the region, and I-520 links I-20 with Augusta. US 1 and US 25/SR 121 are principal north-south routes in the region, and US 78 provides east-west connections. Although three routes passing through the site (US Route 278, SR 19 and SR 125) are open to the public, access to SRS is controlled. There has been limited commercial traffic on the Savannah River since the 1970s.

A site-wide emergency plan is in place to protect the health and safety of the public and workers at SRS.

Based on the information presented above, it is concluded that there are no physical characteristics or significant surrounding population that would present impediments to any emergency response. There are no schools, prisons, hospitals, and public or commercial facilities within 5 miles of the preferred site; however, there are several cities with population density over 500 people per square mile. Consequently, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.4.4 References

1. 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities.

2. 10 CFR Part 52, Early Site Permits; Standard Design Certificates; and Combined Licenses for Nuclear Power Plants.

3. 10 CFR Part 100, Reactor Site Criteria.

4. NRC Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations, Revision 2, April 1998.

5. U.S. Department of Commerce, Bureau of the Census, 1990 Census of Population.

6. USGS Maps for Idaho, South Carolina, Georgia, and Ohio.

7. Portsmouth Gaseous Diffusion Plant Site, Final Environmental Impact Statement, May 1977.

8. Application for USNRC Certification, Portsmouth Gaseous Diffusion Plant Safety Analysis Report, Rev. 57, April 2002.

9. DOE/EA-1346, Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, 2002.

10. U.S. DOE Portsmouth Annual Environmental Report for 2000, Piketon, Ohio, December 2001.

11. Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site, June 1997.

12. DOE/EIS-0270D, Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site, December 1977.

13. PLN-114, INEEL Emergency Plan/RCRA Contingency Plan.

14. Portsmouth Gaseous Diffusion Plant Emergency Plan, Rev. 48, April 2001.

3.5 Labor Supply

This section evaluates the supply of construction labor and associated issues for each of the three sites. Topics evaluated include labor supply, wages and fringes (total compensation), and training.

Based on this evaluation, the INEEL site is ranked a 1, the Portsmouth site is ranked a 2, and the Savannah River Site is ranked a 4 for all reactor types and the Bounding Plant.

Labor Supply

Labor supply data is based on information from the 1990 and 2000 U.S. censuses. The census data are broken down into broad subdivisions and should be considered as indicative information only.

It is expected that the INEEL site will draw its labor supply primarily from the Idaho Falls area. The Portsmouth site will draw from the construction labor population in the tristate area of southern Ohio, northern Kentucky, and western West Virginia. The Savannah River site will draw its labor supply from the Aiken, South Carolina, and Augusta, Georgia, areas.

- INEEL Site

The proportion of construction labor potentially available is based on the proportion of construction labor to the total employed workforce population as described in the 1990 U.S. Census (2000 data is not yet available). The reported population in Idaho for 1990 was 729,814. The employed workforce for 1990 totaled 443,703, of which 28,940 were identified as employed in construction. The construction workforce was 3.97 percent of the total state population.

- Portsmouth Site

The total reported population for Ohio for 1990 was 8,349,183. The employed work force for 1990 totaled 4,931,357, of which 254,208 were identified as employed in construction. The construction workforce was 3.04 percent of the total state population. The total reported population for Kentucky for 1990 was 2,838,709. The employed work force for 1990 totaled 1,563,960, of which 98,785 were identified as employed in construction. The construction workforce was 3.48 percent of the total state population.

- Savannah River Site

The total reported population for South Carolina for 1990 was 2,669,383. The employed work force for 1990 totaled 1,603,425, of which 127,294 were identified as employed in construction. The construction workforce was 4.77 percent of the total state population. The total reported population for Georgia for 1990 was 4,938,381. The employed workforce for 1990 totaled 3,090,276, of which 214,359 were identified as employed in construction. The construction workforce was 4.34 percent of the total state population.

* * *

These ratios are assumed valid for subsets of the total population, such as cities and counties, and valid as a basis for estimating the number of personnel in the construction workforce for 2000.

The population base for the INEEL, Portsmouth, and Savannah River areas is provided in Table 3–2.

Table 3-2. Labor Supply

City or Area	Total Population	Construction Workforce
INEEL Site		
Idaho Falls	50,730	2,014
State of Idaho	729,814	28,940
Portsmouth Site		
Portsmouth, Ohio	20,909	636
Ashland, Kentucky	21,981	765
State of Ohio	8,349,183	254,208
State of Kentucky	2,838,709	98,785
Savannah River Site		
Aiken, South Carolina	25,337	1,209
Augustus, Georgia	195,182	8,471
State of South Carolina	2,669,383	127,294
State of Georgia	4,938,381	214,359

The following is an assessment of the labor supply for each site based on the above data.

- INEEL Site

The current availability of craft for INEEL is reported to be good. There have been no construction shortages recently because of a slowdown in construction projects within the region. The Idaho Falls area workforce would have to be supplemented by travelers to support any project involving 1000+ workers. Because of the remoteness of the area and the potential for severe winter weather, incentives would be required to attract significant numbers of craftsmen to this site.

- Portsmouth Site

The craft availability in the Portsmouth area is currently reported at full employment for all crafts except electricians. The concentration of industrial facilities within this region (oil refineries, steel mills, etc.) provides year after year employment for the building trades. This could present significant competition for manpower if this site were selected for construction of a new commercial nuclear power facility. Moreover, this area has a reputation as a difficult labor climate and the shutdown of the Portsmouth enrichment facility operations has contributed to this climate.

- Savannah River Site

Craft availability for this site is reported to be good. Currently, there are no shortages, and no shortages are anticipated in the near term. A majority of the unions in the area currently have unemployed craftsmen. An in-depth labor survey would be required to determine the outside recruitment area for craftsmen needed to support a large nuclear construction project. However, the Savannah River site has been the primary employer of building trades craftsmen for decades and the local unions are accustomed to providing large numbers of workers to the site. Moreover, the year-round favorable climate would help attract craft to this site, but the lower wages would probably require added incentives to draw out-of-state craftsmen to the site.

* * *

Based on the above assessment, it is concluded that the Savannah River Site presents the best labor climate and opportunity to recruit significant numbers of craftsmen to construct a new commercial nuclear power facility.

Wages and Fringes (Total Compensation)

Wages and fringes currently paid at the three sites are provided in Table 3–3:

Table 3-3. Wage Survey

	Low	High
INEEL Site		
Hourly Wages	Laborers	Pipefitters
Union	$26.50	$34.12
Portsmouth Site		
Hourly Wages	Laborers	Iron Workers
Union	$29.36	$36.18
Savannah River Site		
Hourly Wages	Laborers	Boilermakers
Union	$15.79	$33.89

For the INEEL site, current wage rates will remain in effect until June 2003. The current wage rates for the Savannah River site will change in October 2002. Most contracts for the Portsmouth area will remain in effect until May 2005.

Training

A full assessment of this important subject is beyond the scope of this study. Nevertheless, the following overview is offered.

The major crafts have active apprenticeship and training programs at the INEEL, Portsmouth, and Savannah River sites. A training infrastructure exists (that is, facilities, training materials, and instructors) that could be readily adapted to meet the skills training needs of a nuclear power project.

The existence of local colleges, trade schools, and other training facilities in each area would need to be more extensively evaluated. By way of example, at the Savannah River site there are several good local colleges, technical schools, and training facilities available, such as the University of South Carolina in Aiken, Augusta State, Paine College, Aiken Tech, and Augusta Tech. The pipefitters, electricians, operating engineers and carpenters, to name a few specific trades, have their own training facilities.

In addition, the pipefitter's international union also built a regional training center in Charleston, South Carolina, to serve the eastern United States in specific training areas such as welding.

3.6 Transportation Access

This section evaluates access to the sites for purposes of materials and personnel transportation during construction. Each site was evaluated for four modes of access: road, rail, air, and water.

3.6.1 Evaluation of the INEEL Site

Road, rail, air, and water access to the INEEL site is evaluated in the following paragraphs.

- Road

Road access to the INEEL site is via state highways, which are two-lane paved roads. Additional evaluations would need to be performed to assess the condition of these roads for heavy component transportation. It is assumed that these roads would handle all normal transportation of materials and equipment required for the construction effort. New access roads to the preferred site location would need to be built into the construction site area to eliminate the need to access the INEEL site security area.

- Rail

The INEEL site is served by one rail line. Based on discussions with INEEL site representatives, it does not appear that the main line coming into the site has been well maintained. A more detailed study would be needed to assess the overall condition of the main line, including bridges, condition of track and track bed, etc., to better understand the feasibility of moving large and heavy loads to the site by rail. The rail lines on site are maintained by DOE and appear to be in good condition with only minor upgrades and repairs required. The onsite rail system could be extended to the preferred site without any major site modifications.

- Air

The Idaho Falls airport is capable of handling regular freight and passenger jet services and is of sufficient size to accommodate the relatively small air shipments normally associated with a construction project.

- Water

The INEEL site is not situated near any waterways that are accessible by barge. The closest waterways that would accommodate barge deliveries are more than 400 miles from the site. Transportation from this area would be by truck or rail. A significant amount of this trip would be through the mountains and could be impacted by the winter weather. Oversize loads would most likely be limited to daylight hours, Monday through Friday.

Based on the above evaluation, a ranking of 1 is assigned for all reactor types and the Bounding Plant.

3.6.2 Evaluation of the Portsmouth Site

Road, rail, air, and water access to the Portsmouth site is evaluated in the following paragraphs.

- Road

Southern Ohio's two major highways serve the Portsmouth site: US Route 23 and Ohio SR 32. These highways are within 1 mile of the site. Access is by the main access road, a four-lane interchange with US Route 23, and the North Access Road, two lanes transitioning to four lanes with Ohio SR 32. The preferred site is situated on the property line, making access to the construction site from the county road easily achievable without having to enter the security area for the enrichment facility. Ohio SR 32 and US Route 23 appear to be kept in excellent condition and have been used for the transportation of heavy loads in the past. The major roads go north, south, east, and west making access from all directions to the site easily achievable.

- Rail

The Portsmouth site is serviced by two major rail lines: CSX and Norfolk & Southern (N&S). Both railways appear to be in excellent condition, with the main line for both railways coming to the site property line. The preferred site has a rail line that runs north and south along the property line and parallels US Route 23. At Portsmouth, approximately 22 miles south of the site, two main rail lines run east and west along the Ohio River. The transfer of materials and equipment from barges to railcars could easily be accomplished.

- Air

The Portsmouth site is within 100 miles of numerous airports: Columbus, Cincinnati, Dayton, Charleston, West Virginia, and Parkersburg, West Virginia. All of these airports conduct regular freight and passenger airline services that can accommodate the relatively small air shipments normally associated with a large construction project. There are also numerous smaller airports in the immediate area that may be able to handle these types of items.

- Water

The Portsmouth site is about 22 miles north of the Ohio River, which handles major shipping interest. There are no significant barge offload facilities in Portsmouth; however, barge offload facilities are upstream and downstream of Portsmouth directly adjacent to main rail lines and major roads, making transportation to the site by either means easily achievable.

* * *

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.6.3 Evaluation of the Savannah River Site

Road, rail, air, and water access to the Savannah River site is evaluated in the following paragraphs.

- Road

Road access to the Savannah River site is via State Highway 125. Near the preferred site, US 278 cuts through a portion of the Savannah River site. Easy access to the preferred site area could be accommodated by installing access roads from US 278. Most roads leading to the site are two lane roads, but appear to be kept in excellent condition. The site is near major north-south and east-west interstate highways that would facilitate equipment and material deliveries and not create any undue traffic impacts on the surrounding area. The major commuting route for the current Savannah River workforce is State Highway 125, which is on the opposite side of the Savannah River site and should not be impacted by the construction efforts at the preferred site location.

- Rail

The Savannah River site is served by the CSX railroad. Some upgrades would likely be needed to accommodate the large and heavy loads associated with construction of a new nuclear power plant. Traffic delays at offsite railroad crossings would be expected. CSX would need to inspect and report on required upgrades before committing to this mode of transportation for large and heavy loads. There are approximately 80 miles of onsite rail lines, with approximately 60 miles being maintained by DOE. Currently no rail spur exists at the preferred site, but one of the rail lines is approximately 0.5 miles away. To avoid security issues associated with transportation through the SRS site, CSX could be contacted to discuss the possibility of installing a spur line from the main line to the DOE property line at the preferred site location. Should that be achievable, the construction effort would include the installation of required spur lines on site for the offload of materials and equipment.

- Air

The nearest major airport to the Savannah River site is in Atlanta, Georgia. The closest airport to the Savannah River site is in Augusta, Georgia. This airport conducts regular freight and passenger airline services and is large enough to accommodate the relatively small air shipments normally associated with a large construction project. The Atlanta airport can accommodate large air shipments. Ground transportation from the Augusta airport to the site is approximately 1 hour and from the Atlanta airport approximately 3 hours.

- Water

The Savannah River site is on the Savannah River, with a barge slip situated on DOE property. This barge slip has been used in the past for heavy loads and large components such as steam generators. Shipment of heavy loads by barge to the Savannah River site is dependent on the water level in the Savannah River; with the continued drought conditions in the Southeast, the river level has not been high enough to support barge traffic. The preferred site is on the opposite side of the property from the barge slip and would require some additional heavy haul routes to be constructed. Additional studies would need to be performed for the final location of the haul routes.

* * *

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.7 Security

10 CFR 100, Subpart B, requires that site characteristics be such that adequate security plans and measures can be developed. Regulatory Guide 4.7 indicates that a distance of about 360 feet from public access areas to vital structures or equipment is typically needed to meet the requirements of 10 CFR 73 without special measures or analyses.

3.7.1 Evaluation of the INEEL Site

Because of the size of the preferred site (about 1235 acres) and its location on the INEEL reservation, vital structures and equipment would be distant from any public access areas. This location would provide much greater distance than the Regulatory Guide 4.7 requirement of 360 feet from public access areas to vital structures or equipment.

Based on the above evaluation, a ranking of 5 is assigned for the AP1000, ABWR, GT-MHR, and IRIS reactors. In accordance with the Site Evaluation Process, a ranking of 4 is assigned to the PBMR because some amount of special measures and analyses will likely be required to account for the lack of a containment structure. A ranking of 4 is assigned to the Bounding Plant consistent with the PBMR.

3.7.2 Evaluation of the Portsmouth Site

The preferred location includes portions of the DOE site boundary. However, because of the size and physical location of the preferred site, vital structures and equipment could be located greater than 360 feet from public areas.

Based on the above evaluation, a ranking of 4 is assigned for the AP1000, ABWR, GT-MHR, and IRIS reactors. A ranking of 3 is assigned to the PBMR and the Bounding Plant because some amount of special measures and analyses will likely be required to account for the lack of a containment structure for the PBMR.

3.7.3 Evaluation of the Savannah River Site

The preferred site is situated away from public access areas such as public-use roads and railroads. Consequently, vital structures and equipment would be located greater than 360 feet from the public, which would exceed the Regulatory Guide 4.7 requirements.

Based on the above evaluation, a ranking of 4 is assigned for the AP1000, ABWR, GT-MHR, and IRIS reactors. A ranking of 3 is assigned to the PBMR and Bounding Plant because some amount of special measures and analyses will likely be required to account for the lack of a containment structure for the PBMR.

3.7.4 References

1. Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations, U.S. Nuclear Regulatory Commission, Revision 2, April 1998.

3.8 Collocated or Nearby Hazardous Land Uses

The purpose of this section is to evaluate collocated or nearby hazardous industrial, transportation, and military installations for potential impacts on the safe operation of new nuclear power facilities.

As required by Regulatory Guide 1.70, the impacts of potential accidents near the plant from these activities must be analyzed for determining design basis events. Facilities and activities within 5 miles of a proposed site are considered for this criterion. Facilities and activities of greater distances are also considered as appropriate to their significance.

3.8.1 Evaluation of the INEEL Site

No airports are within 5 miles of the INEEL site. Arco-Butte County Airport is about 20 miles west of INEEL. There are three unpaved airports in Atomic City approximately 12 miles south of INEEL. The closest major airport is the Idaho Falls Fanning Airport located about 40 miles east of the site.

Public transportation routes nearest INEEL include U.S. Highway 20/26, which passes about 4 miles south of the preferred site, and the Mackay Branch of the Union Pacific Railroad, which passes 8 miles south of the preferred site. Other roads in proximity to the preferred site are the controlled access roads between various INEEL facilities. The road nearest to the preferred site location is Lincoln Blvd., the main north-south road at INEEL, passing approximately 2.5 miles to the west. A railroad spur from the Mackay Branch passes within about 2 miles to the west of the preferred site. Hazardous materials, including spent nuclear fuels, radioactive waste, and various chemicals are transported on these routes. Accidents along these transportation routes were evaluated in the TMI-2 ISFSI Safety Analysis Report (SAR). Based on the acceptable conclusions reached for the ISFSI and the proximity of the preferred site to the ISFSI, no adverse impacts on the preferred site location would be expected.

Most of the surface water flow in Big Lost River, Little Lost River, and Birch Creek is diverted for irrigation before it reaches the INEEL site boundary. This diversion often results in little or no flow in these surface water bodies for many years within the boundary of INEEL. The Snake River, about 22 miles from INEEL, is not connected to any surface water body at INEEL but is hydraulically connected to the Snake River Plain aquifer.

The INEEL site is large and remote, and there are no ordinary industrial or military facilities closer to the site boundary than Idaho Falls, which is about 29 miles away.

The ISFSI SAR concluded that there are no natural gas pipelines, mines or stone quarries, oil or gasoline plants, or other activities in which a fire or explosion could cause damage to the ISFSI. Because of the proximity of the preferred site to the ISFSI, no adverse impacts to the preferred site would be expected as a result of fire or explosion accidents.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.8.2 Evaluation of the Portsmouth Site

No airports are within 5 miles of the Portsmouth site. The closest airport, Pike County Airport, is located about 11 miles north-northeast of the site and no commercial or cargo flights occur there. There are no military facilities within 10 miles of the site. In the past, the Ohio National Guard has maintained an area on the Portsmouth site for the reconditioning and storage of equipment; however, no armament is maintained at the facility.

The preferred site is located about 1.8 miles east of US Route 23, 0.5 miles south of SR 32, and 1.75 miles east of the main N&S rail line. The distance from the East Access Road to the preferred site is approximately 1 mile.

The Scioto River, located about two miles west of the site, is used mainly for irrigation purposes. The Ohio River is located approximately 22 miles south of the site. Thus, no hazardous impacts are expected from river accidents.

Economic activities in the vicinity near the Portsmouth site consist primarily of farming, lumbering, and small business. A gravel quarry is situated west of the Portsmouth site, adjacent to the Scioto River. The quarrying is done by surface extraction; no explosives are used.

A 6-inch steel natural gas pipeline comes into the site parallel with the East Access Road. Once inside the site, the pipeline turns south. After that, it turns west to link with two boilers inside Building X-3002. This pipe is routed almost parallel to an old airstrip located on the east-southeast portion of the site. No adverse impacts on the preferred site location are expected.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.8.3 Evaluation of the Savannah River Site

No airports are within 5 miles of the Savannah River Site. The closest airport is Bush Field located near Augusta, Georgia, about 18 miles west-northwest of the preferred site.

There are no military facilities within 5 miles of the SRS boundary. Since the preferred site is about six miles to the nearest site boundary (to the north), no military facilities are within 10 miles of the preferred site.

The closest highway is US 278. It is about 4.3 miles north of the preferred site. This route is not heavily traveled and the traffic accident rate for this route is low (0.09 MVMT). Because of the relatively long distance and the low accident rate, any impacts from the accidental release of hazardous materials transported on US 278 on the preferred site are expected to be small.

The preferred site is approximately 11 miles from the main CSX railway. No significant impacts from postulated railroad accidents are expected due to the relatively long distance of separation.

There has been limited commercial traffic on the Savannah River since the 1970s. No large hazardous chemical storage, handling, or manufacturing facilities exist within 5 miles of the preferred site.

Carolina Metals, Inc. is about 13.5 miles southeast of the preferred site and produces depleted uranium and uranium tetrafluoride.

The largest inland water body in the area is a manmade lake on the Savannah River, 22 miles upstream from Augusta, Georgia; this reservoir is known as Clarks Hill Lake in Georgia and Strom Thurmond Lake in South Carolina. The reservoir is about 38 miles from the closest SRS site boundary.

The nearest natural gas pipeline is approximately 10 miles northwest of SRS near Beech Island.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.8.4 References

1. INEEL, TMI-2 Safety Analysis Report, Rev. 2A, 2001.

2. DOE/NP-0014 (1992), Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operation New Production Reactor Capacity.

3. Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, 2002.

4. Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site, 1997.

3.9 Ease of Decommissioning

This section evaluates the characteristics of the sites for the decommissioning and eventual dismantlement of the proposed facilities at the end of their useful life. Issues considered include the presence of preexisting contamination, collocated operational facilities, adequacy of the transportation network, adequate space for potential long-term storage of spent fuel and contaminated equipment, etc.

3.9.1 Evaluation of the INEEL Site

The proposed location of new nuclear units at the INEEL site has no known hazardous or radioactive material contamination from the operation of existing site facilities. Before construction, any contamination would be addressed in accordance with applicable hazardous material and radiation protection programs during excavation.

As discussed in Section 3.6, the INEEL site is served by one rail line that may not be well maintained. There is no water access to the site. Consequently, the shipment of large components associated with reactor decommissioning will be difficult.

If a federal spent fuel storage repository is not in operation at the time of plant decommissioning, there is ample land available on site for the construction and operation of a large ISFSI.

Based on the above evaluation, a ranking of 3 is assigned to the ABWR and AP1000, which are large light-water reactors. The GT-MHR, IRIS, and PBMR are small modular reactors requiring multiple reactor vessels and other large components to produce the same electrical output as the ABWR and AP1000. Thus, a ranking of 2 is assigned to the GT-MHR, IRIS, and PBMR, because there would be an increased number of large component offsite shipments during decommissioning (for example, reactor vessels and steam generators). A ranking of 2 is assigned to the Bounding Plant consistent with the GT-MHR, IRIS, and PBMR.

3.9.2 Evaluation of the Portsmouth Site

The proposed location of new nuclear units at the Portsmouth site has no known hazardous or radioactive material contamination from the operation of existing site facilities. Before construction, any contamination would be addressed in accordance with applicable hazardous material and radiation protection programs during excavation.

As discussed in Section 3.6, two rail lines that appear to be in excellent condition serve the Portsmouth site. The Ohio River is approximately 22 miles south of the site and supports commercial barge traffic. Large component shipments have previously been accommodated on the site.

If a federal spent fuel storage repository is not in operation at the time of plant decommissioning, there is adequate land available on site for the construction and operation of a large ISFSI.

Based on the above evaluation, a ranking of 4 is assigned to the ABWR and AP1000, which are large light-water reactors. The GT-MHR, IRIS, and PBMR are small modular reactors requiring multiple reactor vessels and other large components to produce the same electrical output as the ABWR and AP1000. Thus, a ranking of 3 is assigned to the GT-MHR, IRIS, and PBMR, because there would be an increased number of large component offsite shipments during decommissioning (for example, reactor vessels and steam generators). A ranking of 3 is assigned to the Bounding Plant consistent with the GT-MHR, IRIS, and PBMR.

3.9.3 Evaluation of the Savannah River Site

The proposed location of new nuclear units at the Savannah River site has no known hazardous or radioactive material contamination from the operation of existing site facilities. Before construction, any contamination would be addressed in accordance with applicable hazardous material and radiation protection programs during excavation.

The Barnwell waste disposal facility is adjacent to SRS and is currently used for the burial of radioactive waste, including large components such as reactor vessels and steam generators, from decommissioned nuclear facilities. However, it is uncertain if the Barnwell disposal facility would be in operation at the time of decommissioning of new commercial nuclear power facilities; thus, offsite shipment to support decommissioning operations is assumed.

As discussed in Section 3.6, the Savannah River site is served by the CSX railroad. The Savannah River is adjacent to the site and has been used in the past for the shipment of large nuclear components such as steam generators; however, water level restrictions currently preclude its use.

If a federal spent fuel storage repository is not in operation at the time of plant decommissioning, there is ample land available on site for the construction and operation of a large ISFSI.

Based on the above evaluation, a ranking of 4 is assigned to the ABWR and AP1000, which are large light-water reactors. The GT-MHR, IRIS, and PBMR are small modular reactors requiring multiple reactor vessels and other large components to produce the same electrical output as the ABWR and AP1000. Thus, a ranking of 3 is assigned to the GT-MHR, IRIS, and PBMR, because there would be an increased number of large component offsite shipments during decommissioning (for example, reactor vessels and steam generators). A ranking of 3 is assigned to the Bounding Plant consistent with the GT-MHR, IRIS, and PBMR.

3.10 Water Rights and Air Permits

Water rights and air permits are evaluated in this section for impact on potential new nuclear generation at the INEEL, Portsmouth, and Savannah River sites.

Water Rights

Water allocation and permitting is a complex process requiring detailed analysis to determine water needs and impacts. The use of water is evaluated to determine if new or modified water use permits would be required so that the plant can make use of available water resources. Among the issues evaluated are:

- Estimated water requirements
- Physical water availability
- Right-of-ways for cooling water conveyance
- Effluents discharged to surface waters, publicly owned treatment works, or waste streams

Air Permits

The use of combustion engines (e.g., auxiliary boiler system, the standby power system) by the proposed new generation nuclear plant is being evaluated to determine if an air permit is required for installation of such equipment.

New and modifications of major stationary sources (emissions greater than 100 ton/year of any regulated criteria pollutants) are required by the Clean Air Act (CAA) to obtain an air pollution permit before commencing construction. Under the CAA, the country has been divided into Air Quality Control Regions. States have designated these regions either in compliance with the ambient air quality standards (AAQS) of the criteria pollutant (nitrogen dioxide, sulfur dioxide, particulate matter, carbon monoxide, ozone and lead), or not in compliance (that is, non-attainment area). Sources to be built or having impact on a non-attainment area are subject to the emission offset requirements and stringent emissions control practices.

The criteria being evaluated are:

- Locate within a non-attainment area for any applicable criteria pollutants
- A major source (greater than 100 tons/year) in an attainment area
- A significant source (greater than 40 tons/year) in a non-attainment area

3.10.1 Evaluation of the INEEL Site

Water Rights

Water use by power generation, industrial facilities, and other users must comply with environmental laws and regulations. Any proposed facility that uses water of the state is required to obtain applicable approvals/permit for water withdrawal before construction of the facilities. The use of water by a new nuclear power facility is evaluated to determine if water use permits would be required to access and use available water resources. Both physical water availability and the estimated water requirement are used in this determination.

As discussed in Section 3.22, new nuclear power facilities would require large quantities of water for closed cycled cooling using wet cooling towers. The cooling system would have to be designed with zero discharge since no plant discharge can be allowed into the groundwater (Reference 1). This type of design reduces the makeup water requirement and eliminates the need for blowdown. However, collection and discharge of certain amounts of water and sludge into an evaporation pond would be required. The pond would be lined and designed in accordance with dam and dike design requirements in the state of Idaho. This type of cooling system has some minor impact on plant output.

If the water requirement for a zero discharge plant is approximately 70 percent of the cooling tower makeup with blowdown, the required annual volume of water ranges from approximately 60,000 acre ft/yr for two ABWRs, to approximately 30,000 acre ft/yr for eight GT-MHR modules. According to Reference 2, INEEL currently has a federal reserve right of 35,000 acre ft/yr. The total estimated volume of groundwater in the Snake River Aquifer is approximately 2.5×10^{12} m^3 (Reference 2), which is equivalent to approximately 2×10^9 acre ft/yr. It has been estimated that only approximately 25 percent of this volume is available for withdrawal for pumping (Reference 2). For new nuclear generation, the estimated maximum water requirement is approximately 1 percent of the allowable withdrawal rate. The current water rights permit represents approximately 0.7 percent of the permissible water withdrawal. If this quantity can be permitted for power generation use, it is less than that required for two ABWRs and approximately equal to that of eight GT-MHR modules. Options available include negotiating for a higher water rights permit, using the full water right of 35,000 acre ft/yr, and reducing the number of units or modules. Alternatively, air-cooled condensers (Reference 1) could be considered. Air-cooled condensers would eliminate the water treatment, disposal of sludge, and an evaporation pond that are needed for zero discharge plants.

Based on the above evaluation, a ranking of 3 is assigned for water rights for all reactor types and the Bounding Plant. Water permits would be required regardless of the type of reactor because the water requirement equals or exceeds current water rights at INEEL.

Air Permits

It is assumed that auxiliary boilers for plant startup and standby diesel generators for backup power will be installed at any new nuclear power facility. However, the use of the equipment will be short-term and intermittent. Primary emissions from these combustion engines will be nitrogen oxides (NO_x), carbon monoxide (CO), unburned hydrocarbons (HC), particulate matters (PM), and sulfur dioxide (SO_2). Yearly emissions for the auxiliary boilers, standby diesel generators, and standby power system gas turbine indicate that the combined annual emissions of any pollutant are much less than 100 tons/year.

INEEL is within the Eastern Idaho Intrastate Air Quality Control Region. As of 1990, none of the areas within INEEL and its surrounding counties was designated as a non-attainment area with respect to any of the National Ambient Air Quality Standards (NAAQS) (Reference 40 CFR 81.313.). The site area is designated as attainment for criteria air pollutants PM, SO_2, and NO_2.

Ambient air quality within and near the INEEL site boundary has been monitored for PM, SO_2, and NO_2. Data collected during the last few years indicate concentrations that are small percentages of the limits set in applicable SO_2, and NO_2 standards, or substantially lower than the limits set in applicable PM (TSP) standards.

There is a designated non-attainment area for PM that is approximately 47 miles south of the preferred site at the Fort Hall Indian Reservation. There is also a PSD Class I area (Sawtooth National Recreation Area) approximately 78 miles west, but the small air emissions would have insignificant impacts on either of these areas.

Although a commercial nuclear power facility is not a major source for any criteria pollutants, a non-comprehensive or minor air permit would still need to be secured for installation and operation of the equipment.

Based on the above evaluation, a ranking of 5 is assigned for Air Permits for all reactor types and the Bounding Plant.

* * *

An overall ranking of 4 is assigned to this criterion for all reactor types and the Bounding Plant, which is an average of the Water Rights and Air Permits rankings.

3.10.2 Evaluation of the Portsmouth Site

Water Rights

Currently, the Portsmouth site has two water sources: the Scioto River and groundwater wells located near the river. The existing three well fields have a capacity of approximately 17,000 gpm. The surface water intake has a capacity of 5,500 gpm but has not been used in many years.

Section 3.22 compares the available well fields and the river intake to what might be needed for new nuclear power facilities and concludes that the current water supply is inadequate. Therefore, water rights permits would be required to obtain water from larger well fields either near the river or at other locations. However, it is conceivable that the new facility water requirements could cause severe depletion of local water resources, including the Scioto River. Thus, the use of air-cooled condensers would likely be required.

Based on the above evaluation, a ranking of 3 is assigned for water rights for all reactor types and the Bounding Plant. Water permits would be required regardless of the type of reactor because the water requirement equals or exceeds the current water rights.

Air Permits

The Portsmouth site region is designated as attainment for criteria air pollutants PM, SO_2, CO and NO_2 listed in the NAAQS. The State of Ohio has adopted the NAAQS regulations. The nearest Class I PSD area is the Dolly Sods Wilderness area, which is approximately 174 miles east of the Portsmouth site in West Virginia.

In 1999, ambient air quality data were collected both on site and in the area surrounding the site. A background ambient air monitoring station is approximately 13 miles southwest of the site. The analytical results from air sampling stations closer to the site are comparable to the background measurements.

In summary, the Portsmouth site is in an attainment area for all applicable criteria pollutants. Yearly emissions from auxiliary boilers, standby diesel generators, and standby power system gas turbine indicate that the combined annual emissions of any pollutant are much less than 100 tons/year. Therefore, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

* * *

An overall ranking of 4 is assigned for this criterion for all reactor types and the Bounding Plant, which is an average of the Water Rights and Air Permits rankings.

3.10.3 Evaluation of the Savannah River Site

Water Rights

The Savannah River is the principal surface water source and is adjacent to the site. The river runs along the southern site boundary for a distance of about 35 river miles. Major tributaries to the Savannah River that run through SRS are Upper Three Runs Creek, Four Mile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek.

The Savannah River and its reservoirs provide water for large domestic and industrial users. Total water withdrawal is approximately 11,570 cfs. SRS and the Vogtle nuclear plant are the major water users. When all of the SRS reactors were in operation, the total water withdrawal was approximately 1350 cfs, with most of the water returned to the Savannah River through onsite tributaries. The total consumptive water use was approximately 120 cfs. The Vogtle plant withdraws an average of 92 cfs and returns an average of 25 cfs.

There are two major water impoundments on the Savannah River site: Par Pond and L-Lake. Par Pond is an artificial lake created on the east side of the site with a surface area of approximately 2700 acres. This impoundment was used for cooling the P and R reactors. L-Lake has a surface area of approximately 1000 acres. The nominal water surface of Par Pond is at elevation 200 ft; the L-Lake water surface is at elevation 190 ft.

The average flow in the Savannah River at Augusta, Georgia, is 10,027 cfs and the 7-day 10-year low flow is 3,746 cfs. The low water level elevation at Augusta is approximately at elevation 80 ft.

As discussed in Section 3.22, once-through cooling of new nuclear power facilities would require large quantities of water, which could significantly affect the Savannah River and its users. The most suitable method of cooling is closed cycle cooling which would require considerably less consumptive water use than what SRS was permitted to withdraw and less than previously used. Water withdrawal would be required to compensate for evaporation and drift from the cooling tower, plus blowdown to control water chemistry. The effluent return from a new nuclear power facility, which would consist mainly of cooling tower blowdown, would be to the Savannah River or to Par Pond, which ultimately reaches the river. Return of the plant effluent, primarily cooling tower blowdown, may require a new NPDES permit for compliance with thermal and chemical regulations applicable to power plants. A new water rights permit may also be required.

Based on the above evaluation, a ranking of 4 is assigned for water rights for all reactor types and the Bounding Plant. Water permits would be required regardless of the type of reactor. The quantity of water differs slightly due to the variation in the rejected heat rate to the environment.

Air Permits

The SRS is near the center of the Augusta-Aiken Interstate Air Quality Control Region. As of 1990, none of the areas within SRS and its surrounding counties was designated as a non-attainment area with respect to any of the NAAQS (40 CFR 81.341.). The region is designated as attainment for criteria air pollutants PM, SO_2, and NO_2.

In 1988, SRS operated five onsite monitoring stations for PM, SO_2, and NO_2. Additional ambient air quality monitoring in the SRS vicinity is performed by the state of South Carolina. Data collected from the onsite monitoring network from 1984 to 1988 indicated that the observed concentrations of SO_2, NO_2 and PM (TSP) were generally less than 50 percent of the respective limits set in the NAAQS.

In summary, the SRS is in an attainment area for all applicable criteria pollutants. Yearly emissions from auxiliary boilers, standby diesel generators, and standby power system gas turbine indicate that the combined annual emissions of any pollutant are much less than 100 tons/year. Therefore, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

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An overall ranking of 4.5 is assigned for this criterion for all reactor types and the Bounding Plant, which is an average of the Water Rights and Air Permits rankings.

3.10.4 References

1. EG&G, NPR Turbine/Dry Tower (Air-cooled Condenser Conceptual Design Study), August 1990.

2. Environmental and Other Evaluation of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, US DOE Volume –1, September 1992.

3. March 19, 2002 letter from Thomas P. Mundy, Exelon Generation, to Mr. Joseph D. Hegner, Dominion Resources Services, Inc., “Exelon Screening Analysis for Government Site.”

4. USEC, Application for United States Nuclear Regulatory Commission Certification, Volume 1: Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, September 1995.

5. DOE/EA-1346, Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, 2002.

6. SRS G-SAR –G-00001 Rev 4.

7. Impingement and Entrainment of Fishes at the Savannah River Plant, An NPDES 316 b Demonstration, Du Pont, DP-1494, February 1978

8. Effect of Geographical Location on Cooling Pond Requirements and Performance, US EPA, Project No. 1613 FDQ, March 1971

9. Site Selection for the Accelerator for Production of Tritium at the Savannah River Site, WSRC - TR –96-0279, Rev 1, October 1996.

10. 40 CFR Parts 51 & 81.

11. DOE/NP-0014, Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, Volume 1, U.S. Department of Energy, Office of New Production Reactors, September 1992.

3.11 Regulatory

The potential impacts of environmental regulations are evaluated to determine if a site selected for new nuclear power plants will be compatible with existing laws. Remediation efforts under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for a contaminated site could be extremely costly and require a long process of negotiation with the appropriate regulatory authorities. However, some contaminated sites are in the EPA's Brownfield Program and receive positive support from the regulators for cleanup and reuse. Environmental restrictions most likely to affect the siting of electric generating facilities include constraints on construction in coastal zones, floodplains, and wetlands. Natural resource protection regulations limit impacts to threatened and endangered species and natural and scenic rivers.

For this criterion, sites are ranked according to their compatibility with major environmental concerns: site contamination, impacts of the use of cooling water, impacts of dredging for structures using cooling water such as impacts on wetlands, and a broad category identified as other regulatory impacts. The final ranking is the average of the applicable sub-criteria scores.

3.11.1 Evaluation of the INEEL Site

The INEEL site was evaluated by determining the compatibility of adding new nuclear plants to the existing site in light of current environmental regulations. The site was ranked based on the degree of difficulty in obtaining permits or approvals. The evaluation considered the construction, operation, and eventual decommissioning of new generation reactors at INEEL (up to 3000 MWe) and the possibility for differences between reactor types.

The following discussion provides the ranking categories for each environmental concern and then discusses the basis for the ranking of the INEEL site for that potential concern.

Regulatory Impacts of Site Contamination

INEEL has generated wastes from prior operations that are regulated as both radioactive and hazardous materials. Remedial programs are in place and the wastes are located in areas of previous facility development. Groundwater contamination plumes have migrated in a direction away from the preferred site. If any contamination were found during construction, it would be addressed in accordance with applicable hazardous material and radiation protection programs.

The INEEL site could be considered a brownfield site in that expansion or redevelopment is complicated by real or perceived environmental contamination. INEEL is on the CERCLA National Priorities List of sites requiring cleanup. However, the location proposed for new nuclear power generation is not specifically listed as a site requiring remediation.

Based on these findings, a ranking of 5 is assigned for the regulatory impacts of site contamination.

Regulatory Impacts of the Use of Cooling Water

As discussed in Sections 3.10 and 3.22, because of water limitations, either a wet, closed-cycle, cooling system with zero discharge, or a dry-type cooling system could be used. If the wet system is used, a change in the water rights permit for increased well water capacity would be required to achieve the planned electrical capacity. Because of the size and location of the site, visual issues are not significant. A ranking of 5 is assigned.

Regulatory Impacts of Dredging for Structures Using Cooling Water

Because well water is the only choice for cooling water; dredging is not an issue. A ranking of 5 is assigned.

Regulatory Impacts on Wetlands

No wetlands are on the site proposed for new nuclear power generation. A ranking of 5 is assigned.

Other Regulatory Impacts

As is evident from the discussions in several sections of this report, in general, the use of the existing INEEL site for the addition of new nuclear power plants will be compatible with environmental regulations and would have minimal impacts on environmentally sensitive areas or protected natural resources. In comparison to the use of a greenfield site, the use of the existing INEEL site with its infrastructure of roads and transmission lines will result in less environmental impact. This approach would demonstrate environmental stewardship, sustainable development, and would minimize the regulatory impacts.

As discussed in Section 3.10, a water use permit change to increase withdrawal rates would be required to achieve the planned electrical capacity if a wet-type cooling system is used. A lined evaporation pond would be required for the wet-type cooling system, as no plant discharge is permitted to enter groundwater.

As discussed in Section 3.10, a minor air permit would be required to address the impacts of an auxiliary boiler and standby power system. These changes to the site are related to issues that are not significant and should result in minimal impact to the air.

As discussed in Section 3.3, no threatened or endangered species were found at the proposed site.

Because other regulatory requirements and review processes are required, but significant issues are not expected, a ranking of 3 is assigned.

* * *

Based on the above evaluation, a ranking of 4.2 is assigned for all reactor types and the Bounding Plant (average of the sub-criteria rankings). There are no differences for environmental regulatory issues between reactor types.

3.11.2 Evaluation of the Portsmouth Site

The 340-acre parcel on the Portsmouth site was evaluated by determining the compatibility of adding new nuclear plants to the existing site in light of current environmental regulations. The site was ranked based on the degree of difficulty in obtaining permits or approvals. The evaluation considered the construction, operation, and eventual decommissioning of new generation reactors at Portsmouth (up to 3000 MWe) and the possibility for differences between reactor types.

The following discussion provides the ranking categories for each environmental concern and then discusses the basis for the ranking of the Portsmouth site for that potential concern.

Regulatory Impacts of Site Contamination

The 340-acre parcel site has minimal hazardous or radioactive material contamination from prior operations. If any contamination were found during construction, it would be addressed in accordance with applicable hazardous material and radiation protection programs.

The Portsmouth site could be considered a brownfield site in that expansion or redevelopment is complicated by real or perceived environmental contamination. Portsmouth is not on the CERCLA National Priorities List of sites requiring cleanup, but is regulated under the provisions of CERCLA by a U.S. EPA Administrative Consent Order. An industrialized part of the site is under lease to USEC, which is regulated by the NRC. Although CERCLA involvement is normally considered a negative attribute, recent activities pursuant to licensing of the Mixed Oxide (MOX) Fuel Fabrication Facility at the SRS are a positive indication that CERCLA involvement should not adversely impact locating new NRC-regulated facilities on leased tracts of land that have minimal hazardous or radioactive material contamination. In addition, during 2000, DOE/Portsmouth had no reportable quantity releases of hazardous substances subject to CERCLA reporting. The U.S. EPA and Ohio EPA have chosen to oversee environmental remediation activities at DOE/Portsmouth under the RCRA Corrective Action Program. The Environmental Restoration Program is active, but not on the 340-acre parcel of land considered for new nuclear power generation. The 340-acre parcel is largely undisturbed land and an examination of records and analytical results found that no hazardous substances have been stored, released, or disposed of on the property. If any contamination were found during construction, it would be addressed in accordance with applicable hazardous material and radiation protection programs.

Based on these findings, a ranking of 5 is assigned for the regulatory impacts of site contamination.

Regulatory Impacts of the Use of Cooling Water

As discussed in Section 3.22, the existing capacity of water sources is inadequate to support a wet, closed-cycle cooling system. Water rights permits would be necessary to add the needed well capacity or else a dry-type cooling system could be used. Because of the location of the Portsmouth site and the boundaries of the 340-acre parcel proposed for new nuclear generation, a wet, closed-cycle cooling system could pose issues related to visible plume, induced fogging/icing, or aesthetics. A ranking of 3 is assigned.

Regulatory Impacts of Dredging for Structures Using Cooling Water

As described in Section 3.22, a Scioto River intake structure is used as a backup source of water to the well systems that normally supply water to the existing plant facilities. The river water supply system has not been used for several years. If a wet, closed-cycle, cooling system is used for the new nuclear power facility, the backup source would likely need to be restored. Restoration would probably involve dredging without replacement of the dredged materials. Therefore, a ranking of 2 is assigned because the site would require a Section 10 permit for dredging in a previously dredged area, but only if a wet, closed-cycle cooling system is used.

Regulatory Impacts on Wetlands

Wetlands cover only about 34 acres of the Portsmouth site. Of that total, only about 2 acres are within the 340-acre parcel considered for new nuclear generation. Dredged materials from the intake structure area and excavated materials from the plant areas can be disposed of without impacting wetlands. Therefore, a ranking of 5 is assigned for this environmental concern.

Other Regulatory Impacts

In general, use of the existing Portsmouth site for the addition of new nuclear power plants will be compatible with environmental regulations and would have minimal impacts on environmentally sensitive areas or protected natural resources. In comparison to the use of a greenfield site, the use of the existing Portsmouth site with its infrastructure of roads and transmission lines will result in less environmental impact. This approach would demonstrate environmental stewardship and sustainable development and would minimize the regulatory impacts.

The U.S. Fish and Wildlife Service has indicated that there are two endangered animal species whose home range includes the Portsmouth site. However, site surveys have not confirmed their presence.

As discussed in Section 3.10, a revision to the water use permit for additional makeup wells will be required, unless a dry-type cooling system is used. Any blowdown to the river will require a revision to an existing permit or a new one. As discussed in Section 4.5, blowdown may create a thermal plume in the summer and a thermal shock in the winter. Therefore, discharge permitting may be difficult.

As discussed in Section 3.10, a minor air permit would be required at the site to address the impacts of an auxiliary boiler and standby power system. These changes to the site are related to issues that are not significant and should result in minimal impact to the air.

Except for blowdown discharge permitting, other regulatory requirements and review processes are required, but significant issues are not expected. A ranking of 2 is assigned because of the potentially significant blowdown issue.

* * *

Based on the above evaluation, a ranking of 3.4 is assigned for all reactor types and the Bounding Plant (average of the sub-criteria rankings). There are no differences for environmental regulatory issues between reactor types for the Portsmouth site.

3.11.3 Evaluation of the Savannah River Site

The SRS site was evaluated by determining the compatibility of adding new nuclear plants to the existing site in light of current environmental regulations. The site was ranked based on the degree of difficulty in obtaining permits or approvals. The evaluation considered the construction, operation, and eventual decommissioning of new generation reactors at SRS (up to 3000 MWe) and the possibility for differences between reactor types.

The following discussion provides the ranking categories for each environmental concern and then discusses the basis for the ranking of the SRS site for that potential concern.

Regulatory Impacts of Site Contamination

SRS has large tracts of undeveloped land that have minimal hazardous or radioactive material contamination from prior operations. New nuclear generating units would be located in such areas. If any contamination were found during construction, it would be addressed in accordance with applicable hazardous material and radiation protection programs.

The SRS could be considered a brownfield site in that expansion or redevelopment is complicated by real or perceived environmental contamination. SRS is on the CERCLA National Priorities List of sites requiring cleanup. Remediation programs are active in some areas of the site. However, new nuclear power generation units would not be located in these areas. Although CERCLA listing is normally considered a negative attribute, recent activities pursuant to licensing of the MOX Fuel Fabrication Facility are a positive indication that CERCLA listing should not adversely impact locating new NRC-regulated facilities on leased tracts of land that have minimal hazardous or radioactive material contamination. In addition, site-wide, only six CERCLA-reportable releases have been reported over the period of 1996 to 2000, including none in 2000.

Based on these findings, a ranking of 5 is assigned for the regulatory impacts of site contamination.

Regulatory Impacts of the Use of Cooling Water

As described in Section 3.22, once-through cooling for new nuclear generating units is not viable. Because of the location and size of the SRS, a wet, closed-cycle cooling system should pose no significant issues related to visible plume, induced fogging/icing, or aesthetics. A ranking of 5 is assigned.

Regulatory Impacts of Dredging for Structures Using Cooling Water

As discussed in Sections 3.22 and 4.5, the makeup water for the cooling system for the new generating units could be withdrawn from, and the blowdown water returned to, the Savannah River. The existing SRS intake channel would need to be dredged, but without replacement of the dredged materials. Therefore, a ranking of 2 is assigned because the site will require a Section 10 permit for dredging a previously dredged channel.

Regulatory Impacts on Wetlands

Wetlands cover about 49,000 acres of the approximate 198,000 acres occupied by the SRS. Administrative, production and support facilities occupy about 17,000 acres. For disposal of dredged materials from the intake channel and excavated materials from the plant areas, there are areas around the SRS site that can be used without impacting wetlands. Given the availability of areas other than wetlands for disposal of the dredged and excavated materials, a ranking of 5 is assigned for this environmental concern.

Other Regulatory Impacts

In general, use of the existing SRS site for the addition of new nuclear power plants will be compatible with environmental regulations and would have minimal impacts on environmentally sensitive areas or protected natural resources. In comparison to the use of a greenfield site, the use of the existing SRS site with its infrastructure of roads and transmission lines will result in less environmental impact. This approach would demonstrate environmental stewardship, sustainable development, and would minimize the regulatory impacts.

The SRS site is not in a Coastal Zone Management Area. There are endangered and threatened species, and designated critical habitats in identified areas of the SRS, but siting considerations would ensure that these areas are not used.

As discussed in Section 3.10, a water use permit may not be required to address the consumption of water by the addition of new nuclear generation units. The effluent discharge will probably require a new discharge permit. These changes are related to issues that are not significant and should result in minimal impact relative to the already approved uses of water at the SRS site.

As discussed in Section 3.10, a minor air permit would be required to address the impacts of an auxiliary boiler and standby power system. These changes to the site are related to issues that are not significant and should result in minimal impact to the air.

Because other regulatory requirements and review processes are required, but significant issues are not expected, a ranking of 3 is assigned.

* * *

Based on the above evaluation, a ranking of 4.0 is assigned for all reactor types and the Bounding Plant (average of the sub-criteria rankings). There are no differences for environmental regulatory issues between reactor types.

3.12 Schedule

An evaluation of the amount of time needed to complete licensing, permitting, and site development activities before the start of new plant construction is provided in Table 3-4.

Table 3-4. Schedule Estimate

Time From Start (months)	Activity
18	Preparation of License and Permit Applications Licensing and permitting activities must be completed before the start of physical site development work. For an NRC Early Site Permit (ESP), it is anticipated that approximately 18 months will be needed to prepare and submit the ESP Application. Preparation of other required permit and license applications (see Sections 3.10 and 3.11) would be performed during this period.
36	Review and Approval of License and Permit Applications In SECY-01-0188, October 12, 2001, the NRC conservatively estimates that about 30 months will be needed for review and approval, including hearings. Considering the ESP application would be for an existing nuclear site with good to excellent stakeholder support (see Section 2.3), for the purposes of this study, an 18-month duration is assumed. The reviews and approvals for other licenses and permits would also be performed during this period.
54	Site Development Activities Following receipt of the ESP and the other required permits and licenses, the physical site development activities identified in Section 2.4 are estimated to take about 18 months to complete. (Engineering design would be performed in conjunction with the licensing and permitting effort.)

In accordance with the Site Evaluation Process, for a duration of 54 months, a ranking of 3 is assigned. This ranking is applicable to all three sites for all reactor types and the Bounding Plant.

3.13 Geologic Hazards

The purpose of this section is to evaluate the INEEL, Portsmouth, and Savannah River sites for the presence of geologic hazards. Geologic hazards (either natural or situations where geology has detrimental manmade modifications) are considered exclusionary, that is, a site with a geologic hazard will be excluded from further consideration. These hazards as listed below from the Site Evaluation Process are non-seismic. Seismic considerations are evaluated in Sections 3.14, 3.15, and 3.16.

- Areas of active volcanic activity
- Sloping areas of deep seated instability (landslides)

- Areas of potential collapse such as cavernous limestone, karstic limestone, and major salt deposits
- Mined-out areas that produce deep-seated settlement because of collapse over time
- Areas with long-term major subsidence caused by pumping of groundwater or oil
- Permafrost areas

3.13.1 Evaluation of the INEEL Site

The INEEL site is situated at the eastern end of the Snake River Plain physiographic province. This area was affected by passage of the Yellowstone hotspot between 6.5 and 4.3 million years ago (Reference 1). The hotspot, an anomalous plume of rising magma in the earth's mantle, results in the formation of volcanic calderas and the deposition of pyroclastic volcanic rocks ejected from the calderas. While the hotspot has remained relatively stationary, the North American tectonic plate formed from the earth's crust is moving over it in a southwestward direction at a rate of 3 to 4 cm/year, resulting in the present position of the hotspot beneath Yellowstone National Park in northwest Wyoming at the northeastern boundary of the Snake River Plain (Reference 2). Because of this movement of the North American plate, the hotspot no longer affects the INEEL site and future impacts are considered unlikely.

Passage of the Yellowstone hotspot resulted in the melting of a large portion of the earth's crust followed by more than 1 mile of subsidence beneath the Snake River Plain. Volcanic lava flows from fissures and small, low-lying shield volcanoes (vents), which are generally concentrated along linear belts known as rift zones, have occurred periodically in the subsiding basin over the last 4 million years, resulting in large areas underlain by basalt rocks (References 1 and 2). The lava flows that formed the surficial basalt beneath the INEEL site flowed from a vent about six miles to the southwest. These flows occurred about 230,000 years ago. The latest flows in the area occurred around 2,100 years ago from the Great Rift zone, about 40 miles southwest of the site, creating Craters of the Moon National Monument (Reference 2). Future lava flows near the site are potentially greatest from the Arco and Lava Ridge-Hells Half Acre volcanic rift zones and the Axial Volcanic Zone. Estimated recurrence intervals for volcanism in these zones are 17,000, 40,000, and 16,000 years, respectively. In addition, annual probabilities of eruption have been estimated to be about 6×10^{-5} for the Arco rift zone and the Axial Volcanic Zone and 2.5×10^{-5} for the Lava Ridge-Hells Half Acre rift zone (Reference 1). The distance of these areas from the site and the local topography, which results in the site's location above the surrounding area, is expected to be a mitigating factor in the direct affect of any lava flows on the site (Reference 2).

The geologic hazards described are not considered exclusionary with respect to the INEEL site but will need to be investigated further if this site is selected. None of the other geologic hazards listed in Section 3.13 are reported to exist at the INEEL site.

3.13.2 Evaluation of the Portsmouth Site

Slopes at the Portsmouth site are generally flatter than 3H:1V and, therefore, are considered stable under most conditions, including earthquake ground motion. Slope failure is unlikely unless the toe of the slope is oversteepened by erosion during a flood (Reference 3).

Collapse or settlement caused by natural conditions or human activity at the Portsmouth site is considered unlikely. No carbonate or evaporite rocks occur within 500 ft of the ground surface at the site, and no coal seams are present beneath the site. No mines of any type are within 5 miles of the site. Small quantities of natural gas are withdrawn from wells in the vicinity; however, subsidence related to the withdrawal of this gas is unlikely. If it does occur it is expected to be minor and relatively uniform at the ground surface. No other hydrocarbons are withdrawn from the strata beneath the site, and any future production would be unlikely to produce significant subsidence. Likewise, there is little to no potential for significant groundwater production from beneath the site or surrounding area that could result in surface subsidence (Reference 3).

The geologic hazards described are not considered significant with respect to the Portsmouth site and none of the other geologic hazards listed in Section 3.13 are reported to exist at the site.

3.13.3 Evaluation of the Savannah River Site

The strata underlying the Savannah River site include a discontinuous layer of variable thickness within the Eocene age Santee Formation that consists of silty and clayey sands with occasional fine shell fragments having low penetration resistance. These “soft zones” generally occur between about 100 and 150 ft below the ground surface. Older reports indicate that these zones caused subsidence of the overlying strata and the creation of depressions at the ground surface, however, more recent reports indicate that no evidence exists of surface settlement due to the presence of these zones. Previously, grouting was performed as a remedial measure at the site to stabilize these zones prior to foundation construction, but settlement calculations for more recently constructed facilities indicated that stabilization of the soft zones by grouting was not required (References 4 and 5).

The geologic hazard described is not considered significant with respect to the Savannah River Site. However, if this site is selected, investigation for the presence of soft zones will be needed. None of the other geologic hazards listed in Section 3.13 are reported to exist at the Savannah River Site.

3.13.4 References

1. INEEL, Safety Analysis Report for TMI-2 ISFSI, October 2001.

2. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Construction, and Operating New Production Reactor Capacity, Office of New Production Reactors, September 1992.

3. Bechtel Jacobs Company, LLC, Safety Analysis Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, Environmental Management & Enrichment Facilities Management and Integration Contract, August 1998.

4. Westinghouse Savannah River Company, Generic Safety Analysis Report, prepared for the U.S. Department of Energy, September 1999.

5. Westinghouse Savannah River Company, Significance of Soft Zone Sediments at the Savannah River Site (U), Historical Review of Significant Investigations and Current Understanding of Soft Zone Origin, Extent and Stability, WSRC-TR-99-4083, September 1999."

3.14 Site-Specific Safe Shutdown Earthquake

Four of the five advanced reactors (ABWR, AP1000, GT-MHR, and IRIS) are designed for a site-specific Safe Shutdown Earthquake (SSE) of 0.30g. It is reasonable to assume that the PBMR will also be designed for an SSE of 0.30g. Appendix S of 10 CFR 50 states that the minimum peak ground acceleration to be considered for an SSE must be 0.1g at the foundation level of the structures. Thus, the site ranking is based on an SSE range of 0.1g to 0.3g, with the highest ranking going to an SSE of 0.1g and the lowest to an SSE of 0.3g. As described below, existing minimum SSE determinations for the INEEL, Portsmouth, and Savannah River sites range from 0.20g to 0.25g. However, these values are based on 1,000- or 10,000-year return periods and are likely to be significantly higher using the latest seismic hazard assessment methodology with a return period of 100,000 years.

Preliminary evaluations of estimated ground motion values for the three sites are provided as part of the following discussion. One of the sites, INEEL, is located in the western United States. The other two sites, Portsmouth and Savannah River, are located in the eastern United States. Preliminary evaluations have been made based on the design spectrum that is expected will be used for new reactor designs (i.e., taken as the AP600/AP1000 design spectrum which is as specified in NRC Regulatory Guide 1.60 scaled to a peak ground acceleration [PGA] of 0.3 g), and any other estimates of ground motion which are applicable for the three sites.

3.14.1 Evaluation of the INEEL Site

Section 2.6.2.3.7.2 of the INEEL TMI-2 ISFSI SAR (Reference 1) indicates a DBE (equivalent to SSE) acceleration of 0.25g for a 2,500-year return period based on a site-specific probabilistic evaluation. Table 2.6-12 of this same document indicates a peak horizontal acceleration of 0.36g for a 10,000-year return period using the same methodology. Section D.3.4 of the DOE NPR study (Reference 2) provides a best estimate of 0.24g for the peak horizontal ground acceleration based on a 10,000-year return period. The document indicates that probabilistic studies to further assess the seismic hazard for the NPR site are being conducted by Lawrence Livermore National Laboratory (LLNL). When considered in conjunction with the following preliminary ground motion evaluation, a ranking of 1 is assigned for all reactor types and the Bounding Plant. If it were determined that INEEL has an SSE above 0.30g, potentially significant engineering evaluations during site-specific licensing would be required.

Preliminary Ground Motion Evaluation

The INEEL site is located in the western United States. In contrast to the Savannah River site, previous studies by the Electric Power Research Institute (EPRI) and LLNL did not include this site in their analy-

analysis. The comparisons shown on Figures 3-1 (velocity) and 3-2 (acceleration) are between the Regulatory Guide 1.60 spectrum scaled to 0.3 g, the AP600 spectrum, the extrapolated USGS (1996) values, and the site-specific INEEL (2000) probabilistic seismic hazard values. These INEEL (2000) site-specific values were obtained via e-mail from Suzette Payne (June 12, 2002). The corresponding PGA values are listed in the table below. The USGS (1996) values exceed the Regulatory Guide 1.60 and AP600 design spectra for all frequencies except 0.5 Hz. In contrast, the site-specific INEEL (2000) equal hazard values only exceed the AP600 design spectrum and the Regulatory Guide 1.60 spectrum for frequencies greater than 20 Hz and 10 Hz, respectively. The large differences between the USGS (1996) values and the INEEL (2000) values could most likely be attributed to the differences in the seismic source characterization and the attenuation models, and the log-log extrapolation of the USGS values from a return period of 5,000 years to a return period of 100,000 years. These differences, however, have not been investigated for this preliminary analysis.

Table 3-5. PGA Values for the INEEL Site Location

Design Spectrum	PGA (g)
Regulatory Guide 1.60 scaled to 0.3 g	0.30
AP600/AP1000 design spectrum	0.30
USGS (1996) extrapolated to 100,000 years	0.62
INEEL (2000) site-specific PSHA	0.32

Figure 3-1. Spectral Velocity Comparison for INEEL Site

Comparison of the Regulatory Guide 1.60 spectrum (PSV in cm/s) scaled to PGA of 0.3g, AP600/AP1000 design spectrum, USGS (1996) extrapolated to 100,000 years, and the INEEL (2000) PSHA values for the INEEL site location.

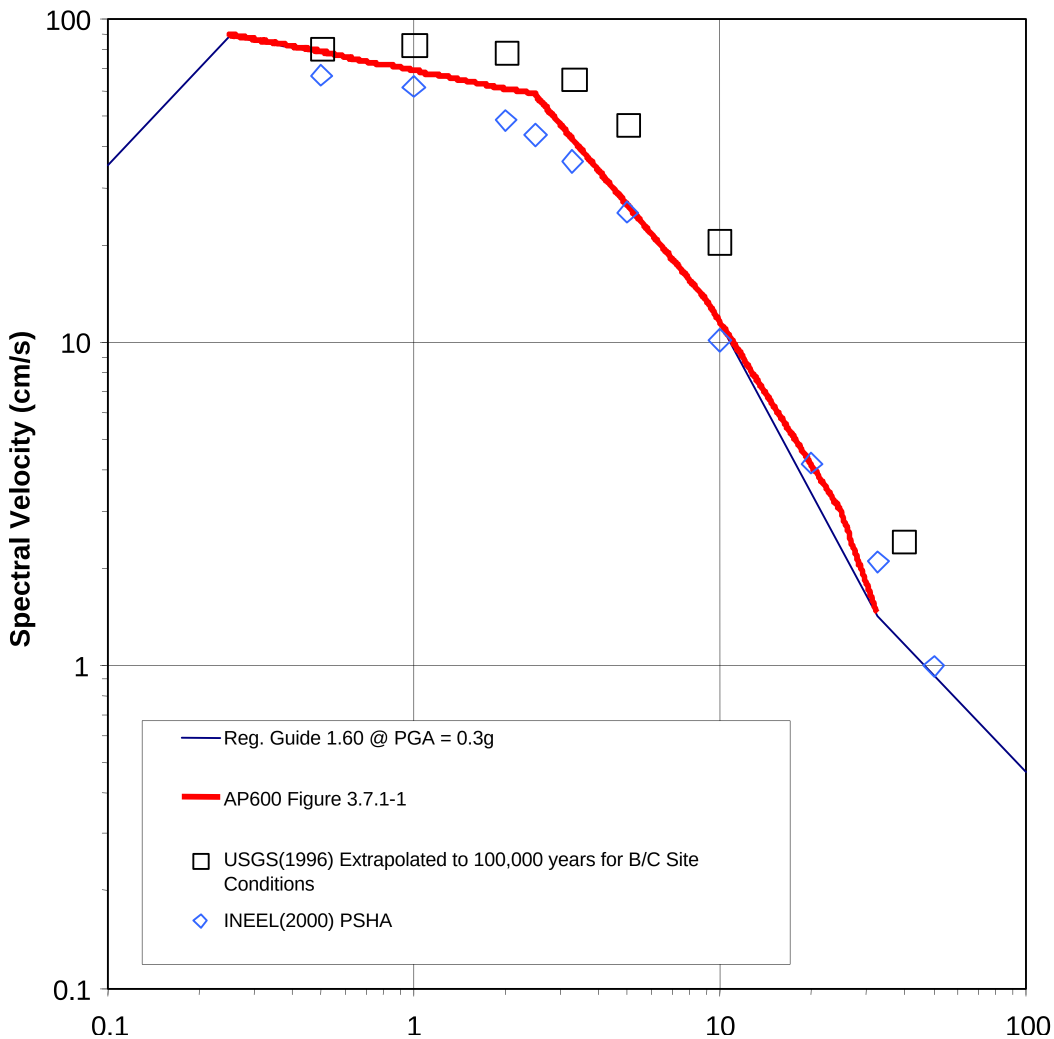
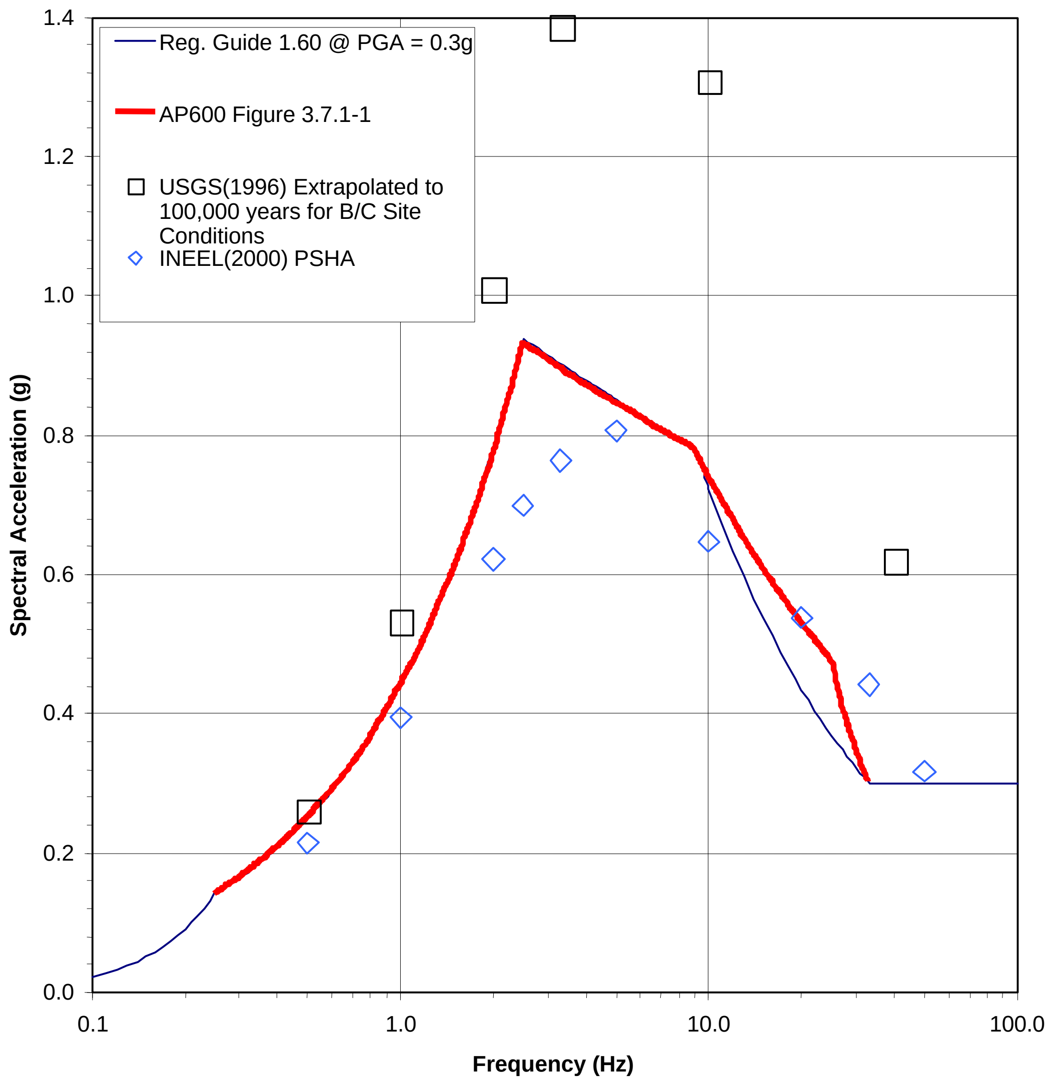


Figure 3-2. Spectral Acceleration Comparison for INEEL Site

Comparison of the Regulatory Guide 1.60 spectrum (SA in g) scaled to PGA of 0.3g, AP600/AP1000 design spectrum, USGS (1996) extrapolated to 100,000 years, and the INEEL (2000) PSHA values for the INEEL site location.



3.14.2 Evaluation of the Portsmouth Site

Section 2.6.3.5.2 of the USEC Certification Application SAR (Reference 2) recommends an EPGA of 0.10g based on a 1,000-year return period. Table 2.6-1 in the same document indicates peak horizontal ground accelerations for a 1,000-year return period ranging from 0.07g to 0.28g, with the majority of values at 0.20g or less based on the results of various studies. When considered in conjunction with the following preliminary ground motion evaluation, a ranking of 2 is assigned for all reactor types and the Bounding Plant.

Preliminary Ground Motion Evaluation

The Portsmouth site is located in the eastern United States. Unlike the Savannah River site, there is no previous EPRI or LLNL analysis for this site. The comparison presented on Figures 3-3 (velocity) and 3-4 (acceleration) contain four different sets of values: Regulatory Guide 1.60 scaled to 0.3 g, AP600 design spectrum, USGS (1996) National Seismic Hazard map extrapolated to 100,000 years, and the PGA value extrapolated from the Portsmouth Gaseous Diffusion Plant Safety Analysis Report. The corresponding PGA values are listed in the following table for this site location. The USGS values exceed the Regulatory Guide 1.60 and AP600 design spectra for frequencies greater than 3.3 Hz. These USGS values were estimated based on a log-log extrapolation of the published USGS National Seismic Hazard map values that are only given out to a return period of 5,000 years. Based on the curvature of typical hazard curves for long return periods and the use of the log-log extrapolation scheme, these estimated 100,000-year values are probably conservative. For frequencies less than 3.3 Hz the extrapolated USGS (1996) values are approximately equal to the Regulatory Guide 1.60-scaled spectrum and the AP600 spectrum.

Table 3-6. PGA Values for the Portsmouth Site Location

Design Spectrum	PGA (g)
Regulatory Guide 1.60 scaled to 0.3 g	0.30
AP600/AP1000 design spectrum	0.30
USGS (1996) extrapolated to 100,000 years	0.84
Portsmouth Gaseous Diffusion Plant SAR	0.24

Figure 3-3. Spectral Velocity Comparison for Portsmouth Site

Comparison of the Reg. Guide 1.60 spectrum (PSV in cm/s) scaled to PGA of 0.3g, AP600/AP1000 design spectrum, USGS (1996) extrapolated to 100,000 years and the PGA from the Portsmouth SAR for the Portsmouth site location.

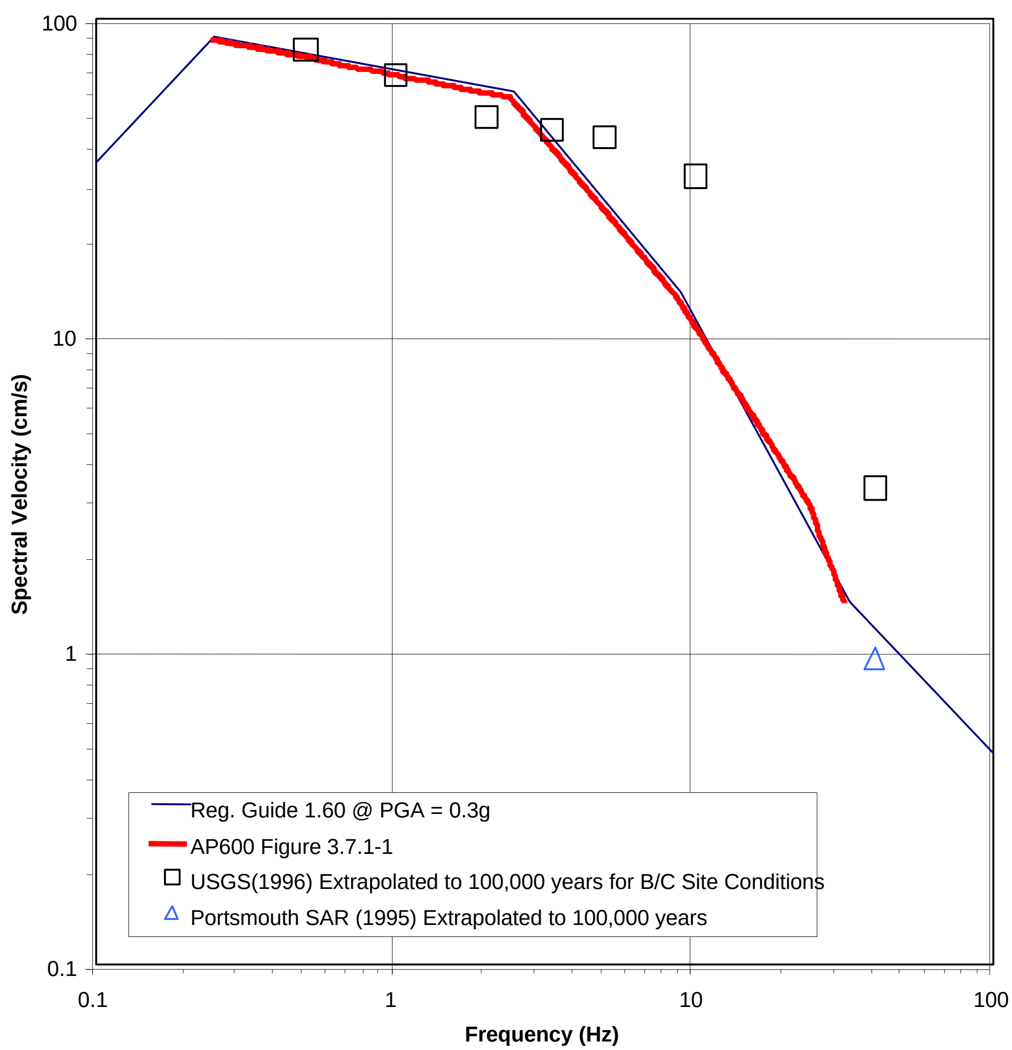
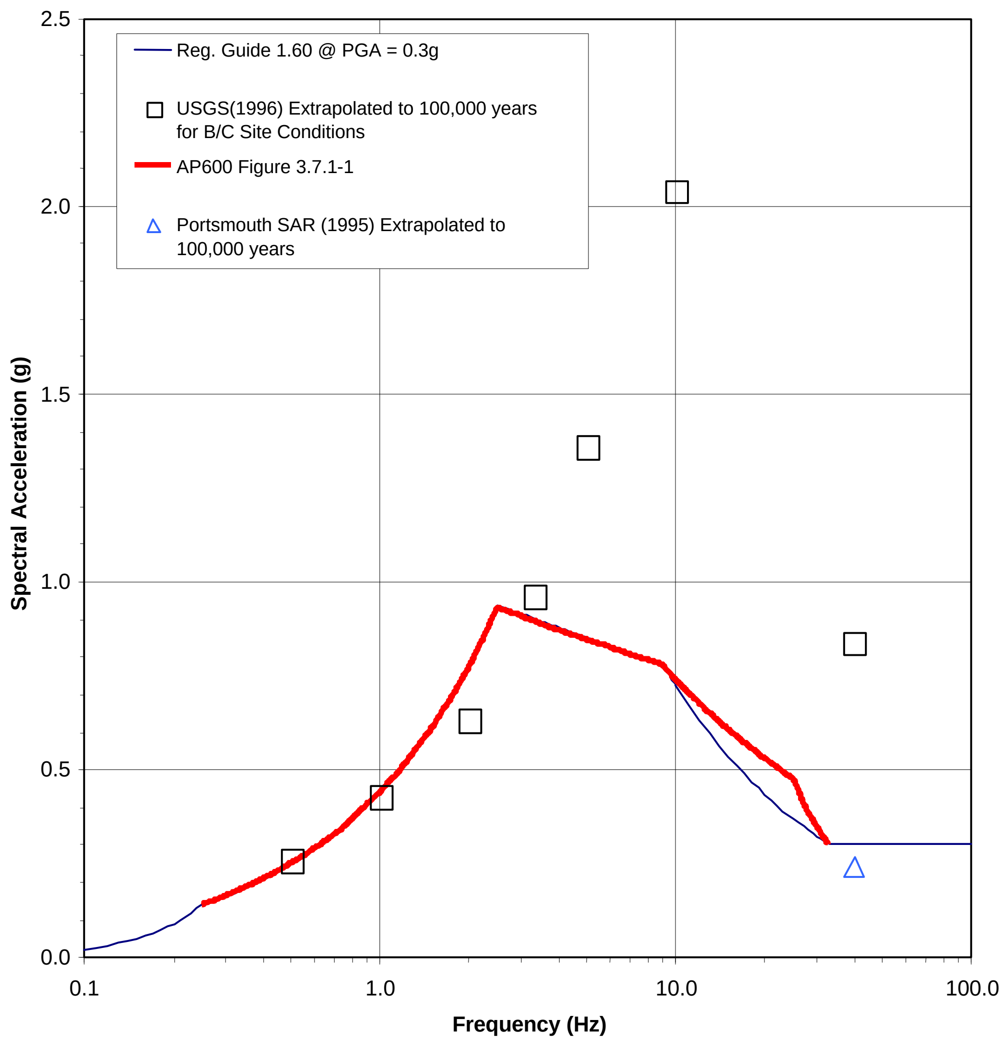


Figure 3-4. Spectral Acceleration Comparison for Portsmouth Site

Comparison of the Regulatory Guide 1.60 spectrum (SA in g) scaled to PGA of 0.3g, AP600/AP1000 design spectrum, USGS (1996) extrapolated to 100,000 years and the PGA from the Portsmouth SAR for the Portsmouth site location.



3.14.3 Evaluation of the Savannah River Site

A performance category 4 (PC-4) earthquake response spectra was previously developed for the Savannah River site based on guidance and methodologies contained in DOE standard STD-1023. PC-4 was determined to envelope a peak horizontal ground acceleration for soil of 0.23g (Reference 3). Based on DOE STD-1020-94, PC-4 has a mean annual probability of exceedance for design ground motion of $1x10^{-4}$, corresponding to a 10,000-year return period (Reference 4). When considered in conjunction with the following preliminary ground motion evaluation, a ranking of 1.5 is assigned for all reactor types and the Bounding Plant.

Preliminary Ground Motion Evaluation

The Savannah River site is located in the eastern United States. Previous work has been performed by EPRI and LLNL for the adjacent Vogtle Nuclear Power plant. For this preliminary comparison of ground motion values, the Vogtle and Savannah River sites are assumed to be collocated. The median probabilistic equal hazard spectra (PSV in units of cm/sec) from the EPRI and LLNL analysis is presented on Figure 3-5 for both the 10,000- and 100,000-year return period levels. The ground motion values for the LLNL 100,000-year level were extrapolated based on the data given in the LLNL report (Reference 5). The scaled Regulatory Guide 1.60 spectrum, scaled to a PGA value of 0.3g, is plotted on Figure 3-5 along with the AP600 design spectrum. The corresponding PGA values for each spectrum are given in the table below. Figure 3-6 shows the comparison of the same suite of design spectra plotted as spectral acceleration in units of g. For frequencies less than 10 Hz, both the Regulatory Guide 1.60 and the AP600 design spectra envelop the EPRI and LLNL 100,000-year spectra. However, for frequencies higher than 10 Hz, the LLNL values are slightly higher and the EPRI values are slightly higher except for the PGA, which is less than 0.3 g.

Table 3-7. PGA Values for the Savannah River Site Location

Design Spectrum	PGA (g)
Regulatory Guide 1.60 scaled to 0.3 g	0.30
AP600/AP1000 design spectrum	0.30
LLNL (NUREG-1488) Median extrapolated to 100,000 years	0.36
EPRI Median for 100,000 years	0.28

Figure 3-5. Spectral Velocity Comparison for Savannah River – Vogtle Sites

Comparison of the Reg. Guide 1.60 spectrum (PSV in cm/s) scaled to PGA of 0.3g, AP600/AP1000 design spectrum, EPRI, and LLNL design spectrum for the Vogtle-Savannah River site location.

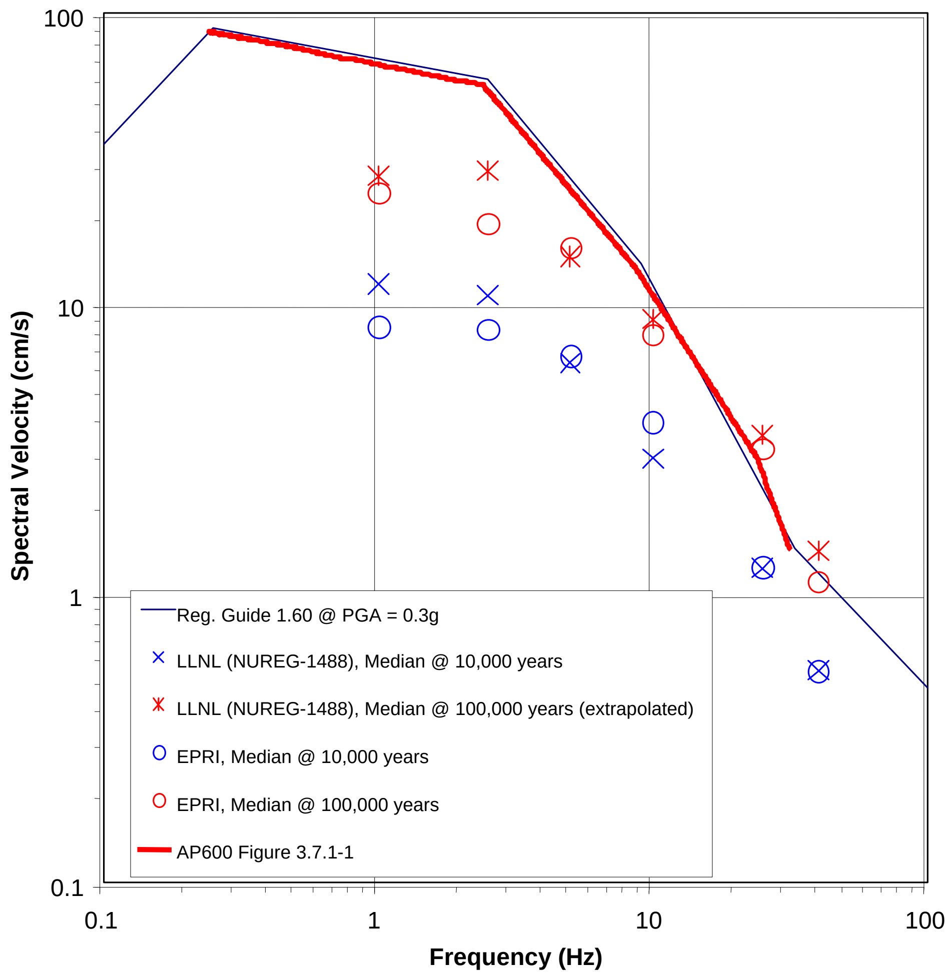
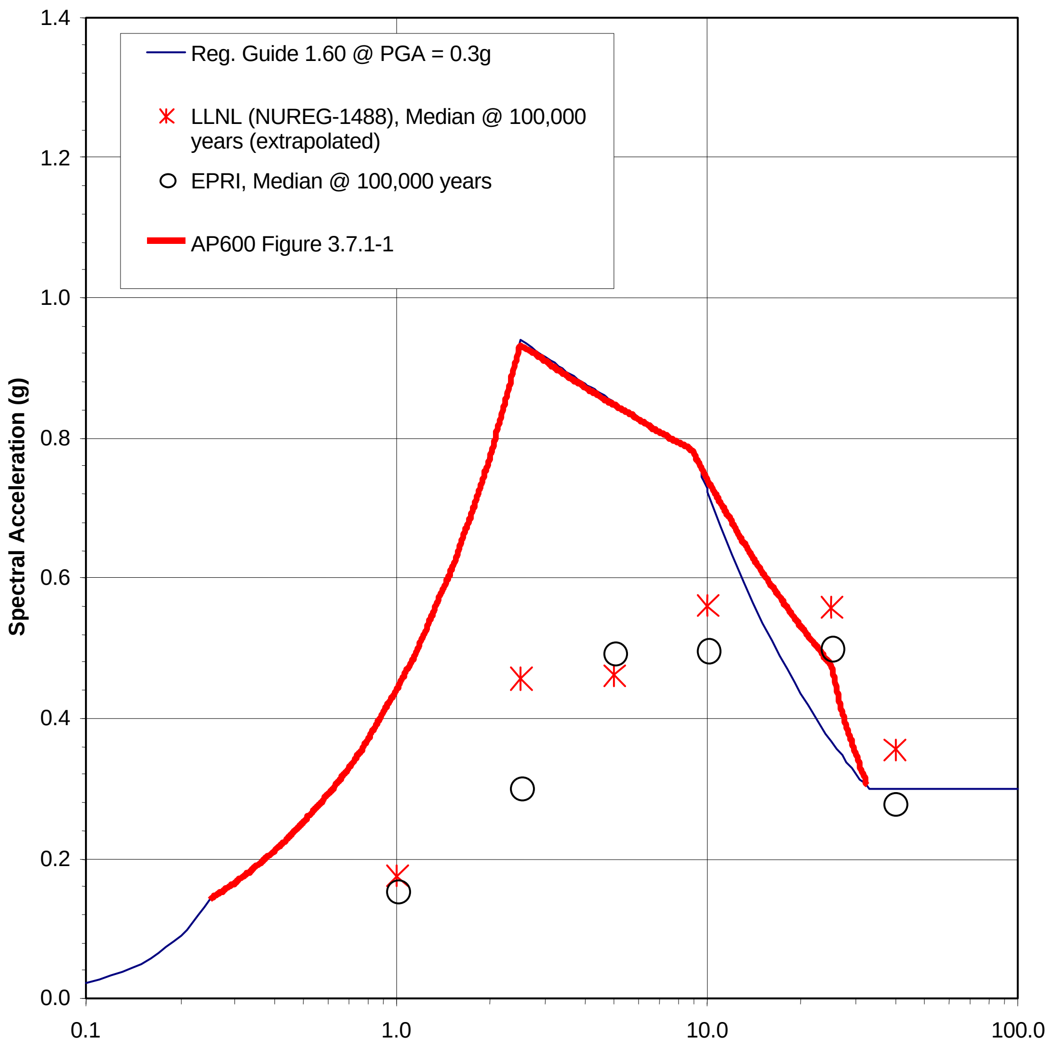


Figure 3-6. Spectral Acceleration Comparison for the Savannah River – Vogtle Sites

Comparison of the Reg. Guide 1.60 spectrum (SA in g) scaled to PGA of 0.3g, AP600/AP1000 design spectrum, EPRI, and LLNL design spectrum for the Vogtle-Savannah River site location.



3.14.4 References

1. INEEL, Safety Analysis Report for TMI-2 ISFSI, October 2001.

2. United States Enrichment Corporation, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant Safety Analysis Report, September 1995.

3. Lee, R. C., M. E. Maryak and M. D. McHood, SRS Seismic Response Analysis and Design Basis Guidelines, WSRC-TR-97-0085, Rev. 0, 1997.

4. U.S. Nuclear Regulatory Commission, Draft Safety Evaluation Report on the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility, Docket No. 70-3098, April 2002.

5. Sobel, P., Revised Livermore Seismic Hazard Estimates for 69 Nuclear Power Plant Sites East of the Rocky Mountains, NUREG-1488, USNRC, April 1994.

6. Bechtel Corporation, AP600 Project, Nuclear Island Structures Seismic Analysis, Report on Generation of Design Ground Motion, October 1990.

7. Code of Federal Regulations, Earthquake Engineering Criteria for Nuclear Power Plants, 10 CFR 50, Appendix S.

8. Electric Power Research Institute, Probabilistic Seismic Hazard Evaluations at Nuclear Power Plant Sites in Central and Eastern United States, NP-4726, 1989-1991.

9. Frankel, et al., National Seismic-Hazard Maps, USGS Open File Report 96-532, Denver, Colorado, 1996.

10. U.S. Atomic Energy Commission, Design Response Spectra for Seismic Design of Nuclear Power Plants, Regulatory Guide 1.60, Directorate of Regulatory Standards, December 1973.

11. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Construction, and Operating New Production Reactor Capacity, Office of New Production Reactors, September 1992.

12. URS Greiner Woodward-Clyde Federal Services, Geomatrix Consultants, and Pacific Engineering and Analysis, Recomputation of the Seismic Hazard at the Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, LLC, External Report INEEL/EXT-99-00786, Rev. 1, 2000.

13. Woodward-Clyde Federal Services, Geomatrix Consultants, and Pacific Engineering and Analysis, Site-specific Seismic Hazard Analyses for the Idaho National Engineering Laboratory, Volume I Final Report and Volume 2 Appendix, Lockheed Idaho Technologies Company Informal Report, INEL-95/0536, 1996.

3.15 Capable Faults

Appendix A of 10 CFR 100 defines a capable fault as one that has exhibited movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years. A capable fault may also be one that has exhibited macro-seismicity as determined instrumentally with records of sufficient precision to demonstrate a direct relationship to the fault. Finally, a fault that can be determined to have a structural relationship to a capable fault as determined from the previous criteria so that movement on one could reasonably be expected to be accompanied by movement on the other is classified as a capable fault. The severity of a capable fault is a function of the distance from the site (FD) and the length of the fault (FL). The ratio SF = FD/FL is used in the Site Evaluation Process to rank the site, with the highest ranking going to the highest SF ratio, i.e., the further away from the site and the shorter the fault, the better the ranking.

3.15.1 Evaluation of the INEEL Site

Faults associated with the portion of the Basin and Range physiographic province north of the Snake River Plain are of primary importance with respect to the seismic design of facilities on the INEEL site (Reference 1). These faults are normal faults that occur along the flanks of north-northwest-trending mountain ranges. The faults dip about 45° to the west-southwest. Three of these faults, the Lost River, Lemhi, and the Beaverhead, are late Tertiary to Holocene in age and at least segments of them are considered capable faults. The faults extend north-northwestward from the northern boundary of the Snake River Plain for a distance of 60 miles or more.

The Howe segment of the Lemhi fault has been identified as the capable fault occurring closest to the preferred plant site (Reference 1). The inferred southern termination point of this fault is about 16 miles north of the site (Reference 2). The length of the Howe segment is estimated to be 9 to 12 miles (Reference 1). The maximum magnitude of earthquakes associated with the southern end of the Lemhi fault is estimated to be 7.1. Investigations of the fault indicate that its effects terminate close to the boundary between the Basin and Range and the Snake River Plain provinces (Reference 2). Studies of this fault and the magnitude of events that have occurred along it are continuing (Reference 1).

Other areas on the INEEL site that could be subjected to surface offset are in the volcanic rift zones. Areas in and near the Arco and Lava Ridge-Hells Half Acre rift zones are expected to have the greatest potential for surface rupture and the creation of fissures by lava flows (Reference 2).

Based on the referenced data, the SF ratio for the Howe segment of the Lemhi fault is about 1.5. Thus, the INEEL site is assigned a ranking of 1 for all reactor types and the Bounding Plant. However, Note 1 of the ranking method in the Site Evaluation Process recommends that sites having capable faults between 5 and 20 miles from the site and greater than 1 mile in length be avoided.

3.15.2 Evaluation of the Portsmouth Site

Within 200 miles of the Portsmouth site, only the White Mountain fault zone has been identified as potentially being a capable fault (Reference 3). The fault is about 155 miles south-southwest of the site and is reported to be 20.5 miles in length. Studies of the Kentucky River fault system have indicated the potential for displacement of Holocene-age sediments in conjunction with the "contemporary stress field." Indications are that these displacements are not compatible with the definition of capable faults but further investigation would need to be performed to resolve this issue.

Based on the referenced data, the SF ratio for the White Mountain fault is about 7.5. Thus, a ranking of 2 is assigned for all reactor types and the Bounding Plant.

3.15.3 Evaluation of the Savannah River Site

There is no evidence for the presence of capable faults at the Savannah River site (Reference 4). Displacement associated with the faulting of Atlantic Coastal Plain sediments in the site area becomes progressively smaller in younger sediments, suggesting that the faulting occurred contemporaneous with deposition (Reference 5). There is no conclusive evidence of Holocene age displacement along any faults within about 200 miles of the Savannah River site (Reference 1). However, the presence of geophysically inferred faults near the epicenter of the 1886 Charleston, South Carolina, earthquake, about 90 miles from the Savannah River site, may still pose a question of capability and are the subject of numerous studies that will require further review (Reference 6).

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant. However, if this site is selected, a thorough effort to review and assess existing data will be required to address the issue of capable faults within a 200-mile radius of the site.

3.15.4 References

1. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Construction, and Operating New Production Reactor Capacity, Office of New Production Reactors, September 1992.

2. INEEL, Safety Analysis Report for TMI-2 ISFSI, October 2001.

3. Bechtel Jacobs Company, LLC, Safety Analysis Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, Environmental Management & Enrichment Facilities Management and Integration Contract, August 1998.

4. Cumbest, R.J., D.E. Stephenson, D.E. Wyatt and M. Maryak, Basement Surface Faulting and Topography for Savannah River Site and Vicinity, WSRC-TR-98-00346, Rev. 0, 1998.

5. U.S. Nuclear Regulatory Commission, Draft Safety Evaluation Report on the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility, Docket No. 70-3098, April 2002.

6. Duke Cogema Stone & Webster, Mixed Oxide Fuel Fabrication Facility, Construction Authorization Request, NRC Docket No. 070-03098, Revision: 2/28/01.

7. Code of Federal Regulations, Seismic and Geologic Siting Criteria for Nuclear Power Plants, 10 CFR 100, Appendix A.

3.16 Liquefaction Potential

Soil liquefaction is a process by which saturated granular deposits lose a significant portion of their shear strength because of pore water pressure buildup resulting from cyclic loading, such as that caused by an earthquake. The Site Evaluation Process looks at the problem from an economic standpoint based on the depth of liquefiable material that will have to be removed and replaced. Additionally, the site can be ranked depending on the factor of safety against liquefaction and the amount of analysis and discussion that would be needed to demonstrate no liquefaction potential exists.

3.16.1 Evaluation of the INEEL Site

Basalt bedrock outcrops at this site and extends to at least 3500 ft below ground surface. The maximum depth of surficial soil across the NPR site is about 5 ft. The basalt has some thin sedimentary layers interspersed (marking the intervals between lava flows). The shallowest of these is at about 100 ft depth. Groundwater is at least 450 ft below ground surface.

This site has no potential for liquefaction; therefore, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.16.2 Evaluation of the Portsmouth Site

The surficial soils at the Portsmouth site consist of shallow fills, lacustrine deposits and older alluvium, which are underlain by native bedrock. The fill materials consist of mostly silty clays, the lacustrine deposits consist mostly of silts and clays, and the older alluvium consists of clayey sands and gravels. The surficial groundwater table is in the lacustrine deposits at depths between 10 and 15 ft below existing grade in the main plant area.

Little soils information is available about the subsurface conditions of the northeast parcel, but it is assumed that the soil conditions are generally similar. The depth to rock in this area may actually be shallower, and there is little likelihood that there is any fill material in that parcel. A portion of this area was stripped at various times during construction at the site for use as borrow materials.

The Portsmouth SAR (Reference 1) reports the results of an extensive liquefaction study conducted in 1992 and 1993 based on three hazard level earthquakes of 500-, 1000-, and 5000-year events. The results of these studies concluded that: “The liquefaction evaluation demonstrated that liquefaction was not a concern for EBE at the site." It is anticipated that the potential for liquefaction in the area of the northeast parcel will be similar or less. Therefore, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.16.3 Evaluation of the Savannah River Site

The soils in the top 100 ft at the SRS are mainly sands, clayey sands, and sandy clays. A great deal of effort has been spent over the years performing liquefaction analyses using various methods. Site-specific soil sampling and testing has demonstrated that the dominant formation (Tobacco Road Formation) is about 40 million years old and has increased strength due to aging. The SRS geotechnical and safety analysis reports consistently indicate acceptable factors of safety against liquefaction.

Nevertheless, it will again be an issue for a new reactor with increased seismic hazard. Therefore, a ranking of 3 is assigned for all reactor types and the Bounding Plant.

3.16.4 References

1. United States Enrichment Corporation, Application for United States Nuclear Regulatory Commission Certification – Portsmouth Gaseous Diffusion Plant Safety Analysis Report, Rev. 1, September 15, 1995 and Rev. 2, January 19, 1996.

2. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, Vol. 2, App. D, September 1992.

3. Westinghouse Savannah River Company, F-Area Geotechnical Characterization Report (U), Site Geotechnical Services Department for U.S. Department of Energy, Savannah River Site, No. WSRC-TR-96-0069, September 1996.

4. Westinghouse Savannah River Company, Generic Safety Analysis Report, for U.S. Department of Energy, Savannah River Site, No. G-SAR-G-00001, Rev. 4, September 1999.

3.17 Bearing Material

Bearing material is the material on which the proposed new plants will be founded. Each of the five reactors being considered will be founded at a considerable depth below finished plant grade. The depths of the bottom of the reactor base mat and the bearing pressure on the base mat are identified in Table 3-8. This information was obtained from each manufacturer's data sheets and descriptions.

Table 3-8. Foundation Depths and Bearing Pressures

Type	Foundation Depth, ft	Bearing Pressure, ksf
ABWR	84	15
AP1000	40	8.4
GT-MHR	148 (Note)	10
IRIS	43	8
PBMR	33	11
Bounding Plant	148	15

Note:. Reactor silo depth given as 128.5 feet. Elevation view shows bottom of base mat at 148 feet.

There is no indication given in the information reviewed for this study as to whether there is flexibility in the depth of the reactor, that is, whether it is possible for the reactor to be founded deeper or shallower than published. The ranking below is based on the tabulated values, which are for the reactor only. Other power block structures will be shallower, particularly in the GT-MHR case. The foundation materials for the remaining structures (including balance-of-plant) are considered in Section 3.18.

Ranking in the Site Evaluation Process is based on the quality of the bearing material at the reactor base mat elevation and the amount and/or difficulty of over-excavation or backfilling required to achieve a satisfactory subgrade.

3.17.1 Evaluation of the INEEL Site

Basalt bedrock outcrops at this site and extends to at least 3500 ft below ground surface. The maximum depth of surficial soil across the preferred site is about 5 ft. The basalt has some thin sedimentary layers interspersed (marking the intervals between lava flows). The shallowest of these is at about 100 ft depth. Groundwater is at least 450 ft below ground surface.

The strength of the vesicular olivine basalt bedrock ranges from about 4,000 to 12,000 psi. It has more than sufficient bearing capacity for each of the plants. The drawback is the rock is massive and will have to be removed by blasting, which will be expensive. There will be much less rock removal for the AP1000 plant founded at 40 ft depth than for the GT-MHR founded at 148 ft. The depth of excavation will form the basis of the ranking. Groundwater is several hundred feet below the surface and will not impact the excavation.

- ABWR

This reactor design is based on an 84 ft depth of embedment. Assign a rank of 2.

- AP1000

This design is based on a 40 ft depth of embedment. Assign a rank of 3.

- GT-MHR

This design is based on 148 ft depth of embedment. Assign a rank of 1.

- IRIS

This design is based on a 43 ft depth of embedment. Assign a rank of 3.

- PBMR

This design is based on a 33 ft depth of embedment. Assign a rank of 3.

- Bounding Plant

This bounding design is based on a 148 ft depth of embedment. Assign a rank of 1.

3.17.2 Evaluation of the Portsmouth Site

It is anticipated that rock will be found within 30 ft or less of the existing grade. For this evaluation, it has been assumed that rock is at a depth of 30 ft. The rock profile at the site, as indicated in the SAR, consists of the Cuyahoga Formation (≈ 60 ft thick), the Sunbury Formation (≈ 20 ft thick), the Berea Formation (≈ 30 ft thick), and the Bedford Formation (≈ 100 ft thick).

- ABWR

At the design embedment depth of 84 ft, the foundation for the reactor will be founded either in the base of the Sunbury Formation or the top of the underlying Berea Formation. The tested strength of the Sunbury Formation ranged from 1,125 psi to 1,675 psi, while the strength of the Berea Formation exceeded 10,000 psi. In either case, the rock will provide sufficient bearing for the reactor's 15-ksf loading. To obtain a foundation depth of 84 ft, removal of more than 50 ft of mostly fairly weak rock will be required. Dewatering will be needed. Assign a rank of 3.

- AP1000

At the design embedment depth of 40 ft, the foundation for the reactor will be in the upper portion of the Cuyahoga Formation. The maximum tested strength of this formation was 1,650 psi. The rock will provide sufficient bearing for the reactor's 8.4-ksf loading. To obtain a foundation depth of 40 ft, removal of about 10 ft of rock is needed. This should also place the foundation below any weathered zone in the top of the Cuyahoga Formation. Dewatering will be needed. Assign a rank of 4.5.

- GT-MHR

At the design embedment depth of 148 ft, the foundation for the reactor will most likely be in the Bedford Formation. There is no available laboratory data for this formation, but bearing in rock at this depth should not create any bearing capacity problems for the 10-ksf loading. To obtain a foundation depth of 148 ft, removal of about 120 ft of rock will be needed. Dewatering will be required. Assign a rank of 1.

- IRIS

This reactor design is based on a 43 ft depth of embedment and a loading of 8 ksf. The foundation requirements are almost identical to those for the AP1000 reactor. Assign a rank of 4.5.

- PBMR

At the design embedment depth of 33 ft, the foundation for the reactor will be in the upper portion of the Cuyahoga Formation. The maximum tested strength of this formation was 1,650 psi. The rock will provide sufficient bearing for the reactor's 11-ksf loading. To obtain a foundation depth of 33 ft, removal of about 3 ft of rock is needed. This should also place the foundation below any weathered zone in the top of the Cuyahoga Formation. Dewatering will be needed. Assign a rank of 4.5.

- Bounding Plant

The bounding reactor design is based on a 148 ft depth of embedment and a bearing pressure of 15 ksf. This will require the same treatment as the GT-MHR reactor. Assign a rank of 1.

3.17.3 Evaluation of the Savannah River Site

The preferred location is a 250-acre site situated north of the site center, about four miles northwest of the F-Facility. The draft geotechnical report prepared for the APT site was not available for review. However, based on conversations with site geotechnical personnel, it is reasonable to assume similar subsurface conditions to those found at the F-Facility.

The soils in the top 100 to 150 ft (which will serve as the bearing materials for the new reactor) are mainly medium dense to dense clayey sands. These should have sufficient bearing capacity for the new reactor, although some rebound settlement can be expected. Settlements will need detailed analysis for the 15-ksf bearing pressure reactors. Detailed investigation will be needed under the reactor footprint to evaluate the foundation soils under postulated static and dynamic loads, and to confirm that no remedial measures will be required in the underlying carbonate-rich deposits. The earlier major structures on the site had grout remediation (reactors, tanks, F and H canyons, K cooling tower, etc.); however, results of intensive studies over recent years have allowed major structures to be installed without grouting, e.g., the Replacement Tritium Facility and the Tritium Extraction Facility. Dewatering will be needed for the excavation for reactors that are founded deeper than about 50 feet.

- ABWR

This reactor design is based on an 84 ft depth of embedment and a bearing pressure of 15 ksf. Dewatering will be needed. The high bearing pressure could produce relatively large settlements. Detailed exploration beneath the reactor footprint will be needed, with possible remedial action if soft zones are found. Assign a rank of 1.5.

- AP1000

This reactor design is based on a 40 ft depth of embedment and a bearing pressure of 8.4 ksf. Dewatering should not be needed. Settlement should be moderate. Detailed exploration beneath the reactor footprint will be needed. Assign a rank of 3.

- GT-MHR

This reactor design is based on a 148 ft depth of embedment and a bearing pressure of 10 ksf. This will require a massive excavation and dewatering effort, probably best managed within a slurry wall cofferdam. Rebound settlement (i.e., reloading the soil unloaded in the excavation) may be relatively large. Excavating to 148 ft depth may bring the foundation below any existing soft zones. Assign a rank of 1.

- IRIS

This reactor design is based on a 43 ft depth of embedment and a bearing pressure of 8.0 ksf. The foundation requirements are almost identical to the AP1000 reactor. Assign a rank of 3.

- PBMR

This reactor design is based on a 33 ft depth of embedment and a bearing pressure of 11 ksf. The foundation requirements are almost identical to the AP1000 reactor. Assign a rank of 3.

- Bounding Plant

The bounding reactor design is based on a 148 ft depth of embedment and a bearing pressure of 15 ksf. This will require the same treatment as the GT-MHR reactor. Assign a rank of 1.

3.17.4 References

1. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, Vol. 2, App. D, September 1992.

2. Westinghouse Savannah River Company, F-Area Geotechnical Characterization Report (U), Site Geotechnical Services Department for U.S. Department of Energy, Savannah River Site, No. WSRC-TR-96-0069, September 1996.

3. Westinghouse Savannah River Company, Generic Safety Analysis Report, for U.S. Department of Energy, Savannah River Site, No. G-SAR-G-00001, Rev. 4, September 1999.

4. United States Enrichment Corporation, Application for United States Nuclear Regulatory Commission Certification – Portsmouth Gaseous Diffusion Plant Safety Analysis Report, Rev. 1, September 15, 1995 and Rev. 2, January 19, 1996.

3.18 Near-Surface Material

Near-surface materials are defined as the materials that will support the balance –of plant (BOP) and some (or possibly all) of the power block structures excluding the reactor. Ranking in the Site Evaluation Process is based on the quality of the bearing material at the foundation elevation, and the suitability of the material for support of excavation for the deeper structures.

Because few details of the power block and BOP structures needed to support each reactor are available, a site ranking is assumed rather than a ranking for each of the five reactors.

3.18.1 Evaluation of the INEEL Site

Basalt bedrock outcrops at this site and extends to great depths. The maximum depth of surficial soil across the NPR site is about 5 ft. The strength of the vesicular olivine basalt bedrock ranges from about 4,000 to 12,000 psi. Groundwater is at least 450 ft below ground surface.

Although some of the support structures may be relatively deep, most will be founded near to the surface. For these, the strong rock and low water table provide the advantages of adequate bearing capacity, essentially zero settlement, no dewatering, and a stable unsupported excavation. The Site Evaluation Process puts these conditions in the desirable category, giving a rank of 4 for fresh unfractured bedrock that extends below the foundation and more than 2 m above the foundation base. Therefore, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.18.2 Evaluation of the Portsmouth Site

The upper site soils above the rock at the Portsmouth site consist of lacustrine deposits and older alluvium. The upper lacustrine deposits consist of medium stiff to very stiff overconsolidated clays and silts, classified in accordance with the Unified Soil Classification System as CL (low plasticity clays) to ML (low plasticity silts). The geotechnical report prepared for the Gas Centrifuge Enrichment Plant indicated that these soils can support foundation loads up to 6 ksf for footings greater than 4 ft square and foundation loads up to 5 ksf for smaller footings. These soils should be adequate for most of the BOP structures. It is assumed that similar soil conditions exist in the northeast sector of the site. Dewatering may be needed for some of the deeper structures.

Based on the above evaluation, a ranking of 3.5 is assigned for all reactor types and the Bounding Plant.

3.18.3 Evaluation of the Savannah River Site

The medium dense to dense sand coupled with a water table that will be at least 40 ft below the ground surface equates to a site ranking of 3, according to the Site Evaluation Process. However, although potential soft zones between 100 and 150 ft depth are not expected to require any remedial action, even for the deeper, heavier power block structures, significant effort is expected to demonstrate this. Accordingly, a ranking of 2.5 is assigned for all reactor types and the Bounding Plant.

3.18.4 References

1. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, Vol. 2, App. D, September 1992.

2. Westinghouse Savannah River Company, F-Area Geotechnical Characterization Report (U), Site Geotechnical Services Department for U.S. Department of Energy, Savannah River Site, No. WSRC-TR-96-0069, September 1996.

3. Westinghouse Savannah River Company, Generic Safety Analysis Report, for U.S. Department of Energy, Savannah River Site, No. G-SAR-G-00001, Rev. 4, September 1999.

4. United States Enrichment Corporation, Application for United States Nuclear Regulatory Commission Certification – Portsmouth Gaseous Diffusion Plant Safety Analysis Report, Rev. 1, September 15, 1995 and Rev. 2, January 19, 1996.

5. Law Engineering Testing Company, Final Report Gas Centrifuge Enrichment Plant Geotechnical Investigation Portsmouth, Ohio, April 28, 1978.

3.19 Groundwater

The objective of this section is to evaluate groundwater levels and subsurface formation characteristics that might impact the design, construction, and operation of a new generation nuclear power plant at the INEEL, Portsmouth, and Savannah River sites. Any subsurface portions of safety-related structures, systems, and components that extend below the seasonally high water table are subject to groundwater-induced hydrostatic loadings. The design of subsurface facilities extending below the water table must incorporate additional material quantities to resist hydrostatic loadings and uplift. Dewatering may be required on a permanent basis to reduce groundwater-induced hydrostatic loadings or to prevent groundwater seepage into reactor facilities located below the water table. Dewatering may also be required during construction to protect the integrity of safety-related structures and to facilitate construction.

3.19.1 Evaluation of the INEEL Site

Groundwater beneath the INEEL site occurs primarily in the Snake River Plain aquifer. However, perched groundwater may exist locally where layers of fine-grained, low-permeability sediments retard the downward migration of infiltrating water (Reference 1). Small areas of perched water may also occur at shallow depths in alluvial sediments. A “deep perched groundwater zone” is reported to be present in an interbedded sediment-basalt sequence beneath a portion of the INEEL site. The base of this zone is about 300 ft above the top of the Snake River Plain aquifer. These perched groundwater zones largely appear to be associated with the presence of wastewater disposal ponds on the ground surface.

The Snake River Plain aquifer is comprised of volcanic rocks (rhyolitic and basaltic lava flows) and interbedded sediments. The bulk of the groundwater occurs in the basalt layers. The aquifer generally occurs in an unconfined condition, although it behaves as a partially confined aquifer due to the contrasts in hydraulic conductivity between the dense basalt layers, interbedded sediments, and water-bearing openings in the rock, especially at the top and bottom of lava flows. Recharge to the aquifer beneath the INEEL site is primarily by underflow from the northeastern portion of the Snake River Plain and, to a lesser extent, from surface water drainages to the west and north. Local precipitation and snowmelt provide minor amounts of recharge (Reference 1). Groundwater beneath the INEEL site generally flows from the northeast to the south and southwest at a hydraulic gradient of about 10 ft per mile (Reference 2) and a velocity of about 5 to 20 ft per day (Reference 1).

The Snake River Plain aquifer is estimated to contain about $6.6x10^{14}$ gallons of water, about 25 percent of which is estimated to be available for withdrawal by pumping (Reference 1). The transmissive properties of the aquifer vary substantially due to the variations in its composition. The transmissivity of the aquifer is reported to range from about $1x10^6$ to $1x10^8$ gallons per day per ft (gpd/ft) with an average of $5x10^6$ gpd/ft, while its storativity varies from 0.001 to 0.2 and averages 0.15. Its effective porosity is estimated to range from about 5 to 10 percent (Reference 2). The potentiometric surface of the Snake River Plain aquifer beneath the preferred plant site is at about elevation 4,470 ft and the aquifer is estimated to be at least 250 ft thick (Reference 1).

Based on the depth to groundwater (~450 ft), the issues associated with groundwater hydrostatic loading and dewatering at the INEEL preferred plant site merit a ranking of 5 for all reactor types and the Bounding Plant. However, the potential for the presence of locally perched groundwater and its impact will need to be considered should this site be selected for further study.

3.19.2 Evaluation of the Portsmouth Site

Near-surface groundwater beneath the Portsmouth site occurs in the unconsolidated Quaternary age Minford and Gallia units, and in the underlying Mississippian age Sunbury, Berea, and Bedford bedrock units (Reference 3). Recharge to the unconsolidated deposits beneath the site is from the infiltration of direct precipitation while the bedrock units are believed to receive recharge from precipitation on outcrop areas to the west.

The unconfined Gallia aquifer beneath the Portsmouth site is comprised of the lower silt unit of the Minford and, where present, the Gallia sand (Reference 3). The Gallia sand is discontinuous in areal extent due to its deposition as localized infilling of an ancient streambed. The Gallia aquifer overlies the Sunbury shale or, in its absence, the Berea sandstone. The Minford has a total average thickness of 23.9 ft beneath the site. The basal Minford silt has an average thickness of 7.6 ft, while the Gallia sand has an average thickness of 3.4 ft, resulting in a combined average thickness for the Gallia aquifer of approximately 11 ft. The bottom of the Gallia aquifer beneath the site occurs at elevations ranging from 630 to 640 ft.

The Sunbury shale ranges in thickness from 0 to 20 ft, with an average thickness of 10 ft (Reference 3). Where present, the Sunbury shale acts as a confining layer over the Berea sandstone, which has a relatively uniform thickness of about 30 ft. Where the Sunbury is absent or very thin, the Berea and Gallia aquifers behave essentially as one unit. The Berea is underlain by about 100 ft of Bedford shale beneath the Portsmouth site.

Hydraulic conductivity values have been determined for the Gallia and Berea aquifers beneath the Portsmouth site. The values determined for the Gallia aquifer range from $5.3x10^{-2}$ to $3.9x10^{-5}$ cm/sec with a mean value of $1.2x10^{-3}$ cm/sec (Reference 3). The values determined for the Berea sandstone range from $5.3x10^{-3}$ to $1.6x10^{-6}$ cm/sec with a mean value of $5.7x10^{-5}$ cm/sec. Storativity values for the Gallia aquifer are reported to range from 0.00011 to 0.41 with a mean value of 0.016. No values have been reported for the Berea sandstone. An effective porosity of 20 percent was assumed for the Gallia aquifer while a value of 1 percent was assumed for the Berea sandstone. Well yields from the Gallia aquifer are reported to range from about 5 to 100 gpm, while yields from the Berea sandstone are reported to range from about 2 to 3 gpm. Groundwater levels in the Gallia aquifer in the vicinity of the preferred plant location were indicated to be at elevations on the order of about 640 to 650 ft during the third quarter of 2000 (Bechtel Jacobs map), while potentiometric levels in the Berea sandstone were indicated to be at an elevation on the order of about 640 ft at the end of 1988 (Reference 3).

Based on the depth to groundwater (<70 ft), a moderate hydraulic conductivity of (1.2×10^{-3} cm/sec), and well yields between 5 and 100 gpm for the Gallia aquifer, the issues associated with groundwater hydrostatic loading and dewatering at the Portsmouth site merit a ranking of 3 for all reactor types and the Bounding Plant. The impact of groundwater on design and construction of the proposed plant will need to be addressed should this site be selected for further study.

3.19.3 Evaluation of the Savannah River Site

Groundwater likely to have the most significant impact on the Savannah River site occurs in the Coastal Plain sediments lying directly beneath the site. Of lesser importance is groundwater occurring in the underlying metamorphic and igneous basement rocks and in Upper Triassic age sedimentary rock strata of the Dunbarton basin, a down-faulted elliptical structure lying just to the southeast of the preferred plant site and bordered on its northwest side by the Dunbarton and Pen Branch faults (Reference 5).

The Coastal Plain sediments contain four water-bearing units designated Aquifers 1 through 4 and two confining units designated Aquitards 1 and 2 (Reference 1). Aquifer 1, the lowermost aquifer, overlies a non-water bearing unit that forms the base of the Coastal Plain sediments beneath the Savannah River site. Aquifers 1 and 2 are the principal sources of groundwater in this area. They have a combined thickness of about 450 ft and are separated by Aquitard 1. The aquifers receive recharge from their outcrop areas and through overlying sediments to the northwest. Groundwater flow in the aquifers is toward the southwest. Industrial wells in the area that penetrate these aquifers generally yield more than 800 gpm. The two aquifers are reported to have a horizontal hydraulic conductivity of about 5×10^{-2} cm/sec and an effective porosity of about 20 percent.

Aquifer 2 is separated from Aquifer 3 by Aquitard 2, which appears to be a principal confining layer beneath the Savannah River site as evidenced by hydraulic heads in Aquifers 1 and 2 that are higher than the head in Aquifer 3 beneath a large part of the site (Reference 1). Where these higher heads in the lower aquifers are maintained, the vertical hydraulic gradient is upward, resulting in a reversal in the normally expected movement of groundwater between the aquifers above and below Aquitard 2. A clay layer known locally as the green clay separates Aquifer 3 from the overlying Aquifer 4. In many areas, the green clay-confining layer supports a hydraulic head in Aquifer 3 that is higher than that in Aquifer 4. Aquifer 3 is recharged from its outcrop area and by seepage from the overlying sediments.

Aquifer 4 is an unconfined aquifer and exhibits a water table level that varies from a depth of about 40 to 60 ft below the ground surface at the preferred plant site. This aquifer is recharged by infiltration through the overlying sediments. Aquifers 3 and 4 are generally used by the local population as a source of water supply. Wells in these aquifers are capable of yielding water at a rate of about 300 gpm. Aquifer 4 generally supports only low-production wells for domestic purposes due to restricted capacity imposed by the relatively fine-grained nature of the sediments comprising this aquifer. Aquifer 4 is reported to have a horizontal hydraulic conductivity of about 1.5×10^{-2} cm/sec to 2.5×10^{-3}

cm/sec while Aquifer 3 has a value of about 3×10^{-2} cm/sec. Both aquifers have effective porosities on the order of 25 percent (References 1 and 6).

Perched groundwater may be encountered locally at depths as shallow as 6 ft.

Based on the depth to groundwater of 40 to 60 ft, a moderate hydraulic conductivity of 8×10^{-3} cm/sec, and well yields on the order of 300 gpm for the uppermost aquifer (Aquifer 4), the issues associated with groundwater hydrostatic loading and dewatering at the Savannah River site merit a ranking of 2 for all reactor types and the Bounding Plant. The impact of the indicated aquifers and the potential for the presence of locally perched groundwater will need to be considered should this site be selected for further study.

3.19.4 References

1. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Construction, and Operating New Production Reactor Capacity, Office of New Production Reactors, September 1992.

2. INEEL, Safety Analysis Report for TMI-2 ISFSI, October 2001.

3. Bechtel Jacobs Company, LLC, Safety Analysis Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, Environmental Management & Enrichment Facilities Management and Integration Contract, August 1998.

4. Bechtel Jacobs Company, LLC, Portsmouth Gaseous Diffusion Plant, 2000 TCE Plume Map, Drawing No. DX-761-776-C, Rev. 12/11/01.

5. Westinghouse Savannah River Company, Generic Safety Analysis Report, prepared for the U.S. Department of Energy, September 1999.

6. U.S. Department of Energy, Draft Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site, DOE/EIS-0270D, December 1997.

3.20 Flooding Potential

A probable maximum flood (PMF) must be considered for nuclear power plant sites. The objective of this section is to determine the PMF levels from existing analysis performed for the existing INEEL, Portsmouth, and Savannah River sites. These flood levels are compared with elevations at the proposed sites to determine if a flooding potential exists. Additionally, plant drainage from local intense Probable Maximum Precipitation (PMP) at each proposed site is addressed.

3.20.1 Evaluation of the INEEL Site

The proposed new power generation facility site is about one mile east of the Big Lost River in the south central portion of the INEEL site. The site is about 45 miles downstream of Mackay Dam.

Analyses have been performed for both the PMF on the Big Lost River and a dam breach on the Mackay Dam. The results of these analyses indicate that a dam break because of the PMF flowing into the reservoir upstream of the dam and overtopping the dam produces the most extensive flooding scenario. Thus, the site is characterized as being subject to dam failure flooding. Since all reactor types would be built on the same plant grade elevation, the flooding evaluation for each reactor type is the same.

The PMF study conducted on the Big Lost River indicates that the proposed site is above the PMF water surface elevation. However, a dam failure caused by over topping because of a Probable Maximum Precipitation (PMP) rainfall event produces water levels that would affect the lower elevations of the proposed site. An analysis of the Mackay Dam has indicated that the existing spillway is not capable of passing the inflow PMF without overtopping the dam. Thus, dam failure during a PMP event is a likely scenario. The grade elevation selected for the site will need to consider the PMP-induced dam failure floodwater elevations. Fill will need to be placed in some areas of the site to achieve the necessary site grade. Where fill has been placed, erosion protection will also need to be provided for the fill.

In addition to flooding from an adjacent water body, flooding from the site drainage because of a local PMP needs be considered. Overland flows at the proposed site are primarily sheet flows towards the Big Lost River. The design of site drainage structures, such as ditches, swales, etc. will need to consider discharges produced by a PMP event and ensure that flooding of safety-related structures does not occur. In selecting the site grade consideration must also be given to the need to provide positive drainage for the local PMP flows to the Big Lost River while under flooding conditions from a PMF-induced dam breach. Runoff from upland areas east of the site can be diverted around the site with ditches designed to pass the peak discharges from a local PMP.

Since the existing proposed site elevations, in some locations, are below the PMF-induced dam breach flood elevation on the Big Lost River and will require some fill to raise the site, a ranking of 3 is assigned for all reactor types and the Bounding Plant. Runoff produced by a local intense precipitation as severe as the PMP can be discharged offsite with no flooding to safety-related facilities.

3.20.2 Evaluation of the Portsmouth Site

The preferred new power generation site at the Portsmouth facility is on an undeveloped 340-acre parcel of land northeast of the existing facilities. The proposed location is bounded on the northwest and southeast by intermittent creeks, which are tributaries to Little Beaver Creek, which is a tributary to the Scioto River located about 2.5 miles to the east. The intermittent creeks are usually dry and only contain flow during and shortly after heavy rainfall. The major flooding sources for the site are the creeks mentioned above and the Scioto River. There is an existing dam for the X-611B sludge lagoon on the Little Beaver Creek watershed as well as dams on the Scioto River. The existing onsite sludge lagoon dam is about 0.5 mile from the preferred site. Flooding for this site is characterized as dam failure flooding. Since all reactor types would be built on the same plant grade elevation, the flooding evaluation for each reactor type is the same.

The Portsmouth SAR indicates that a PMF analysis has been completed from the Scioto River. The water surface elevations on the Scioto River near the facility during the PMF are at elevation 571 ft

NGVD. The average elevation of the preferred site is at about elevation 675 ft. NGVD. A PMF-induced dam failure analysis for the existing dams on the Scioto River has not been performed for the site SAR. However, given the elevation difference of more than 100 feet between the proposed site and the Scioto River PMF values, the dam breach flood levels will not affect the site. Even though flood levels on the Scioto River do not affect the proposed site, the existing groundwater fields that supply makeup water to the existing facility have equipment that at elevation 571 ft NGVD. The PMF water level at the well field location is at elevation 575 ft. NGVD. Thus, if these well fields are to be used as a source of makeup water to the new power plant they will require modification to raise the equipment above the PMF levels.

PMF and dam breach analyses for the creeks near the preferred new power generation site have not been completed. Flood analysis for the creeks has been completed for a 10,000-year storm, however. The existing sludge pond dam has a top of embankment elevation of about 685 ft NGVD. The stream distance a flood wave from a possible PMF-induced dam breach would be required to travel to reach the site is approximately 4000 feet. Approximately 2000 feet of this length is traveling upstream along the intermittent tributary bounding the southeast side of the proposed site. The streambed elevation at the mouth of the intermittent tributary at Little Beaver Creek is about 15 feet lower than the streambed elevation at the downstream toe of the dam embankment. Considering the drop in streambed elevation, the initial water surface elevation drop across the dam breach, and the friction losses as the flood wave travels downstream, the flood elevation produced by a PMF-induced dam failure will most likely be lower than the average site grade elevation at the proposed site. A complete PMF analysis with a dam breach analysis will be required for the new power generation site to determine the actual impact to the site and to meet NRC requirements.

Local flooding caused by a localized PMP must also be considered for the proposed site. From the site visit that was conducted on June 5, 2002, it is evident that the drainage can be designed to safely pass the peak discharges from the PMP offsite and to the existing creeks without flooding any safety-related facilities for the proposed units.

Based on the information provided for the PMF values for the existing Portsmouth site and discussion presented above, flooding potential does not appear to be a threat to safety-related facilities at the proposed nuclear power generation site. Therefore, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.20.3 Evaluation of the Savannah River Site

The preferred new power generation site at the SRS installation is situated on high ground at the top of a drainage divide. Approximately 1.2 miles west of the site is the confluence of Tinker Creek and Upper Three Runs Creek, with Tinker Creek being a tributary of Upper Three Runs Creek. Tinker Creek is about 1 mile northwest of the site, and Mill Creek, a tributary to Tinker Creek, is about 0.7 mile northeast of the site. The proposed site elevations are more than 120 feet above all the existing streambeds near the site. The major flooding sources for the site are the creeks mentioned above. There are no dams in the Upper Three Runs Creek watershed. Flooding for this site is characterized as river flooding. Since all reactor types would be built on the same plant grade elevation, the flooding evaluation for each reactor type is the same.

According to the SAR for the SRS site, a PMF analysis has been performed for Upper Three Runs Creek. The analysis did not include its tributaries and thus it did not extend up Tinker Creek or Mill Creek. The analysis determined that the PMF peak discharge for Upper Three Runs Creek just downstream of its confluence with Tinker Creek is 150,000 cfs. The maximum water level corresponding to this discharge is 173.5 ft NGVD. The existing elevations at the preferred power generation site range from 290 ft to 320 ft NGVD. Although PMF water levels on Tinker and Mill creek would likely be higher than the elevation determined for Upper Three Runs Creek, it is inconceivable that they would pose a threat to the proposed site more than 120 feet above the existing streambeds, especially when considering the small drainage areas for these creeks. Thus, the proposed site is above the PMF elevations for the existing creeks in the area.

Local flooding caused by a localized PMP must also be considered for the proposed site. From the site visit that was conducted May 14-15, 2002, it is evident that the drainage can be designed to safely pass the peak discharges from the PMP offsite and to the existing creeks without flooding any safety-related facilities for the proposed units.

The PMF and PMP analysis performed for the SRS site were performed after the current guidelines outlined in NUREG-1407 were developed and make use of the latest guidelines for determining the PMP and PMF. Since PMF levels have not been determined for Tinker or Mill Creek, a new analysis will need to be performed to determine these elevations. However, given the elevation difference between the creeks and the preferred power generation site, the flood elevations will not impact the site.

Based on the information provided for the PMF values for the existing SRS site and the proposed site grade elevation of about 310 ft NGVD, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.20.4 References

1. SAR, INEEL TMI-2, October 2001

2. March 19, 2002 letter from Thomas P. Mundy, Exelon Generation, to Mr. Joseph D. Hegner, Dominion Resources Services, Inc., "Exelon Screening Analysis for Government Site."

3. Generic SAR, SRS, September 1999

4. USEC Portsmouth Gaseous Diffusion Plant SAR, April 2002.

3.21 Ice Formation

Regulatory Guide 1.70.17, Section 2.4.2.3, requires evaluation of the impact of ice accumulation on site facilities where such an accumulation could coincide with winter PMP and could cause flooding or damage to safety-related structures. Section 2.4.7 of Regulatory Guide 1.70.17 requires evaluation of potential ice impacts and design criteria for protection of safety-related facilities from ice causing flooding and forces.

The potential impacts of ice at the new proposed plants may include:

- Blockage of cooling water intake
- Formation of frazil ice that may adhere to trash racks and traveling screens
- Formation of ice sheets in the cooling lake that could exert forces on the walls of the intake structure
- Blockage of site drainage ditches resulting in site flooding during winter PMP
- Blockage of roof drains that may cause accumulation of winter PMP on the roofs

These issues are primarily design-related and not site-related. The design of roof drains, site drainage, and forces on structures in contact with water that may be subjected to ice formation should be designed to function in the presence of ice and in accordance with Regulatory Guide 1.70.17.

Formation of ice at intakes can cause blockage by surface ice accumulating and by water in the lower layers withdrawing small ice floes. In addition, frazil ice can lead to severe blockage of intakes by adhering to trash racks and traveling water screens. This condition can lead to complete blockage of an intake that could lead to plant shutdown. During the data collection and analysis at a given site, the potential for ice formation is assessed and, if applicable, the design should incorporate measures to prevent the adverse impact on the power plant intake and water supply dependability. Measures usually used are deep intakes, use of low withdrawal velocity to prevent submergence of ice floes, heating elements to heat trash racks or traveling screens, or warm water recirculation into the intake if practical.

3.21.1 Evaluation of the INEEL Site

The average annual snowfall at the INEEL site is 27.6 inches and the maximum annual snowfall is 59.7 inches. The site is in a relatively cold region with January being the coldest month. The average air temperature for January is approximately 16°F, and the average minimum is 4.6°F. Because of these low temperatures, there is a potential for the formation of ice jams. This may affect site drainage. However, it would have minimal impact on the cooling water intake because it would be taken from groundwater as discussed in Section 3.22. The low temperature will require insulation of all aboveground pipes and cooling water components such as valves, manholes, pump motors, etc.

Based on the information reviewed, ice formation is likely to occur at the site. Since groundwater will be used, ice formation should not have adverse effects. However, protection of the cooling system and safety-related buildings against icing would require assessment to develop protective measures. For these reasons, a ranking of 3 is assigned for all reactor types and the Bounding Plant.

3.21.2 Evaluation of the Portsmouth Site

The average annual snowfall at the Portsmouth site is 20.4 inches and the maximum annual snowfall based on records at three nearby stations ranges from 28.4 inches to 39.5 inches. The climate is relatively mild. On the average, there are 112 days per year with below 32°F. Because of the low temperatures in the winter, there is a potential for the formation of ice jams. This may affect site drainage.

Ice occurs on all streams in the Ohio River Basin. The ice layer in 1963 was 18 inches thick and was formed in the tributaries of the Ohio River. Ice formation in the Scioto River may have an impact on a river cooling water intake. Although river water is not the primary water source as discussed in Section 3.22, the formation of ice in the river would need to be considered in the design of a surface intake. The low temperature would require insulating aboveground pipes and cooling water components such as valves, manholes, pump motors, etc.

Based on the information reviewed, ice formation is likely to occur at the site. Depending on the design features of the selected normal and emergency cooling system, the impact of ice formation would require assessment to develop protective measures. For these reasons, a ranking of 2 is assigned for all reactor types and the Bounding Plant.

3.21.3 Evaluation of the Savannah River Site

No ice conditions have been experienced at the existing SRS facilities. However, some ice has been observed in the Savannah River on several occasions.

Based on the information reviewed, ice formation is not likely to occur at the site. Depending on the design features of the selected normal and emergency cooling system, the impact of ice formation would require assessment to develop protective measures. A ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.21.4 References

1. EG&G, NPR Turbine/Dry Tower (Air cooled Condenser Conceptual Design Study), August 1990.

2. Environmental and Other Evaluation of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, US DOE Volume –1, September 1992.

3. USEC, Application for United States Nuclear Regulatory Commission Certification, Volume 1: Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, September 1995.

4. SRS G-SAR –G-00001 Rev 4.

5. Impingement and Entrainment of Fishes at the Savannah River Plant, An NPDES 316 b Demonstration, Du Pont, DP-1494, February 1978.

6. Effect of Geographical Location on Cooling Pond Requirements and Performance, US EPA, Project No. 1613 FDQ, March 1971.

7. Site Selection for the Accelerator for Production of Tritium at the Savannah River Site, WSRC-TR–96-0279, Rev 1, October, 1996.

3.22 Cooling Water Source

Nuclear power plants require a reliable source of water for cooling of heat rejected from the condenser, service water system, component cooling system, and other uses. The water available must be sufficient during normal operation, shutdown, postulated accident conditions, and for fire protection. In addition, no adverse impacts on existing site facilities must be created.

Table 3-9 presents the data used for this evaluation based on the information contained in Part I. The table presents an estimated heat load from each type of reactor with cooling water requirements for once-through cooling and closed cycle cooling using wet cooling towers.

3.22.1 Evaluation of the INEEL Site

The water resources at the INEEL site consist of surface water and groundwater. The average yearly precipitation in the region, excluding the mountains, ranges from 8 to 10 inches. Considering evaporation and local users, rainfall contribution to stream flow may be negligible. The major surface water source is the Big Lost River. Water in this river and other smaller streams is used primarily for irrigation (Reference 1). Therefore, groundwater is the only source for cooling water for any facilities at the INEEL site.

Several plant cooling water options are preliminarily evaluated below:

- Zero Discharge Closed Cycle System Using Wet Cooling Towers

The estimated water requirements for a zero discharge plant are a maximum of 60,000 acre ft/yr for two ABWR-size units, which is greater than the current INEEL water rights permit of 35,000 acre ft/yr. For a zero discharge plant using groundwater as a source, the number of units that could be supported within the current water rights is:

Plant	Water Requirements
1 ABWR Unit	30,000 acre ft/yr
1 AP1000 Unit	27,000 acre ft/yr
8 GT-MHR Modules	29,000 acre ft/yr
4 IRIS Modules	31,000 acre ft/yr
8 PBMR Modules	22,000 acre ft/yr

Table 3-9. Estimated Plant Heat Load and Cooling Water Requirements

Reactor	MWe per Unit or Module	Number of Units or Modules	MWe per Site	MWt per Site	MW Discharged to the Environment	Btu/hr (x 10^9) (see Note 1)	Flow for Once-Through Cooling (cfs) (see Note 2)	Cooling Tower Makeup (cfs) (see Note 3)	Cooling Tower Blowdown (cfs)	Btu/hr/MWe (x 10^6)
ABWR	1350	1	1350	3926	2576	8.8	2200	59	20	6.5
		2	2700	7852	5152	17.6	4400	117	39	
AP1000	1117	1	1117	3415	2298	7.8	1963	53	18	7.0
		2	2234	6830	4596	15.7	3925	105	35	
GT-MHR	286	4	1144	2400	1256	4.3	1075	29	10	3.8
		8	2288	4800	2512	8.6	2150	58	20	
IRIS	335	3	1005	3000	1995	6.8	1700	46	16	6.8
		6	2010	6000	3990	13.6	3400	91	31	
PBMR	160	8	1280	3200	1920	6.5	1610	43	14	5.1
		16	2560	6400	3840	13.1	3220	86	28	

Notes:

1. *One watt (thermal) is equivalent to 3.41 Btu/hr.*
2. *Flow rate is based on 18°F.*
3. *Closed cycle is a wet cooling tower, mechanical or natural draft cooling tower with makeup. Makeup rate is based on three cycles of concentration. For a zero discharge plant (i.e., no blowdown), the make water requirement is approximately 70 percent of the flow rates shown.*

These water requirements may be reduced by using higher cycles of concentrations, which depends on the water quality, plant water management, and treatment requirements.

For the supply of potable water, it is anticipated that separate groundwater wells would be used, similar to what is provided at existing INEEL facilities. It may be possible to use an existing potable water supply at the site for the proposed power generation facility.

The plant UHS (ultimate heat sink) could also be a closed system such as a mechanical draft cooling tower with an enclosed storage basin.

- Apply for a Higher Water Use Permit

See the discussion in Section 3.10.

- Use Air-Cooled Condensers for Plant Cooling

Air-cooled condensers provide cooling to the steam cycle of a power plant using large mechanically driven fans. The fans generate sufficient airflow to provide the necessary cooling. For this type of cooling system, a cooling water supply is not required for the steam cycle. However, it is expected that cooling water would still be required for various plant auxiliary systems. Plant auxiliary cooling water requirements, which are significantly less than that required for steam cycle cooling and will vary depending on the reactor type selected, would be met using conventional water-cooled condensers. It is anticipated that the auxiliary cooling water requirement could easily be provided by the existing groundwater well fields without the addition of additional wells or acquiring additional water rights. Potable water and the UHS would be as described previously.

* * *

Based on the above evaluation, a ranking of 3 is assigned for all reactor types and the Bounding Plant.

3.22.2 Evaluation of the Portsmouth Site

The objective of this section is to evaluate the availability of water sources to provide cooling water for new nuclear power facilities at the Portsmouth site. The evaluation is based on the assumption that the existing well fields will be available to supply water to the new plants and that the water supply should not affect the availability of water for existing water users in the Scioto River basin.

The Scioto River basin has a drainage area of 6,517 square miles from its headwater to its confluence with the Ohio River. At the river gauging station at Higby, Ohio, approximately 13 miles north of the Portsmouth site, the mean annual flow for the period 1930-1991 was 4654 cfs. The lowest recorded flow is 244 cfs in October 1930, and the 7-day minimum discharge of record is 255 cfs.

Water use at the Portsmouth site averages 19 cfs and normally comes from groundwater. The four well fields all supply water from the Scioto River alluvium and have a total capacity ranging from 36.4 to 40.2 cfs. A river intake structure is located near the well fields. Water is withdrawn from this intake only when the well systems are unable to produce sufficient water to meet plant demand. It is noted that the groundwater supply at the Portsmouth site has various degrees of contamination (Reference 2).

Several cooling water options are preliminarily evaluated below:

- Wet Cooling Towers with Blowdown to the Scioto River

Based on Table 3-9, if wet cooling towers with blowdown to the Scioto River are used, available water resources would restrict the number of units that could be placed on the site. In addition, blowdown to the river could have a thermal and chemical impact on the river water quality and aquatic habitats.

- Wet Cooling Towers with Zero Discharge

Wet cooling towers with zero discharge and makeup from the well fields at the Scioto River could be considered. The existing well field system would not be adequate for a new power facility, and a new well system, along with a new river intake for backup cooling water, would be necessary. Assuming the new well field system has approximately the same capacity as the existing well field system, the number of units that could be supported and not exceed current water use levels would be limited to the following:

Plant	Water Requirement
1 ABWR Unit	30,000 acre ft/yr (marginal and may require use of the river intake)
1 AP1000 Unit	27,000 acre ft/yr
8 GT-MHR Modules	29,000 acre ft/yr
4 IRIS Modules	31,000 acre ft/yr (marginal and may require use of the river intake)
8 PBMR Modules	22,000 acre ft/yr

These water requirements may be reduced by using higher cycles of concentrations, which depends on the water quality, plant water management, and treatment requirements.

It is anticipated that potable water will be supplied using the existing potable groundwater supply.

The UHS would be a closed system such as a mechanical draft cooling tower with an enclosed storage basin.

- Use Air-Cooled Condensers for Plant Cooling

Air-cooled condensers provide cooling to the steam cycle of a power plant using large mechanically driven fans. The fans generate sufficient airflow to provide the necessary cooling. For this type of cooling system, a cooling water supply is not required for the steam cycle. However, it is expected that cooling water would still be required for various plant auxiliary systems. Plant auxiliary cooling water requirements, which are significantly less than that required for steam cycle cooling and will vary depending on the reactor type selected, would be met using conventional water-cooled condensers. It is anticipated that the auxiliary cooling water requirement could easily be provided by the existing groundwater well fields without the addition of wells or acquiring additional water rights. Potable water and the UHS would be as described previously.

* * *

Based on the above evaluation, a ranking of 2 is assigned for all reactor types and the Bounding Plant.

3.22.3 Evaluation of the Savannah River Site

The objective of this section is to evaluate the availability of surface water sources to provide cooling water for new commercial nuclear power plants at the Savannah River site. Assuming the existing reactors at SRS will not be operational in the future, the addition of new nuclear power generation may not increase the total consumptive water use above what was estimated for SRS—approximately 120 cfs. The evaluation is based on not affecting the availability of water for existing water users along the Savannah River.

Several cooling water options are preliminarily evaluated below:

- Once-Through Cooling Using the Savannah River or Par Pond

A once-through cooling system using water from the Savannah River is not viable since the required flow equals or exceeds the 7-day, 10-year low flow in the river.

An evaluation was also made of using Par Pond as a source for once-through cooling. The estimated plant grade at the preferred site is at elevation 260 ft. The nominal water level in Par Pond is at elevation 200 ft. Thus, water from the plant could flow by gravity and be returned to the plant by pumping under 60 ft of static head plus friction head through approximately 3 miles of large diameter pipes. The approximate capability of Par Pond to dissipate the rejected heat from any one of the reactors was assessed using Reference 3. The assessment showed that the pond could only dissipate an approximate heat load of 5.5×10^9 Btu/hr with an intake temperature rise of at least 4°- 5°F and an intake temperature during the summer in excess of 90°F. This is a small heat load compared to the heat rejected even if one reactor or fewer modules are used. To compensate for evaporation, seepage, and blowdown to control the water chemistry, makeup water would be required. In addition, the Par Pond dam, which was built in 1958, may require a new safety evaluation and possible upgrading or rebuilding to meet NRC requirements (some upgrades were completed in the early 1990s). It is noted that the pumping head from Par Pond to the plant may equal or exceed the pumping head for a cooling tower system. For these reasons, Par Pond cannot be considered as a viable cooling system, regardless of the size of the units or modules used.

- Closed Cycle Cooling with Cooling Towers

A closed cycle cooling system (wet cooling towers, mechanical draft cooling towers, or natural draft cooling towers) could be considered. Makeup water would be taken from the Savannah River with blowdown to control chemistry returned directly to the river or through Par Pond, which discharges into

Lower Three Runs Creek. As shown in Table 3-9, cooling tower consumptive water use for all reactor types (makeup and blowdown) is less than the past consumptive use at SRS of 120 cfs.

Potable water would be provided from the existing well fields or new wells that may have to be installed to ensure reliability. The plant UHS would be a closed system such as a mechanical draft cooling tower with an enclosed storage basin.

Currently, SRS has two main pumping stations at the Savannah River, Stations 681-1G and 681-3G. Both stations have the combined design capability to support 20 horizontal pumps, each with a design capacity of 32,500 gpm for a total pumping capacity of approximately 1300 cfs as shown in Reference 4. Each station pumps the water into an 84-inch pipe that conveys the water to all functions of SRS facilities. The pipelines and the pumping stations were built in the 1950s.

The intake at the Savannah River is situated at the end of a channel approximately 1640 feet long. This channel has been subjected to siltation in the past and was dredged during operation of the SRS facilities. For new power generation facilities, because of the required low flow rate as compared to the design flow for the channel, a higher rate of siltation may be expected in the channel. The channel will act as a settling basin for coarse and medium sediment before it reaches the pump intake. However, fine sediment may have to be managed at the plant through suitable water treatment to remove the sediment, which may affect certain cooling water systems including heat exchangers.

During the May 2002 site visit, it was observed that the channel has an extensive degree of aquatic growth and algae. These could affect the type of screening and potentially the water treatment plant.

Although the existing intake structure can be assessed visually and through testing for its structural integrity, the condition of the piping system is unknown. Since the makeup water requirement is low compared to the design capacity of the each conduit, installation of a new pipe with a smaller diameter would be prudent to ensure the dependability of the water supply to the new plants. The new pipe design size should maintain an adequate velocity to prevent deposition of suspended sediment along the pipe. The estimated pipe length is approximately 16 miles. The existing trash racks, traveling screens, and probably the pumps and valves at the intake structure would require replacement to fit the new pipeline design and flow capacity.

- Use Air-Cooled Condensers for Plant Cooling

Air-cooled condensers provide cooling to the steam cycle of a power plant using large mechanically driven fans. The fans generate sufficient airflow to provide the necessary cooling. For this type of cooling system, a cooling water supply is not required for the steam cycle. However, it is expected that cooling water would still be required for various plant auxiliary systems. Plant auxiliary cooling water requirements, which are significantly less than those required for steam cycle cooling and will vary depending on the reactor type selected, would be met using conventional water-cooled condensers. It is anticipated that this requirement could be provided by the existing cooling water supply system at SRS from the Savannah River or Par Pond. Some modifications and upgrading of the system may be necessary. Potable water and the UHS would be as described previously.

* * *

Based on the above evaluation, it appears that closed cycle cooling with makeup from the Savannah River is the most feasible option. Based on the issues associated with water availability, intake channel sedimentation, and potentially water quality, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.22.4 References

1. Environmental and Other Evaluation of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, US DOE Volume –1, September 1992.

2. USEC, Application for United States Nuclear Regulatory Commission Certification, Volume 1: Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, September 1995.

3. Effect of Geographical Location on Cooling Pond Requirements and Performance, US EPA, Project No. 1613 FDQ, March 1971.

4. Impingement and Entrainment of Fishes at the Savannah River Plant, An NPDES 316 b Demonstration, Du Pont, DP-1494, February 1978.

5. EG&G, NPR Turbine/Dry tower (Air cooled Condenser Conceptual Design Study), August 1990.

6. SRS G-SAR –G-00001 Rev 4.

7. Site Selection for the Accelerator for Production of Tritium at the Savannah River Site, WSRC - TR –96-0279, Rev 1, October, 1996.

3.23 Temperature and Moisture Content

A variety of ambient temperature requirements must be met at potential sites for the design of a power plant. For example, cooling tower and HVAC designs are determined by dry-bulb and wet-bulb temperatures. The winter design dry-bulb temperatures represent those values that are not exceeded 1 percent of the time during the coldest three consecutive months (i.e., standardized as December, January, and February in the contiguous United States). The maximum coincident design dry-bulb and wet-bulb temperatures represent those dry-bulb temperatures that are exceeded 1 percent of the time during the four warmest consecutive months. The mean coincident wet-bulb temperatures are the average of those values that occur coincidentally with the respective 1 percent summer design temperature. The maximum coincident summer design wet-bulb temperatures represent those values that are exceeded 1 percent of the time during the four warmest consecutive months.

3.23.1 Evaluation of the INEEL Site

The maximum temperature at the site never exceeds 110°F based on long-term records (1950-1988) collected at INEEL. A record high of 101°F occurred in July. However, the minimum temperature experienced was lower than -30°F. A record low of –40°F occurred in January and December (Reference 1).

The winter design dry-bulb temperature (1 percent exceed) and summer design wet-bulb temperature (1 percent exceed) noncoincident have never been lower than -10°F or higher than 80°F, respectively. Based on Idaho Falls data (Reference 2), the above values are -1.5°F and 17.1°F, respectively. At Idaho Falls, the maximum temperature for 1 percent exceed, coincident, never goes beyond the range of 100°F dry-bulb and 77°F wet-bulb. Similarly, the maximum temperature for 0 percent exceed, coincident, never goes beyond the range of 115°F dry-bulb and 80°F wet-bulb (Reference 3).

Based on the above evaluation, a ranking of 4.5 is assigned for all reactor types and the Bounding Plant.

3.23.2 Evaluation of the Portsmouth Site

Based on long-term records collected at Columbus, Ohio, the maximum temperature never exceeds 110°F and the minimum temperature is never lower than –30°F. A record high of 102°F occurred in June 1944, and a record low of –22°F occurred in January 1994 (Reference 4).

The winter design dry-bulb temperature (1 percent exceed) and summer design wet-bulb temperature (1% exceed) noncoincident have never been lower than –10°F or higher than 80°F, respectively. Based on the Columbus data (Reference 2), the above values are –4°F and 23.9°F, respectively. At Columbus, the maximum temperature for 1% exceed, coincident, never goes beyond the range of 100°F dry-bulb and 77°F wet-bulb. Similarly, the maximum temperature for 0 percent exceed, coincident, never goes beyond the range of 115°F dry-bulb and 80°F wet-bulb (Reference 3).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.23.3 Evaluation of the Savannah River Site

Based on long-term records collected at Augusta, Georgia, the maximum temperature never exceeds 110°F and the minimum temperature is never lower than –30°F (Reference 4). A record high of 108°F occurred in August 1983. A record high of 107°F that also occurred in August 1983 was measured at the SRS (Reference 5). A record low of –1°F occurred in January 1985 at Augusta (Reference 4), while a record low of –3°F occurred in January 1985 at SRS (Reference 5).

The winter design dry-bulb temperature (1 percent exceed) and summer design wet-bulb temperature (1 percent exceed) noncoincident have never been lower than -10°F or higher than 80°F, respectively. Based on the Augusta data (Reference 2), the above values are 7.7°F and 25.4°F, respectively. At Augusta, the maximum temperature for 1 percent exceed, coincident, never goes beyond the range of 100°F dry-bulb and 77°F wet-bulb. Similarly, the maximum temperature for 0 percent exceed, coincident, never goes beyond the range of 115°F dry-bulb and 80°F wet-bulb (Reference 3).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.23.4 References

1. INEEL, TMI-2 Safety Analysis Report, Rev. 2A, 2001.

2. ASHRAE Fundamental Handbook (SI), 2001.

3. Engineering Weather Data, Department of the Air Force, the Army and the Navy, 2000 Interactive Edition published by the National Climate Data Center.

4. Local Climatological Data, National Climatological Data Center, 1999.

5. G-SAR-G-00001, Rev. 4, 1999

3.24 Winds

The minimum design load for a building depends on the wind conditions experienced. For design basis applications, the basic wind speed, which is defined as the fastest wind speed at 33-foot level for Exposure Category C (open terrain with scattered obstructions having heights generally less than 30 feet) with a 50-year return period (ASCE 7-88, 1990), is required to be adjusted by a value called importance factor. Specific values for importance factors depend on the category of the structure being designed (safety- or nonsafety-related), the corresponding recurrence interval of the design wind speed (e.g., 100-year return for safety-related structures), and the location of the facility.

For nuclear power plant applications, design basis tornado values are specified in Regulatory Guide 1.76.

3.24.1 Evaluation of the INEEL Site

The INEEL site is more than 100 miles from a coastline. Thus, neither hurricanes nor tropical storms occur at the INEEL site (Reference 1). The basic wind speed in the area is about 70 mph (Reference 2). The site is outside of Tornado Region 1 (east of 105 meridian) (Reference 3). The site has no influence from tropical storms due to its relatively high latitude. The annual frequency of gust reports is about 1 per 10,000 square miles in the INEEL area (Reference 4).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.24.2 Evaluation of the Portsmouth Site

The Portsmouth site is more than 100 miles from a coastline. The basic wind speed in the area is about 70 mph (Reference 2). The Portsmouth site is within Tornado Region 1 (east of 105 meridian) (Reference 3). The site is located in a region that has the most continental climate of any part of the U.S. The annual frequency of gust reports is about 8 per 10,000 square miles in the Portsmouth area (Reference 4).

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.24.3 Evaluation of the Savannah River Site

The SRS is within 100 miles of the coast. The basic wind speed in the area is about 75 mph (Reference 2). The site is within Tornado Region 1 (east of 105 meridian) (Reference 3). South Carolina and Georgia are southern Atlantic states with less severe tropical storms. The annual frequency of gust reports is about 8 per 10,000 square miles in the Savannah River area (Reference 4).

Based on the above evaluation, a ranking of 3 is assigned for all reactor types and the Bounding Plant.

3.24.4 References

1. INEEL, TMI-2 Safety Analysis Report, Rev. 2A, 2001.

2. ASCE 7-88, Minimum Design Loads for Buildings and Other Structures, 1990.

3. Regulatory Guide 1.76, Design Basis Tornado for Nuclear Power Plants, U.S. NRC, 1974.

4. Doswell, C. A., Storm Scale Analysis, NOAA Tech Memo. ERL ESG-15, 1985.

3.25 Rainfall

The amount of rainfall can affect the design of a nuclear power plant and the selection of a plant site. Winter PMP can affect the design of structures if this rain is in the form of snow. Regulatory Guide 1.70 (Reference 1) and ANS/ANSI-2.8-1992 (Reference 2) discuss the requirements for site drainage and analysis so that safety-related structures are not flooded or affected by the imposed loads.

3.25.1 Evaluation of the INEEL Site

The PMPs estimated within 10 square miles during July-September (high precipitation months) for averaging time periods of 6 hours, 24 hours, and 72 hours are lower than 20, 24, and 28 inches, respectively (Reference 3). These values are in the low range based on the PMP patterns developed for the entire United States. Additionally, the INEEL flood diversion facilities include a diversion dam, dikes, and spreading areas. The flood diversion facilities were constructed in 1958 and expanded in 1984 to reduce the threat of flood on the INEEL site from the Big Lost River (Reference 4).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.25.2 Evaluation of the Portsmouth Site

The PMPs estimated within 10 square miles during July-September (high precipitation months) for averaging time periods of 6 hours, 24 hours, and 72 hours are 27.5, 35, and 40 inches, respectively (Reference 3). These values are in the middle range based on the PMP patterns developed for the entire United States. The highest flood level of the Scioto River in the vicinity was 570.9 ft above mean sea level and occurred in January 1913. Plant site elevation is approximately 670 ft above mean sea level (Reference 5). Therefore, the Scioto River poses insignificant flood threat to the plant site.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.25.3 Evaluation of the Savannah River Site

The PMPs estimated within 10 square miles during July-September (high precipitation months) for averaging time periods of 6 hours, 24 hours, and 72 hours are 31, 43, and 50 inches, respectively (Reference 3). These values are in the high range based on the PMP patterns developed for the entire United States. Although the PMP is high, there are well-draining soils and adequate topographic relief to allow drainage with minor guidance. No waterway diversion could flood the site because the site is much higher than the surrounding streams and rivers (Reference 6).

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.25.4 References

1. Regulatory Guide 1.70, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, Nuclear Regulatory Commission, November 1978.

2. ANS/ANSI-2.8-1992, Determining Design Basis Flooding of Power Reactor Sites, American Nuclear Society, 1992.

3. NUREG/CR-1486, Seasonal variation of 10-Square-Mile Probable Maximum Precipitation Estimates – United States East of the 105th Meridian, Hydrometeorological Report No. 53, 1980.

4. INEEL, TMI-2 Safety Analysis Report, Rev. 2A, 2001.

5. ERDA-1549, Portsmouth Gaseous Diffusion Plant Expansion, Final Environmental Statement, 1977.

6. G-SAR-G-00001, Rev. 4, Savannah River Site Generic Safety Analysis Report, 1999.

3.26 Snow

Snow accumulation on building roofs can increase the design load and, when combined with winter PMP in the form of snow, can further increase the design loads for safety-related structures. Snow on the plant site can block drainage canals, which could cause water to enter into safety-related buildings. Regulatory Guides 1.70 and 1.70.17 address the requirements for analyzing snow conditions at nuclear power plant sites.

3.26.1 Evaluation of the INEEL Site

The average annual snowfall at the INEEL site is 27.6 inches and the maximum annual snowfall is 59.7 inches. The greatest 24-hour total snowfall was 8.6 inches, while the greatest snow depth on the ground was 27 inches (Reference 1).

Based on the above evaluation, a ranking of 2 is assigned for all reactor types and the Bounding Plant.

3.26.2 Evaluation of the Portsmouth Site

The average annual snowfall at the Portsmouth site is 20.4 inches and the maximum monthly based on records at three nearby stations ranges from 28.4 inches to 39.5 inches. January has the highest amount of snowfall; the monthly average is 8.6 inches. Measurements taken at Waverly indicated the highest average monthly snowfall was 5.5 inches, which occurred in January 1948 (Reference 3). Since Waverly is closer to the site, it is expected that the snowfall at the site would be smaller than that collected at Columbus.

Based on the above evaluation, a ranking of 3 is assigned for all reactor types and the Bounding Plant.

3.26.3 Evaluation of the Savannah River Site

Based on 48 years of observations made in Augusta, Georgia, the average annual snowfall is 1.1 inches (Reference 2). February has the highest amount of snowfall, but the monthly average is only 0.7 inches. The region has minor snowfall.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

3.26.4 References

1. INEEL, TMI-2 Safety Analysis Report, Rev. 2A, 2001.

2. Local Climatological Data, National Oceanic and Atmospheric Administration, 1999.

3. ERDA-1549, Portsmouth Gaseous Diffusion Plant Expansion, Final Environmental Statement, 1977.

3.27 Atmospheric Dispersion

Estimates of the atmospheric dispersion factor (X/Q) at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) for averaging times up to 30 days after an accident are required to estimate offsite doses. Realistic estimates of annual average atmospheric transport and diffusion characteristics to a distance of 50 miles from the plant are also required.

These X/Q estimates are site-specific depending on surrounding terrain features and are functions of the onsite meteorological conditions and the separation distances between the releases and the receptors.

3.27.1 Evaluation of the INEEL Site

The INEEL site is situated in a broad, mostly flat plain averaging 4865 feet above MSL. The local northeast-southwest orientation of the Eastern Snake River Plain and bordering mountain ranges tend to channel the prevailing west winds so that a southwest wind predominates over the INEEL site; the second most frequent winds come from the northeast. The relatively dry air and infrequent low clouds permit intense solar heating of the surface during the day and rapid radiation cooling at night. The preferred site is in a flat-lying area near the Big Lost River in the south central part of the INEEL site.

These factors combine to give a large diurnal range of temperature near the ground (Reference 1).

The shortest distance from the preferred site to the exclusion area boundary is more than 8 miles. Atmospheric stability classifications are not published in the readily available literature. However, the INEEL site is not expected to subject to significant conditions of stable conditions with low wind speeds.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.27.2 Evaluation of the Portsmouth Site

The Portsmouth site is generally in a rural area in south central Ohio, and was previously farmland and the watershed for several intermittent streams. South central Ohio lies in the steep to gentle rolling Appalachian foothills. The elevation of the Portsmouth site is about 120 ft above the Scioto River flood plain (Reference 2).

Although the preferred site is in the northeast corner of the site, due to its relatively large size, the shortest distance to the exclusion area boundary is expected to be greater than 0.4 miles. The combined frequency of E (slightly stable) and F (stable) atmospheric conditions is 9.4 percent (Reference 2).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.27.3 Evaluation of the Savannah River Site

There is no strong prevailing wind direction; however, there is a relatively high frequency of winds from the northeast during the late summer and early-to-mid fall and from the south through northwest from late fall through spring. Except for the Savannah River, no unusual topographic features significantly affect the general climate (Reference 3).

The shortest distance from the preferred site to the exclusion area boundary is more than 6 miles. Based on meteorological data collected at the H-Area, the closest meteorological tower to the preferred site, the records indicate that the combined frequency for E and F stabilities is 18.7 percent (Reference 4).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

3.27.4 References

1. INEEL, TMI-2 Safety Analysis Report, Rev. 2A, 2001

2. Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, 2002.

3. WSRC-TR-2000-00328, Savannah River Site Environmental Report for 2000.

4. G-SAR-G-00001, Rev. 4, Savannah River Site Generic Safety Analysis Report, 1999.

4. Environmental Criteria

4.1 Terrestrial Habitat

The purpose of this section is to assess site suitability regarding the potential adverse impacts on populations of important terrestrial species or ecological systems in the site areas being evaluated.

The criteria being evaluated are:

- Adjacent to existing major facilities
- Displacing importing living resources in the area
- Adjacent to Class I and/or high value wetlands
- Breeding and nursing grounds
- Nesting, feeding, or migrating areas
- Having known threatened/endangered/protected species or regionally important species
- Having known commercially valuable terrestrial species

4.1.1 Evaluation of the INEEL Site

The TMI-2 ISFSI Environmental Report (Reference 1) and Safety Analysis Report (Reference 2) provide useful information related to the terrestrial habitat on the INEEL site.

The eastern Snake River Plain on which INEEL is situated is classified as a high desert ecosystem. Cattle and sheep grazing are allowed outside the general area of the INEEL facilities. The INEEL facilities are in a large area that stretches from the southwest to the northeast through the center of the INEEL site. There is a restriction that grazing cannot be closer than two miles to any nuclear facility. The ISFSI ER states that the vegetation on the INEEL site is not unique, but is typical of the shrub-steppe vegetation found throughout the general area.

The Big Lost River crosses into the southwest section of INEEL from the mountains to the west. The riverbed passes close to the INEEL facilities. However, water seldom flows in this part of the river because the area is so arid and because the river water is diverted upstream for irrigation purposes in the nearby hills. There are extended periods, sometimes lasting for years, when no water flows onto the INEEL site. When there is flowing water in the riverbed on the INEEL site, it is usually due to flooding caused by rapid snowmelt in the mountains. That is, except for the immediate area about the riverbed, the Big Lost River does not create a major change in vegetation on the INEEL site that would pose issues about possible destruction of unique habitat should a new nuclear power facility be constructed.

Although there are two federally listed endangered and threatened species (bald eagle and gray wolf) potentially occurring on the INEEL site, neither has ever been observed near any of the INEEL facilities. No federal or state-listed plant species has been identified as potentially occurring on the INEEL site.

There are scattered man-made "ponds," potential wetlands, and intermittent waters (Big Lost River) that occur near the onsite facilities and that are sources of water for the wildlife that inhabit the area. However, these areas are mostly away from the site proposed for the power plant and should not be affected by construction or operation of the power plant. If the selected site for the proposed power plant does include, or is in proximity to, a wetland, then measures will have to be taken to avoid adverse impacts. Any wetland in a high desert area is considered important.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant. The new nuclear facility would not displace or disrupt important living resources. There are no breeding or nursing grounds or commercially valuable resources on site, nor will the site be adjacent to Class 1 and high value wetlands. There are no nesting, feeding, or migrating areas that would be affected. Although there are two federally listed endangered and threatened species (bald eagle and gray wolf) potentially occurring on the INEEL site, neither has ever been observed near any of the INEEL facilities.

4.1.2 Evaluation of the Portsmouth Site

Much of the Portsmouth site is covered by the structures comprising the gaseous diffusion plant. Furthermore, many of these structures are contaminated and much of the built-up area of the Portsmouth site has underground plumes of contamination or has contaminated soil or surface waters. Some structures have had remediation of the contamination performed. Many will not be remediated until the facility is decommissioned.

The proposed location of the nuclear power plant is in the northeast section of the site in a 340-acre area where no prior industrial activities have occurred. This area is upslope from the industrialized area, so the likelihood of surface or subsurface contamination from prior activities on the site is low. DOE had a site evaluation performed for the 340 acres, which demonstrated that this acreage has been relatively unaffected by contamination from the industrialized area of the Portsmouth site. The Portsmouth landfill, which has undergone remediation, is situated along the western boundary of the proposed 340-acre area. To date, there is no indication that any contamination from this landfill has migrated onto the proposed power plant site.

The hilly, forested areas of the 340-acre site were harvested for timber before the Portsmouth facilities were established. The vegetation recorded for the flatter area of the 340-acre site consists mainly of old fields and managed grasslands that are not considered unique habitat or environmentally sensitive areas. Little Beaver Creek runs through the southwestern part of the 340-acre area and is identified as having riparian forest along its banks according to the Environmental Assessment that has been completed for the Portsmouth site. Oak-hickory forest borders the riparian forest.

There is one federally listed endangered species and one proposed species that potentially could be found on the site, the Indiana bat and the timber rattlesnake, respectively. Habitat for the timber rattlesnake would be "high, dry ridges" during the winter. Possibly, the hilly, forested areas of the site could have habitat for the timber rattlesnake. The timber rattlesnake was not recorded during any of the field studies performed for the Portsmouth site. The Little Beaver Creek stream corridor has been identified as a potential habitat for the Indiana bat. The Indiana bat has been recorded in the northwest part of the Portsmouth site; however, none were found along the Little Beaver Creek stream corridor. Although neither of these species has actually been observed in the area of the proposed new commercial nuclear power facility, DOE has indicated that the transfer of the 340-acre site will include requirements for extensive studies and mitigation measures that must be implemented to protect potential habitat, if any, for these two species during construction and operation of any facility that is proposed for this site.

Based on the above evaluation, a ranking of 3 is assigned for all reactor types and the Bounding Plant. The new nuclear station would not displace or disrupt important living resources. There are no breeding or nursing grounds or commercially valuable resources on site, nor will the site be adjacent to Class 1 and high value wetlands. There are no nesting, feeding, or migrating areas that would be impacted. Field studies have identified potential habitat along the riparian area of the Little Beaver Creek for the federally endangered Indiana bat; this potential habitat borders the southern part of the 340-acre site. Although DOE will require extensive studies and possible mitigation measures with regard to this species as part of the transfer of the site, it is likely that the U.S. Fish & Wildlife Service would be involved in a biological assessment for the site if the site were selected for construction of a new nuclear power facility.

4.1.3 Evaluation of the Savannah River Site

The area of the Savannah River site being considered for this nuclear power plant is the preferred site for the proposed Accelerator Production of Tritium (APT) facility. The draft and final Environmental Impact Statements (EISs) for the APT site were reviewed, as were available reports on comprehensive environmental studies of the entire SRS that have been conducted over the years for DOE, in order to understand the status of the existing local terrestrial environment. Additionally, a site visit on May 14 and 15, 2002 provided an opportunity to view the site in the context of the entire SRS complex of facilities.

Before the federal government took over the site, the SRS was mainly farmland that had been highly eroded. Approximately 90 percent of the SRS has been planted with loblolly, slash pine, and hardwood trees. The proposed site is within the approximately 250 acres of the preferred APT site, which consists of mostly wooded land, predominantly loblolly and slash pine that have been planted since the late 1950s. The site is part of a designated forest timber unit under the SRS land use system. The Savannah River Institute (formerly known as the Savannah River Forest Station) will coordinate the removal and sale of marketable timber from the site. There are no wetlands on the site.

According to the draft EIS for the APT facility (Reference 10), one of the criteria for selection of the preferred and alternate APT sites was that the sites not be considered unique ecological habitats based on the environmental studies of the SRS. Since the draft EIS for the APT facility was prepared in 1997, there have been no major activities that have occurred at the preferred site. The ecological studies of the SRS in 1997 and 2000 did not indicate any changes in the terrestrial ecology of the area of the preferred APT site. Therefore, it can be concluded that per the EIS criteria for selection of the preferred and alternative APT sites the proposed power plant site would not be considered a unique ecological habitat.

There are federal and state listed rare, threatened, and endangered species that have been seen within the SRS, including the bald eagle, wood stork, and red-cockaded woodpecker. However, none have been recorded in the immediate vicinity of the proposed power plant site nor have any nests been observed in the general area of the site. The smooth purple coneflower is the only federally listed endangered plant species that occurs within the SRS, but this is not found in the immediate vicinity of the site.

The red-cockaded woodpecker nests in pine forests with mature trees (older than 70 years) and forages in pine forests with trees older than 30 years. No foraging red-cockaded woodpeckers have been observed on the proposed site, although many of the pines are older than 30 years. Furthermore, although some of the trees on site were planted in the early to mid-1950s and, therefore, are approaching the age preferred for nesting by the woodpecker, no nests have been observed on the proposed site.

The nearest sightings of bald eagles and bald eagle nests have been around the Par Pond system. Par Pond is about 3 miles south of the preferred site and, therefore, bald eagles attracted to this pond should not be adversely affected by the construction or operation of the proposed power plant.

The routings of the linear facilities associated with the proposed new nuclear power facility (e.g., water and wastewater pipelines, transmission line) are not known at this time. Once these are known, a review of previous study results and, possibly, a field study will have to be conducted to determine if the linear facilities would impact unique ecological habitat within the SRS and, if so, whether there would be any significant adverse impacts on such areas during construction of the linear facilities.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant. The new nuclear power facility would not displace or disrupt important living resources. There are no breeding or nursing grounds or commercially valuable resources on site, nor will the site be adjacent to Class 1 and high value wetlands. There are no nesting, feeding, or migrating areas that would be affected. Although there are federally listed endangered and threatened species (bald eagle and red cockaded woodpecker) that have been seen on the SRS, none have been observed within 2 miles of the proposed power plant site. Since the cooling tower blowdown will be discharged via pipeline into the Savannah River, the Par Pond area where foraging eagles have been observed should not be impacted by operation of the new power plant as it is more than 2 miles from the proposed site.

4.1.4 References

1. US DOE Environmental Report – Independent Spent Fuel Storage Installation (ISFSI) License for the Three Mile Island Unit Two (TMI-2) Fuel.

2. Safety Analysis Report (SAR) INEEL TMI-2-SAR Revision 2 and 2A, 2/12/01- 10/30/01.

3. Evaluation of Site Conditions for 340 Acres of Department of Energy Land, Northeast Portion of the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio DOE/OR/11-3082&D3, January 2002.

4. U.S. Department of Energy Portsmouth Annual Environmental Report for 2000, Piketon, Ohio DOE/OR/11-3077&D1, December 2001.

5. Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant Piketon, Ohio DOE/EA-1346, February 2002.

6. Portsmouth Local Geography/Geology Presentation Site Visit May 5, 2002.

7. Draft Finding of No Significant Impact for the Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant (Rev 1), U.S. DOE February 2002.

8. Mitigation Action Plan Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant Piketon, OH, Rev 1, February 2002.

9. SRS Ecology Environmental Information Document, WSRC-TR-97-0223.

10. Draft Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site, DOE/EIS-0270D December 1997.

11. Final Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site, DOE/EIS-0270, March 1999.

12. Savannah River Site Environmental Report for 2000. WSRC-TR-2000-00328.

4.2 Terrestrial Vegetation

This section evaluates site suitability regarding potential impacts on local terrestrial ecology during plant construction and operation.

Local terrestrial vegetation could be displaced or disrupted by various activities conducted at a nuclear power plant site. Two factors that determine construction impact on terrestrial ecology are the ecological value and acreage of each ground cover type covering the site. If cooling towers are used as a heat dissipation system, cooling tower drift impacts on surrounding areas are of importance.

The criteria being evaluated are:

- Displacing or disturbing important regional species
- Area or site in a predominant woodland area or grass pastures
- Area with significant amount of wetlands

- Area with known endangered/protected species or important regional species
- Proximity to park and forests
- Adjacent to agricultural lands
- Area with relatively small number of common plant communities
- Proximity to mature or uncommon plant communities
- Vegetation in the area sensitive to cooling tower drifts and salt depositions (i.e., impact on native plants, crops, orchards, etc.)

4.2.1 Evaluation of the INEEL Site

The INEEL site of approximately 890 square miles is predominantly flat high desert. There are some naturally occurring wetlands near the facilities in the southwest part of the INEEL site, although the majority of the wetlands in this area are man-made. The two rivers that flow off the surrounding mountains to the west have intermittent flows on site. Despite the intermittent nature of the flow, there is riparian vegetation, including some trees, that is established along the banks of the Big Lost River on site. Otherwise, the vegetation on site is what is typically found in high desert terrain. The lands surrounding INEEL have the same type of high desert vegetation as is found on site.

Construction of a new nuclear power facility will result in the removal of existing vegetation. Onsite facilities in the southwest part of the INEEL site are close to the Big Lost River riverbed. However, the proposed site is east of the existing facilities and of the riverbed by about a mile, in which case, only the construction of linear facilities might potentially encroach upon any wetland associated with this riverbed.

The routing of transmission lines for a new power facility is not yet known. The ecology of the area along the lines will have to be studied to ensure that no sensitive environmental areas will be adversely impacted during construction and operation of the facility.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant. Construction and operation of a new nuclear power facility should not displace or disturb important regional species. There is no significant amount of wetlands in the immediate area of the site, and, although the entire INEEL site has been designated as potential habitat for the bald eagle and gray wolf, none have ever been seen in the immediate area of the INEEL facilities. The vegetation in the immediate area of the site is common to the entire INEEL site so the construction and operation of the power plant should have no significant impacts on the terrestrial vegetation of the area. Because it is anticipated that air-cooled condensers will be used for cooling purposes at the power plant, no impact from operating the cooling system should occur to the local vegetation.

4.2.2 Evaluation of the Portsmouth Site

The Portsmouth site of 3714 acres, of which approximately 1000 acres is taken up by the gaseous diffusion plant, is hilly to the east. In the 340-acre northeast section of land that is being considered in this study, the eastern area has steep forested slopes, while the central and western area has fairly flat areas of grassland. The Little Beaver Creek has riparian vegetation. The entire 340 acres has been relatively undisturbed, except for two borrow areas, since the federal government took over the site in the 1950s.

Construction of a new nuclear power facility will have to be performed in a manner that does not adversely impact the Little Beaver Creek and the riparian vegetation. If studies show that the hilly, forested area on the eastern side of the property is potentially habitat for the timber rattlesnake, there will be restrictions on how close to this area construction can occur.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant. Construction and operation of a new nuclear power facility should not displace or disturb important regional species. There is no significant amount of wetlands in the immediate area of the site and there are no threatened, endangered, or important regional plant species. Additionally, the proposed site is not proximate to mature or uncommon plant communities. It is unlikely that any vegetation in the immediate area of the cooling tower will be sensitive to cooling tower drift and salt deposition, although this will have to be studied further.

4.2.3 Evaluation of the Savannah River Site

The Savannah River site of approximately 310 square miles consists of uplands that gradually slope down to the Savannah River. A series of six streams and their tributaries drain the site, five of which discharge to the river via the swamp system that borders the Savannah River. Due to the release of large amounts of cooling water from the various reactors and other facilities that operated on the SRS through the early 1980s, scouring of the creeks and streambeds resulted in the formation of deltas where the streams entered the swamp. Although the vegetation of the site around these streams was drastically changed due to the high temperatures and high flows of these cooling water releases, native vegetation has been recovering along the streams, however, not necessarily in the same species distribution as before the releases. The lands surrounding the SRS are predominantly rural and agricultural.

Vegetation at the preferred site is predominantly pine and hardwood forests. Construction of the power plant will result in the harvesting of the trees for sale since the site is part of a designated timber unit. Installation of the linear facilities will result in at least temporary impacts to the vegetation along the right-of-way. Although the right-of-way for these linear facilities are not yet known, it is anticipated that a study will be performed to identify alternatives that have the lowest impacts to any unique ecological area that might exist between the site and the end-point of the linear facility. The preferred site is about three miles from the nearest wetland, the Par Pond system. It is expected that any cooling tower drift will be designed to have minimal impacts on this and other wetlands in the areas about the site. However, this will have to be studied, especially with respect to the environmentally sensitive area that has been identified near the junction of Tinker Creek and Upper Three Runs.

This is in the area where the only federally listed endangered plant species on the SRS, the smooth purple coneflower plant, exists.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant. Construction and operation of a new nuclear power facility should not displace or disturb important regional species. Although there are significant amounts of wetlands 2 to 4 miles from the site, there are none in the immediate area of the site. The closest area of endangered plant species is on the other side of Tinker Creek about a mile from the site, where some smooth purple coneflower plants have been identified. It is unlikely that the cooling tower drift or salt deposition will adversely impact these plants, but that will have to be verified as part of the permitting process.

4.2.4 References

1. US DOE Environmental Report – Independent Spent Fuel Storage Installation (ISFSI) License for the Three Mile Island Unit Two (TMI-2) Fuel.

2. Safety Analysis Report (SAR) INEEL TMI-2-SAR Revision 2 and 2A, 2/12/01- 10/30/01.

3. Evaluation of Site Conditions for 340 Acres of Department of Energy Land, Northeast Portion of the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio DOE/OR/11-3082&D3, January 2002.

4. U.S. Department of Energy Portsmouth Annual Environmental Report for 2000, Piketon, Ohio DOE/OR/11-3077&D1, December 2001.

5. Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant Piketon, Ohio DOE/EA-1346, February 2002.

6. Portsmouth Local Geography/Geology Presentation Site Visit, May 5, 2002.

7. Draft Finding of No Significant Impact for the Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant (Rev 1), U.S. DOE February 2002.

8. Mitigation Action Plan Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant Piketon, OH, Rev 1, February 2002.

9. SRS Ecology Environmental Information Document, WSRC-TR-97-0223.

10. Draft Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site, DOE/EIS-0270D December 1997.

11. Final Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site, DOE/EIS-0270, March 1999.

12. Savannah River Site Environmental Report for 2000. WSRC-TR-2000-00328.

4.3 Aquatic Habitat / Organisms

During plant construction, potential impacts to aquatic resources may occur as a result of activities such as dredging in a wetland or water body, installing temporary or permanent roads over streams, and related operations, which disturb bottom sediments and possibly change the characteristics of the water flows. If the sediment is already contaminated from prior operations in the area of the site, there would be a concern that such contaminated sediment would be re-entrained into the water body and result in additional impacts on aquatic and terrestrial wildlife, and, through them, might affect human health.

The main operational impact of an operating power plant is related to the discharge of effluent to a body of water.

The criteria being evaluated are:

- Collocated or adjacent to an existing major facility
- Water bodies with known important regional aquatic species
- Areas with known threatened or endangered species
- Water bodies with spawning areas or along migrating routes for important species
- Areas with known commercially or recreationally valuable species
- Water bodies with species sensitive to thermal discharges

4.3.1 Evaluation of the INEEL Site

Construction of a new nuclear power facility will include a number of activities that could result in adverse impacts to any wetlands that are nearby. However, using best management practices and careful planning, these can be avoided.

The INEEL site is situated in a high desert area. Groundwater is used exclusively at the INEEL facilities. It is currently anticipated that air-cooled condensers will be used for cooling purposes. There will be other effluent streams but these will be minor sources and will not be discharged so that they affect any nearby wetland. Therefore, it is not anticipated that the construction, operation, or eventual decommissioning of a new commercial nuclear power facility will affect any aquatic habitats or organisms.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant. Plant. Given the lack of bodies of water, there are no known important regional aquatic organisms, threatened or endangered aquatic species, spawning areas or migrating routes for aquatic species nor commercially or recreationally valuable aquatic species in the vicinity of the power plant.

4.3.2 Evaluation of the Portsmouth Site

The only wetland identified on the 340-acre site is Little Beaver Creek. Because the riparian vegetation associated with this creek is considered potential habitat for the endangered Indiana bat, the control measures required to avoid impacts should also serve to avoid aquatic habitat impacts during both construction and operation.

The potential exists to discharge cooling tower blowdown to the Scioto River through a pipeline. The discharge will require a wastewater discharge permit that will stipulate limitations on the chemical and thermal content of the discharge. These limitations are supposed to address the need to avoid adverse impact to aquatic ecology of the body of water that will receive this discharge. The need to install a pipeline for this purpose may result in the need to cross streams or to traverse environmentally sensitive areas. An ecological survey will have to be performed to identify the potential for traversing such areas and to recommend steps to take to avoid or minimize such impacts in order to receive approval of the regulatory agencies to install the pipeline.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant. There are no known important regional aquatic organisms, threatened or endangered aquatic species, spawning areas or migrating routes for aquatic species, nor commercially or recreationally valuable aquatic species in the immediate vicinity of the power plant.

4.3.3 Evaluation of the Savannah River Site

Construction of a new nuclear power facility will likely include the need to cross existing streams with pipelines or temporary access roads. The SRS will not allow activities that result in the contamination of the Upper Three Runs or its tributaries (e.g., Tinker Creek). For other streams, which may already be contaminated, permits and approvals will have to be obtained before linear facilities can be installed. Additionally, it will be necessary to demonstrate that the route selected for a linear facility will not adversely affect threatened or endangered species.

The Savannah River will be the receiving body of water for cooling tower blowdown that will be discharged by pipeline from the power plant. The wastewater discharge permit that will have to be obtained for this discharge will set effluent limits that will serve to protect any recreational, or any threatened and endangered, species known to be found in this section of the river. Because most of the other major sources of wastewater discharges that once operated on site have been shut down, issues associated with cumulative impacts will not arise. A salt-drift analysis for the cooling tower will have to be performed to assess the likelihood that the wetlands on the SRS will be adversely affected. Because the nearest wetlands are about three miles away, it is unlikely that any significant impact will be predicted. This salt-drift analysis will also have to assess the likelihood that any threatened or endangered species that forage or nest in the SRS will be adversely affected by the salt drift.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant. There are no known important regional aquatic organisms, threatened or endangered aquatic species, spawning areas or migrating routes for aquatic species, nor commercially or recreationally valuable aquatic species in the immediate vicinity of the power plant.

4.3.4 References

1. US DOE Environmental Report – Independent Spent Fuel Storage Installation (ISFSI) License for the Three Mile Island Unit Two (TMI-2) Fuel.

2. Evaluation of Site Conditions for 340 Acres of Department of Energy Land, Northeast Portion of the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio DOE/OR/11-3082&D3, January 2002.

3. SRS Ecology Environmental Information Document, WSRC-TR-97-0223.

4. Draft Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site, DOE/EIS-0270D December 1997.

5. Final Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site, DOE/EIS-0270, March 1999.

6. Savannah River Site Environmental Report for 2000. WSRC-TR-2000-00328.

4.4 Groundwater

The primary objective of this section is to evaluate the potential environmental impacts that might result from onsite groundwater withdrawal necessary to supply cooling, service, or potable water; to reduce groundwater-induced hydrostatic loadings; or to prevent groundwater seepage into reactor facilities located below the water table. Onsite groundwater withdrawal could potentially reduce the well yields for adjacent groundwater users, induce saltwater intrusion and degrade the water quality of adjacent users, induce land subsidence, or negatively impact the water balance for onsite or adjacent wetland areas.

A secondary objective of this section is to evaluate the site relative to groundwater-related accident effects. Accidental releases of radiologically contaminated liquids to aquifers that are or may be used by large populations for domestic, municipal, industrial, or irrigation water supplies provide potential pathways for the transport of radioactive material to humans in the event of an accident. The presence and characteristics of any such aquifers must be evaluated to assess site suitability.

4.4.1 Evaluation of the INEEL Site

The depths to groundwater, aquifer transmissive characteristics, and water quality have been identified as the parameters necessary to evaluate groundwater-related environmental impacts. The groundwater table depth and aquifer transmissivity for the INEEL site are discussed in Section 3.19. Based on this discussion, it is concluded that the groundwater table is deep (between 100 and 500 ft below ground surface), and the aquifer transmissivity is high (an average of 5×10^6 gpd/ft).

The Snake River Plain aquifer at the INEEL site, one of the largest and most productive groundwater resources in the United States, is listed as a Class I aquifer, and has been designated a sole-source aquifer by the U.S. EPA (Reference 1). Water from the aquifer provides nearly all of the drinking water consumed in the eastern portion of the Snake River Plain and water for over one-third of the irrigated acres within the Snake River Plain. The aquifer water is low in dissolved solids and is satisfactory for most uses without treatment.

Contaminant plumes resulting from disposal operations at the INEEL site have been detected in both perched groundwater zones and the Snake River Plain aquifer (Reference 2). Contamination of the Snake River Plain aquifer is the result of prior operation of an injection well at the Idaho Chemical Processing Plant. Low-level radioactive and chemical wastes were injected into the aquifer through this 590-ft deep well from 1953 until 1984. The well was available for disposal in emergencies from 1984 to 1986. The operation of unlined disposal ponds has resulted in the introduction of contaminants into localized areas of perched groundwater zones above the Snake River Plain aquifer. None of these contaminant plumes is reported to be near the preferred plant site.

Based on the issues associated with groundwater-related environmental impacts, a ranking of 3 is assigned for all reactor types and the Bounding Plant. This ranking reflects an average of the various components that comprise the ranking criterion. The depth to the Snake River Plain aquifer is likely to preclude any degradation impacts due to the accidental release of radionuclides at the ground surface. However, the freshwater nature of the aquifer and its use as a major source of drinking and irrigation water supply for the area make it susceptible to any impacts generated by the proposed plant. Although the aquifer contains an abundant supply of water, its availability for proposed plant cooling water and other service/process water purposes will be dependent on the demonstration of minimal impacts on the water source and the ability to obtain the relevant permits from the appropriate regulatory agencies. The potential for the presence of perched groundwater zones beneath the preferred site will need to be addressed but any such zones are unlikely to be significantly impacted by the proposed plant and are unlikely to represent a resource for it. The potential for additional groundwater resources below the Snake River Plain aquifer has not been investigated for the purposes of this evaluation effort because of time constraints and limited available reference material.

4.4.2 Evaluation of the Portsmouth Site

The groundwater table depth and transmissive characteristics of the aquifers beneath the Portsmouth site are discussed in Section 3.19. Based on this discussion, it is concluded that the depth to the groundwater table is shallow (between 10 and 50 ft below ground surface), and the hydraulic conductivity of the unconsolidated sediments (Gallia) aquifer is moderate (a mean of 1.2×10^{-3} cm/sec). Well yields in this aquifer are on the order of 10 to 100 gpm.

Groundwater quality at the Portsmouth site has been degraded in some areas by chemical contamination from previous site operations. However, groundwater areas not subject to contamination are used locally for primarily domestic and agricultural purposes (Reference 3). Laboratory analyses of groundwater considered to be representative of the ambient quality of water contained in the unconsolidated sediments (Gallia aquifer) and the Berea sandstone exhibited total dissolved solids of less than 1000 milligrams per liter, indicating that this water can be considered “fresh” and, therefore, acceptable for drinking and agricultural use.

Based on the issues associated with groundwater-related environmental effects, a ranking of 2 is assigned for all reactor types and the Bounding Plant. This ranking reflects an average of the various components that comprise the ranking criterion. The fresh-water nature of the aquifers and their use as a source of drinking and agricultural water supply in the area make them potentially susceptible to impacts generated by the proposed plant. However, the location of the preferred plant site within the boundary of the Portsmouth site affords some degree of isolation from surrounding offsite groundwater users.

Groundwater from the Scioto River glacial outwash aquifer, about 2.5 miles west of the site, may provide a source of water for the proposed plant. This aquifer is one of the principal aquifers in Ohio and is directly connected to flow in the Scioto River (Reference 3). However, the aquifer is a major source of water supply for individuals, towns, industries, and agriculture situated along the river. Therefore, the impact of any withdrawal by the proposed plant on existing users and development plans would need to be adequately determined. Additional investigation would need to be performed to determine the viability of this aquifer as a source of water for the proposed plant from both a productivity and regulatory standpoint. The potential for additional groundwater resources in the deeper rock strata at the Portsmouth site has not been investigated for this evaluation effort because of time constraints and limited available reference material. Reference 3 indicates that use of these deeper aquifers in the site area is limited and provides no discussion of them.

4.4.3 Evaluation of the Savannah River Site

The groundwater table depth and transmissive characteristics of the aquifers beneath the Savannah River site are discussed in Section 3.19. Based on this discussion, it is concluded that the depth to the groundwater table is shallow to moderate (between 10 and 100 ft below ground surface), and the hydraulic conductivity of the uppermost aquifers (Aquifers 3 and 4) is moderate (an average of 3×10^{-2} and 2.5×10^{-3} cm/sec, respectively). Well yields in these two aquifers are on the order of 300 gpm or less.

Groundwater quality in parts of Aquifers 3 and 4 near the preferred site has been significantly degraded due to the infiltration of radioactive and chemical contaminants from previous site operations (Reference 2). Aquifer 1, on the other hand, has not been shown to be degraded by site operations. Groundwater beneath the preferred site is reportedly expected to be uncontaminated due to local flow patterns and the fact that the site has not been used previously for waste disposal. Laboratory analyses of groundwater samples from wells at the Savannah River site indicate that chloride concentrations are within drinking water limits, suggesting that the water can be considered as “fresh” (total dissolved solids less than 1000 milligrams per liter) and suitable for drinking or irrigation purposes. In fact, groundwater from Aquifers 3 and 4 is used for municipal, industrial, and agricultural purposes in the site area.

Based on the issues associated with groundwater-related environmental effects, a ranking of 2 is assigned for all reactor types and the Bounding Plant. This ranking reflects an average of the various components that comprise the ranking criterion. The fresh-water nature of the aquifers and their use as a source of drinking and irrigation water supply in the area make them potentially susceptible to impacts generated by the proposed commercial nuclear power facility. However, the location of the preferred site near the center of the Savannah River site will help to isolate it from offsite groundwater users. Environmental impacts from pumping or accidental releases of radionuclides into the groundwater are expected to be minimal and maintained within the Savannah River site. The potential for the presence of perched groundwater zones beneath the preferred site will need to be addressed but any impact on these zones by the proposed plant are unlikely to be of significance.

4.4.4 References

1. INEEL, Safety Analysis Report for TMI-2 ISFSI, October 2001.

2. U.S. Department of Energy, Environmental and Other Evaluations of Alternatives for Siting, Construction, and Operating New Production Reactor Capacity, Office of New Production Reactors, September 1992.

3. Bechtel Jacobs Company, LLC, Safety Analysis Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, Environmental Management & Enrichment Facilities Management and Integration Contract, August 1998.

4.5 Surface Water

The objective of this section is to evaluate the impacts of water withdrawal and discharge on the aquatic environment and water users near the INEEL, Portsmouth, and Savannah River sites.

The construction, operation, and eventual decommissioning of new nuclear plants may have several impacts on adjacent water bodies. The impact of water withdrawal includes changing the habitat environment, entrapment, and possibly impingement of plankton, including eggs, larvae, and juvenile fish. Water consumption may affect existing and future users. Effluent discharges from the plant may influence the fish passage zone, cold shock, and high temperature zone that can affect fish migration and spawning.

4.5.1 Evaluation of the INEEL Site

As discussed in Section 3.22, groundwater would be used for cooling purposes if the current water rights for INEEL can be permitted for the power generation. Alternatively, air-cooled condensers may have to be used. This, of course, would have an economic impact on the project due to the lower efficiency of the system.

The impact on surface water of using groundwater would be minimal. It may reduce the recharge to downstream streams and rivers.

Plant effluent would not be discharged into either surface or groundwater bodies. It would be discharged into an evaporation pond, which would be designed and lined in accordance with applicable regulations and standards.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

4.5.2 Evaluation of the Portsmouth Site

Water withdrawal for full quantities of makeup from the Scioto River is not technically feasible due to the required large quantities of cooling water makeup as discussed in Section 3.22. Surface water may be used as a backup in combination with well fields. The water withdrawal should be limited to approximately 5 percent of the 7-day low flow. The surface water intake design should incorporate measures to prevent fish entrapment and impingement.

Discharge of the blowdown with makeup from the groundwater could have severe impacts on the river if wet cooling towers are used. Discharge in the summer may create a large thermal plume. In the winter, a thermal shock may be created.

Unless a zero discharge plant or air-cooled condensers are used, the impact of plant effluent on the surface water could be high. Therefore, a ranking of 3 is assigned for all reactor types and the Bounding Plant.

4.5.3 Evaluation of the Savannah River Site

Construction and operation of new nuclear power plant facilities at SRS require considerations for sharing the water with other users and minimizing the impact of the plant discharge on the aquatic environment. Water withdrawal for closed cooling and for consumptive use has insignificant impact on the water availability in the Savannah River as discussed in Section 3.22. Discharge of cooling tower blowdown to control the chemistry may have a minor impact on the water quality in the river and may affect the aquatic habitat. These adverse effects, if any, can be minimized by proper design of the outfall to meet applicable thermal and chemical discharge criteria. The heated effluent from the cooling towers in terms of temperature and total Btu/hr is significantly less than the once-through cooling used for SRS reactors.

Discharge of the blowdown may be directly to the Savannah River or to Par Pond. Returning the blowdown to Par Pond requires a shorter pipeline than returning it to the Savannah River, but it has certain disadvantages. First, the blowdown water may affect the water quality of the pond, which may affect its aquatic habitat. Second, water quality monitoring at the dam for compliance with the NPDES permit could be affected by other releases from the site. Third, the dam condition requires a safety assessment and possible upgrading, for long-term use. For these reasons, returning the blowdown to the river may be the most viable approach. Returning the blowdown to the Savannah River will require approximately 16 miles of pipeline, potentially with gravity flow.

Therefore, it does not appear that the addition of new generation will have an adverse impact on the aquatic environment. However, thermal plume and chemical plume numerical modeling would be required for the design and for the preparation of the NPDES permit.

Based on available information, the addition of new nuclear power generation may have less impact on the aquatic environment than during the previous operation of the SRS reactors. However, demonstration of compliance with applicable regulations, including thermal discharge criteria, would be required. For these reasons, a ranking of 4 is assigned for all reactor types and the Bounding Plant. The ultimate heat sink could consist of a closed cooling system such as a mechanical draft-cooling tower with enclosed water storage basin or a spray pond system, depending on space availability.

4.5.4 References

1. EG&G, NPR Turbine/Dry tower, Air cooled Condenser Conceptual Design Study, August 1990

2. Environmental and Other Evaluation of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity, US DOE Volume –1, September 1992.

3. USEC, Application for United States Nuclear Regulatory Commission Certification, Volume 1: Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, September 1995.

4. SRS G-SAR –G-00001 Rev 4.

5. Impingement and Entrainment of Fishes at the Savannah River Plant, An NPDES 316 b Demonstration, Du Pont, DP-1494, February 1978.

6. Effect of Geographical Location on Cooling Pond Requirements and Performance, US EPA, Project No. 1613 FDQ, March 1971.

7. Site Selection for the Accelerator for Production of Tritium at the Savannah River Site, WSRC -TR –96-0279, Rev 1, October, 1996.

4.6 Population

This section determines the potential for manrem exposure due to the effluent releases, including gaseous pollutants and liquids, from the proposed new nuclear power plants.

Most nuclear power plants are situated in rural and remote areas and their Low Population Zone distances generally range from 2 to 6 miles. During nuclear power plant operation, there are radioactive materials as well as chemicals and air pollutants that are routinely or accidentally released to the environment. The various possible pathways for human exposure include direct radiation from radioactivity, immersion in airborne effluents, internal exposure from inhalation of airborne effluents, and ingestion pathways through release materials deposited on the ground surface, vegetation, and surface water.

The criteria being evaluated are:

- Proximity to existing nuclear power plant
- Population (permanent and transient) distribution within 10 miles of the site
- Locations of nearby animal, vegetable, or fruit farms
- Sources of domestic water supplies and location of surface water bodies and groundwater sources
- Location of effluent releases of the proposed plants

The most recent and readily available relevant licensing documents, topographic and transportation maps, and the U.S. Bureau of Census data were reviewed in conjunction with a site visit to examine the local environment, agricultural activities, and population distribution surrounding each of the selected sites.

4.6.1 Evaluation of the INEEL Site

Eight reactors and an ISFSI are located in the same general area of the preferred site within the 890-square-mile INEEL facility. There is no permanent population within the site. The preferred site is not within 2 miles of any commercial animal/vegetable farms or orchards. Furthermore, it is also not within 5 miles of residences, schools, hospitals, correctional facilities, or publicly used facilities, nor within 10 miles of a city or town.

The INEEL site is situated in a high desert area. Groundwater is used exclusively at the INEEL facilities. It is currently anticipated that air-cooled condensers would be used for plant cooling. There would be other effluent streams but these would be minor sources and would not be discharged such that they affect any nearby wetland or groundwater.

There are scattered man-made “ponds," potential wetlands, and intermittent waters (Big Lost River) that occur near the onsite facilities and that are sources of water for the wildlife that inhabit the area. The Big Lost River enters the southwestern corner of the INEEL site, and flows north about 12.5 miles from the preferred site, but it has not held water since 1986. However, these areas are mostly away from the preferred site and should not be affected by construction or operation.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant. There are no significant direct or indirect inhalation and ingestion pathways for radiation exposure of humans.

4.6.2 Evaluation of the Portsmouth Site

Much of the Portsmouth site is covered by the structures comprising the enrichment plant. Many of these structures are contaminated and the buildup area of the Portsmouth site has underground plumes of contamination or has contaminated soil or surface waters. The preferred site is located in the northeast section of the Portsmouth site.

Land within 5 miles of Portsmouth is used primarily for farms, forests, and urban or suburban residences. About 25,430 acres of farmland, including cropland, wooded lot, and pasture, lie within 5 miles of the site. The cropland is found mostly on or adjacent to the Scioto River flood plain and is farmed extensively, particularly with grain crops. The hillsides and terraces are used for cattle pasture. Both beef and dairy cattle are raised in the area. A relatively small area of urban land, about 510 acres, is also located in and around Piketon, approximately 3.5 miles north of the Portsmouth site.

In addition to the residential population, there are institutional and transient populations in the area. Eight schools, daycare centers, and nursing homes are within 5 miles of the site. The total employment on site was 2477 as of January 1995 and has been significantly reduced in the last several years.

The Scioto River Valley is 1 mile west of the site. No known public or private water supply draws from the river.

Based on the above evaluation, a ranking of 3 is assigned for all reactor types and the Bounding Plant. There are significant possible inhalation and/or ingestion pathways for human radiation exposure through commercial animal and vegetable farms within 2 miles of the preferred site and public facilities and residences within 5 miles of the site.

4.6.3 Evaluation of the Savannah River Site

Access to the Savannah River site is controlled. With the exception of travelers on through highways, the only people on the limited-access SRS are members of the site workforce. The current onsite workforce is approximately 13,000. There are no permanent residents within the SRS.

The preferred site is approximately 6 miles from the nearest SRS site boundary to the north. There are no commercial (e.g., animal and vegetable farms) or public facilities (e.g., schools, hospitals, prisons, and recreational facilities) within the site. However, there are numerous small towns and communities within 10 miles of the site.

The two main bodies of water on site, Par Pond and L-Lake, are manmade and were created to provide cooling water as well as to receive heated cooling water from various reactors on site. SRS is bounded on its southwest border by the Savannah River for about 35 river miles. Five major SRS streams feed into the river.

The Savannah River will be the receiving body of water for cooling tower blowdown that will be discharged by pipeline from the new power plant. A wastewater discharge permit will have to be obtained. The preferred site is about three miles from the nearest wetland, the Par Pond system. It is expected that the cooling tower drift will be designed to have minimal impacts on this and other wetlands.

Based on the evaluation above, a ranking of 3 is assigned for all reactor types and the Bounding Plant. There are significant possible pathways for radiation exposure of permanent and transient populations at or near the SRS during construction and operation of the new nuclear plant.

4.6.4 References

1. 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities
2. 10 CFR Part 52, Early Site Permits; Standard Design Certificates; an Combined License for Nuclear Power Plants
3. 10 CFR Part 100, Reactor Site Criteria
4. NRC Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations, Revision 2, April 1998.

5. U.S. Department of Commerce, Bureau of the Census, 1990 Census of Population.

6. USGS Maps for Idaho, Ohio, Georgia and South Carolina.

7. Portsmouth Gaseous Diffusion Plant Site, Final Environmental Impact Statement, May 1977.

8. Application for USNRC Certification, Portsmouth Gaseous Diffusion Plant Safety Analysis Report, Rev. 57, April 2002.

9. DOE/EA-1346, Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, 2002.

10. U.S. DOE Portsmouth Annual Environmental Report for 2000, Piketon, Ohio, December 2001.

11. Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site, June 1997.

12. DOE/EIS-0270D, Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site, December 1977.

5. Sociological Criteria

5.1 Land Use

Land use plans, zoning regulations, and related regulatory requirements are the formal expression of recent stakeholder sentiment and represent the direction being actively pursued by officials of the jurisdiction. The degree of compatibility with land use patterns is one indicator of how easily a new plant will be accepted into a community.

5.1.1 Evaluation of the INEEL Site

The evaluation of land use for the INEEL site was performed based on land-use planning information available from the Internet and from referenced documents provided by INEEL for this report. The ranking of the INEEL site is based on the following observations.

Existing and Planned Land Uses at INEEL

Categories of land use at the INEEL site include facility operations, grazing, general open space, and infrastructure such as roads. Facility operations include industrial and support operations associated with energy research and waste management activities. Land is also used for recreation and environmental research associated with the designation of the INEEL as a National Environmental Research Park.

Much of the INEEL site is open space that has not been designated for specific uses. Some of this space serves as a buffer zone between INEEL facilities and other land uses. About 2 percent, approximately 11,400 acres, of the total INEEL site area is used for facilities and operations. Public access to most facility areas is restricted. Approximately 6 percent, about 34,000 acres, of the INEEL site is devoted to public roads and utility rights-of-way that cross the site. Recreational uses include public tours of general facility areas and EBR-I, and controlled hunting that is generally restricted to half a mile within the INEEL boundary. Between 300,000 and 350,000 acres are used for cattle and sheep grazing. The U.S. Sheep Experiment Station uses a 900-acre portion of this land, located at the junction of Idaho State Highways 28 and 33, as a winter-feed lot for approximately 6,500 sheep. Grazing is not allowed within 2 miles of any nuclear facility, and, to avoid the possibility of milk contamination by long-lived radionuclides, dairy cattle are not permitted. Rights-of-way and grazing permits are granted and administered by the U.S. Department of the Interior's Bureau of Land Management.

Some additional land development is planned over the next 10 years. During the next five years, INEEL plans to increase research and development for the nation's environmental, energy, security, and science needs while accelerating environmental cleanup. New facilities and new technologies are part of the plan. In the next 10 years, INEEL expects to shift from primarily environmental cleanup to research and development. By FY 2007, completion of a new Subsurface Geoscience Laboratory is planned. INEEL expects to continue teaming with universities and other national laboratories to further science and to share its technological findings with private industry to enhance U.S. economic competitiveness.

Existing and Planned Land Uses in the Surrounding Areas

The federal government, the State of Idaho, and private parties own lands surrounding the INEEL site. Land uses on federally owned land consist of grazing, wildlife management, rangeland, mineral and energy production, and recreation. State-owned lands are used for grazing, wildlife management, and recreation. Privately owned lands are used primarily for grazing, crop production, and range land.

Small communities and towns near the INEEL boundaries include Mud Lake to the east; Arco, Butte City, and Howe to the west; and Atomic City to the south. The larger communities of Idaho Falls/Ammon, Rexburg, Blackfoot, and Pocatello/Chubbuck are situated to the east and southeast of the INEEL site. The Fort Hall Indian Reservation is southeast of the INEEL site.

Recreation and tourist attractions in the region surrounding the INEEL site include Craters of the Moon National Monument, Hell's Half Acre Wilderness Study Area, Black Canyon Wilderness Study Area, Camas National Wildlife Refuge, Market Lake State Wildlife Management Area, North Lake State Wildlife Management Area, Yellowstone National Park, Targhee and Challis National Forests, Sawtooth National Recreation Area, Sawtooth Wilderness Area, Sawtooth National Forest, Grand Teton National Park, Jackson Hole recreation complex, and the Snake River.

All county plans and policies encourage development adjacent to previously developed areas to minimize the need to extend infrastructure improvements and to avoid urban sprawl. Because INEEL is remotely located from most developed areas, INEEL lands and adjacent areas are not likely to experience residential and commercial development, and no new development is planned near the INEEL site. However, recreational and agricultural uses are expected to increase in the surrounding area in response to greater demand for recreational areas and the conversion of rangeland to cropland.

Conclusions

No current or future regulatory land-use restrictions were identified that are incompatible with locating nuclear power generation plants on the INEEL site. During the late 1980s and early 1990s, INEEL was one of three DOE sites evaluated for site suitability of a new tritium production facility (the NPR). The proposed location of new generation nuclear power plants is on the former NPR-designated site.

There are no differences between reactor types for the INEEL site. The existing land use plans for the INEEL site do not distinguish between types of nuclear plants. Based on the above evaluations, a ranking of 5 is assigned for each reactor type and the bounding plant.

5.1.2 Evaluation of the Portsmouth Site

The evaluation of land use for the Portsmouth site was performed based on land-use planning information available from referenced documents provided by Portsmouth for this report, the Internet, and from a site visit. The ranking of the Portsmouth site is based on the following observations.

Existing and Planned Land Uses at Portsmouth

Portsmouth is one of the only two federally owned, privately operated uranium enrichment facilities in the United States. The uranium enrichment production and operations facilities at the site are owned by the DOE and leased to USEC. The NRC regulates USEC's operations. USEC's lease is active through July 1, 2004, although some facilities may be returned to DOE on an earlier date. USEC's enrichment operations ceased May 11, 2001; however, some support facilities are still in use by USEC, and DOE plans to maintain the enrichment cascade facilities in a cold standby condition for an indefinite period. Bechtel Jacobs Company, LLC, acts as a managing and integrating contractor for DOE and is responsible for environmental restoration, waste management, and operation of non-leased facilities (facilities not leased to USEC).

The industrialized portion of the approximately 3700-acre plant site encompasses about 1000 acres. A perimeter road surrounds an approximate 1200-acre centrally developed area. The uranium enrichment production and operations facilities leased to USEC are situated on approximately 640 acres. In addition to the three main gaseous diffusion process buildings, support facilities include administration buildings, a steam plant, electrical switchyards, cooling towers, cleaning and decontamination facilities, water and wastewater treatment plants, fire and security headquarters, maintenance, warehouse, and laboratory facilities.

The area outside the perimeter road is used for a variety of purposes, including a water treatment plant, holding ponds, sanitary and inert landfill, and open and forested buffer zones. This area includes the 340-acre parcel of land proposed for new generation nuclear power plants. The parcel is in a mostly undisturbed part of the Portsmouth site. Land used by security personnel for training and as a firing range is adjacent to the parcel boundary lines.

Several ongoing, reindustrialization initiatives are underway at Portsmouth in coordination with SODI. SODI was established in August 1995 and was incorporated as a nonprofit organization in July 1997. The purpose of the organization is to create job opportunities within the four counties most affected by Portsmouth downsizing – Pike, Ross, Jackson, and Scioto. SODI members represent business, industry, education, economic development, government, the DOE, Bechtel-Jacobs LLC, and USEC. SODI actively promotes the reuse of DOE property by private industry. The first lease between DOE and SODI, signed in April 1998, was for 6 to 8 acres of land on the north side of the Portsmouth property. The tract was used as a right-of-way for a railroad spur to connect with the existing DOE north rail spur. A second lease between DOE and SODI, signed in October 2000, was for 12 acres of land adjacent to the area of the first lease. This tract will be used for additional railroad spurs and use of existing rail facilities.

Additional DOE real estate out grants that have occurred at Portsmouth include:

- Right-of-way easement for a waterline and sewer line
- License for nonfederal use of property for concurrent road usage
- Recreational license to Scioto Township for development of a community park
- Greenway licenses to Scioto Township and Seal Township
- Lease/license (short-term) for use of parking lots by SODI

DOE evaluated the undeveloped 340-acre parcel technically for possible transfer to SODI for reindustrialization. This transfer has not occurred.

DOE recently completed an environmental assessment of a program to transfer real property (i.e., underused, surplus, or excess Portsmouth land and facilities) by lease or disposal (e.g., sale, donation, transfer to another federal agency, or exchange) under the reindustrialization program. The assessed land available for transfer occupies about 2200 acres of the site. The assessment considered five land use categories, consisting of various combinations of industrial and commercial uses, depending on site location. "Rail/Industrial" was the combination assessed in the part of the site that includes the proposed 340-acre parcel. Using the program, DOE would transfer the real property to a community reuse organization, to other federal agencies, or to other interested people and entities, should DOE determine them suitable. One alternative specifically excluded from the assessment was transfer of land only from the undeveloped areas of Portsmouth with access to on site utilities.

Existing and Planned Land Uses in the Surrounding Areas

Land within 5 miles of Portsmouth is used primarily for farms, forests, and urban or suburban residences. About 25,430 acres of farmland, including cropland, wooded lot, and pasture, lies within 5 miles of Portsmouth. The cropland is mostly found on or adjacent to the Scioto River flood plain and is farmed extensively, particularly with grain crops. The hillsides and terraces are used for cattle pasture. Both beef and dairy cattle are raised in the Portsmouth area.

There are no state or national parks, forests, conservation areas, wild and scenic rivers, or other areas of recreational, ecological, scenic, or aesthetic importance within the immediate vicinity of the Portsmouth site. Approximately 24,400 acres of forest lie within 5 miles of Portsmouth. This includes some commercial woodlands and a small portion of Brush Creek State Forest.

A relatively small area of urban land, about 510 acres, is also within 5 miles of Portsmouth. This land is situated primarily in and around Piketon, approximately 3.5 miles north of the center point of Portsmouth.

All or part of 18 Ohio counties, 5 Kentucky counties, and 1 West Virginia county are within 50 miles of Portsmouth. Almost 2.5 million acres of farmland are within that area. This accounts for about 49 percent of the area within this radius. Approximately 65 percent of the farmland is cropland; the remaining farmland is woodland or range and pastures or is occupied by farm-related buildings.

A notable portion of the land within 50 miles of Portsmouth is held in the public trust as forestland or for recreational use. State parks of Ohio and Kentucky occupy more than 38,000 acres of land within 50 miles of Portsmouth. The Ohio Department of Natural Resources also manages approximately 165,000 acres of land as state forests, natural preserves, and wildlife areas. Wayne National Forest occupies approximately 120,000 acres of land within 50 miles

Few urban areas are within 50 miles of Portsmouth. The cities of Chillicothe, Ohio, and Portsmouth, Ohio lie approximately 25 miles away, and the metropolitan area comprising primarily Huntington, West Virginia, and Ashland, Kentucky, lies approximately 50 miles southeast of Portsmouth.

The region is chronically depressed economically, so significant development in the area surrounding Portsmouth is not expected. There are a few residences adjacent to the Portsmouth site boundary.

Conclusions

During the May 5, 2002 site walkdown, Portsmouth site representatives described a probable negative reaction from one local community group, which has national ties, to an initiative that would locate nuclear power plants on Portsmouth property. Based on experiences with other reindustrialization initiatives, the site representatives emphasized that this group was the only local group likely to be in opposition to land development, while the rest of the community would be supportive.

No current or future regulatory land-use restrictions were identified which would be incompatible with locating nuclear power generation plants on the Portsmouth site. Nuclear energy supplies about 11 percent of the electricity generated in Ohio. Ohio maintains a boiler inspector program for "nuclear boilers." Ohio participates with the NRC in a joint inspection and observation program at the Davis-Besse and Perry nuclear power plants. There are no nuclear power plants in the Portsmouth region; however, the Ohio State University in Columbus has a non-power reactor. Davis-Besse and Perry have been in commercial operation status for many years. Although the Portsmouth site, Davis-Besse, and Perry have had some newsworthy events, the Portsmouth site representatives indicated state political support for nuclear power remains either neutral or positive. The representatives also mentioned that Portsmouth receives positive political support for potential site development plans.

The existing land use plans for the Portsmouth site do not distinguish between types of nuclear plants. The reactor plants do vary in height as described in Section 5.5. Based on the above evaluation and the differences in reactor/containment building heights, a ranking of 5 is assigned for the ABWR, GT-MHR, IRIS, and PBMR reactors. A ranking of 4 is assigned to the AP1000 reactor and the Bounding plant.

5.1.3 Evaluation of the Savannah River Site

The evaluation of land use for the Savannah River site was performed based on land-use planning information available from referenced documents provided by SRS for this report, the Internet, and from a site visit. The ranking of the SRS is based on the following observations.

Existing and Planned Land Uses at SRS

The U.S. Government established the SRS in the 1950s for the production and processing of nuclear materials for national defense. DOE manages the SRS as a controlled area with limited public access.

The changing world caused a downsizing of the site's original defense mission. The current SRS mission is to fulfill its responsibilities safely and securely in the stewardship of the nation's nuclear weapons stockpile, nuclear materials, and the environment. These stewardship areas reflect current and future missions to meet the needs of the enduring U.S. nuclear weapons stockpile; store, treat, and dispose of excess nuclear materials safely and securely; and treat and dispose of legacy wastes from the Cold War and clean up environmental contamination.

The SRS occupies approximately 310 square miles in a generally rural area in western South Carolina. Administrative, production, and support facilities are concentrated in six major production areas and occupy 5 percent (approximately 17,000 acres) of the total SRS area. The remaining land, approximately 181,000 acres, is forestland and swamp managed by the U.S. Forest Service, under an interagency agreement with the DOE. Approximately 14,000 acres of SRS have been set aside exclusively for nondestructive environmental research in accordance with the designation of the SRS as a National Environmental Research Park.

There are several future uses of SRS land for new facilities in development: MOX Fuel Fabrication Facility, and a Pit Disassembly and Conversion Facility. The MOX facility is a private initiative regulated by the NRC as lead agency. Additional private initiatives are encouraged.

Existing and Planned Land Uses in the Surrounding Areas

The region of influence includes six counties in two states. Most of the Savannah River site (61.3 percent) is in Barnwell County. Aiken and Allendale counties contain the remainder (36.6 percent and 2.1 percent, respectively). The region of influence also includes Bamberg County in South Carolina and Columbia and Richmond counties in Georgia.

Forested land accounts for 43 percent of the total 3,090-square-mile region of influence. Combined agricultural, grassland, pasture, barren land, disturbed land, and exposed earth categories cover 19 percent of the region. Wetlands, marsh, and saturated bottomlands occur in approximately 15 percent of the region. Open water accounts for 2 percent and cities another 5 percent. The SRS occupies approximately 9.9 percent of the region of influence.

Land-use characteristics in the 50-mile area around SRS are similar to those in the region of influence, dominated by forest (50.5 percent) and agricultural lands (40.7 percent), including grassland/pasture, cropland, and bare soil. The Savannah River site accounts for 4 percent of the 50-mile area. Pine forests are more prevalent in the northwest portion of the area, north of the fall line. In addition, agriculture and urban development are considerably less prevalent in this area. Wetland forests occur in all major and minor drainage in the area. Non-forested wetlands occur throughout the area in conjunction with surface water features and along stream valleys. Several industrial businesses are within 5 miles of the SRS site boundary, including the Vogtle nuclear plant.

The land-use controls or planning tools most commonly used by local and county governments in Aiken, Barnwell, Columbia, and Richmond counties are zoning ordinances, subdivision regulations, building codes and permits, and the regulation of mobile homes and trailer park development. Planning tools not widely used or absent from the study area are development standards, utility extensions or moratoriums, floodplain regulations and flood insurance, environmental regulations, and tax incentives.

As of 1997, Columbia and Richmond counties were the only counties in the region of influence that had zoning ordinances. Such ordinances typically divide the jurisdiction into districts according to land use, such as residential, commercial, industrial, and agricultural.

Aiken, Columbia, and Richmond counties have subdivision regulations. The application of these regulations before the development of a community ensures that the new community design and construction is according to plan.

All four counties near the Savannah River Site use county-enforced building codes or county-issued building permits. Building codes ensure that new construction and existing structures meet minimum established standards (i.e., plumbing, mechanical, and electrical codes). Aiken, Barnwell, Columbia, and Richmond counties issue building permits or enforce building codes through inspections. Columbia and Richmond counties have countywide mobile home or trailer park regulations.

Conclusions

No current or future regulatory land-use restrictions were identified that are incompatible with locating nuclear power generation plants on the SRS. Previous and proposed nuclear-related missions have received positive local public and political support. The Vogtle nuclear plant is nearby in the state of Georgia. Vogtle has been in commercial operation status for many years. Given the size of SRS, the possible locations of new nuclear power plants on the site, and the positive local public and political support for nuclear missions, no land-use issues are evident.

There are no differences between reactor types for the SRS. The existing land use plans for the SRS do not distinguish between types of nuclear plants. Based on the above evaluations, a ranking of 5 is assigned for each reactor type and the Bounding Plant.

5.1.4 References

1. "U.S. Department of Energy's Environmental Report - Independent Spent Fuel Storage Installation (ISFSI) License for the Three Mile Island Unit Two (TMI-2) Fuel," enclosed by Department of Energy, Idaho Operations Office, letter titled "License Application for the Idaho National Engineering Laboratory Three Mile Island Unit Two Independent Spent Fuel Storage Installation," Docket No. 72-20, Revision 0, October 1996

2. "Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant Piketon, Ohio," DOE/EA-1346, February 2002

3. "Evaluation of Site Conditions for 340 Acres of Department of Energy Land, Northeast Portion of the Portsmouth Gaseous Diffusion Plant Piketon, Ohio," DOE/OR/11-3082&D3, Date Issued —January 2002

4. "USEC Application for United States Nuclear Regulatory Commission Certification, Volume 1, Portsmouth Gaseous Diffusion Plant Safety Analysis Report," Rev. 57, April 12, 2002

5. "Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site," June 1997

6. "Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site," DOE/EIS-0270D, Draft December 1997.

5.2 Demography

The capacity of communities to absorb an increase in population depends on the availability of sufficient community resources, such as housing, schools, medical care facilities, local infrastructure, etc.

Because the INEEL, Portsmouth, and Savannah River sites are located in rural areas with a few small towns or communities nearby, the required labor force during plant construction and operation will be difficult to secure from these nearby small towns and communities. Furthermore, there will not be adequate community resources in these areas to meet the needs of influx project-related population. Therefore, the criteria being evaluated is the number of major towns or cities that are within a 2-hour commuting distance of the evaluated sites that could provide the appropriate labor force without relocation.

A review of the most recent and readily available relevant licensing documents, topographic and transportation maps, and the U.S. Bureau of Census data was conducted in conjunction with a site visit to examine the area transportation network and population distribution surrounding the selected sites.

5.2.1 Evaluation of the INEEL Site

Eastern Idaho has a moderate growing labor force. INEEL is not near a large metropolitan area. The region has approximately 150,000 people and growing at an above national average of 6.3 percent annually. A direct labor force of approximately 62,000 resides within a 30-minute drive from Idaho Falls. The four largest cities in Eastern Idaho are Idaho Falls, Pocatello, Blackfoot, and Rexburg.

Based on the information presented above, a ranking of 4 is assigned for all reactor types and the Bounding Plant. It is concluded that although the INEEL site is not near a large metropolitan area, a minimal influx of project-related population during plant construction and operation would be expected. Nearby surrounding cities have adequate capacity to accommodate the expected increase in population.

5.2.2 Evaluation of the Portsmouth Site

The Portsmouth site is about 70 miles south of Columbus, Ohio, and 75 miles east of Cincinnati, Ohio, the two closest metropolitan areas. Huntington, West Virginia, is approximately 87 miles away. The cities of Portsmouth, Jackson, and Chillicothe, Ohio, are approximately 25 miles from the facility (south, east and north, respectively). There are numerous small towns within 50 miles of Portsmouth. All these cities could supply an adequate appropriate labor force and are within a 2-hour commuting distance via local transportation routes. The regional transportation network consists of two major highways: US Route 23 and SR 32 and numerous state routes: SR 52, SR 124, SR 139 and SR 35.

In summary, a minimal influx of project-related population during new plant construction and plant operation would be expected. Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.2.3 Evaluation of the Savannah River Site

The labor force residing in the region of influence increased to 221,000 in 1995. The rate of growth has been the largest in Columbia County. In 1995, 70 percent of the total labor force in the region lived in Richmond and Aiken counties. The regional labor force should increase to approximately 232,000 workers by 2005.

The SRS is approximately 25 miles southeast of Augusta, Georgia, and 19.5 miles south of Aiken, South Carolina. In 1994, the population of the neighboring six-county region of influence was estimated to be 457,824. Augusta was the largest city with a population of 43,459. There are numerous towns and cities within 50 miles of the site. Roads and highways are the primary means of travel to SRS. With the extensive local transportation network in the area, all these cities could supply an adequate labor force and are well within a 2-hour commuting distance. Therefore, a minimal influx of project-related population during plant construction and operation can be expected.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.2.4 References

1. 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities.

2. 10 CFR Part 52, Early Site Permits; Standard Design Certificates; and Combined Licenses for Nuclear Power Plants.

3. 10 CFR Part 100, Reactor Site Criteria.

4. NRC Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations, Revision 2, April 1998.

5.3 Socioeconomic Benefits

This section evaluates the potential socioeconomic benefits associated with the addition of new nuclear units at INEEL, Portsmouth, and Savannah River sites. Positive impacts on surrounding communities from this capacity addition could include employment, increased tax revenue, improved community facilities, support to local emergency planning efforts, etc. Negative economic impacts would be present if the land could be used for other purposes such as agriculture. Negative economic impacts could include a loss of income and jobs.

5.3.1 Evaluation of the INEEL Site

As one of the largest employers in the state, INEEL has demonstrated significant socioeconomic benefits for the eastern Idaho community for more than 50 years. As a leader in research and development in energy, environmental quality, national security, and science and technology, INEEL provides a highly educated, stable, productive and high-income work force to the Idaho economy. The facility employs an average of more than 8,000 highly trained researchers, professionals, administrators, and support staff. Half of INEEL employees have earned college degrees and 40 percent of the college degrees are at the graduate level. Wages, salaries, and benefits received by INEEL employees living in the state exceed half a billion dollars each year. The combination of wages, salaries, benefits, and purchases injects more than $750 million directly into the Idaho economy each year. The addition of commercial nuclear generation would be expected to add jobs of similar quality to the existing work force. In excess of 800 people are usually employed at a two-unit commercial nuclear site. Additional units would increase this total. These jobs would provide economic benefits to the local communities for the life of the units, approximately 60 years.

It is estimated that INEEL employees and retirees accounted for approximately $78 million in state and local taxes in 2001. The federal government also contributed an additional $12 million in Impact Aid to local governments. Adding commercial nuclear capacity to the INEEL site would be expected to increase the tax base for these localities for the life of the new units.

INEEL is involved in a number of educational outreach efforts, providing training to mathematics and science teachers, making classroom presentations in many elementary schools, high schools, and colleges throughout the state, and investing funds and resources in schools at all levels. INEEL also brings students and educators to the local community by hosting large educational events like Science Expo. In addition, the research facilities at INEEL play host to students from universities in the region. Educational outreach programs provide students with first hand knowledge of careers in science, math, engineering, and technology. These programs are vital to maintaining a well-educated and well-trained workforce for the commercial nuclear power industry, and would be enhanced for commercial nuclear application.

Because DOE already owns the INEEL site, there should be no preemptive land use issues. Any commercial nuclear capacity would be built on the existing site, so there would be no negative economic impacts to the local community with respect to alternative uses of the land. However, there would be a significant short-term positive economic impact on the local community from the large construction force necessary to construct the units. Depending on the number of units built, this benefit could be sustained for 8 to 10 years.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.3.2 Evaluation of the Portsmouth Site

The Portsmouth site has demonstrated significant socioeconomic benefits for the surrounding communities over the last five decades. The facility has provided thousands of jobs with above average salaries, which has resulted in a dedicated workforce where two generations have been employed.

DOE does not pay property taxes to the local communities around the Portsmouth site. However, DOE has provided $12.9 million in grants to SODI. USEC has collected sales taxes for the state of Ohio on uranium enrichment services. Adding commercial nuclear capacity at the Portsmouth site would therefore be expected to increase the tax base for these localities for the life of the new units.

The Portsmouth site currently provides employment for more than 1800 people. The site employs a highly skilled workforce with decades of nuclear-related experience. During the last several years, the Portsmouth site has undergone a major downsizing. The addition of commercial nuclear generation would be expected to add jobs of similar or higher quality to the existing work force, many of which could be filled by current or former Portsmouth site employees. In fact, many former employees would like to continue working locally in the nuclear industry. In excess of 800 people are usually employed at a two-unit commercial nuclear site. These jobs would provide economic benefits to the local communities for the life of the units, approximately 60 years. These jobs would be particularly valuable to the Portsmouth site localities, since the unemployment rate is well above the Ohio average.

Portsmouth site employees have demonstrated a strong commitment to local communities through charitable contributions and volunteer programs. In 2001, Bechtel Jacobs employees made $24,500 in contributions to the United Way and USEC employees donated $53,000. Bechtel Jacobs provides approximately $80,000 per year to the local community, and USEC approximately $55,000 per year, through a corporate contribution program. The Portsmouth site provides 2000 children with Christmas gifts each year through an ongoing employee program. Commercial power companies have similar records of long-standing community involvement, so the additional employees necessary to operate commercial nuclear units at the Portsmouth site would be expected to continue and to enhance these commitments.

The Portsmouth site actively supports educational programs in the local area. Educational outreach programs are primarily focused on local vocational schools to provide skilled labor for the Portsmouth site. These programs are vital to maintaining a well-educated and well-trained work force for the commercial nuclear power industry, and would be enhanced for commercial nuclear application.

The Portsmouth site uses local companies for services where possible. For example, printing work is contracted out locally, as is DOE vehicle maintenance. Commercial nuclear capacity at the Portsmouth site could be expected to make use of some of these private companies for support services.

Because DOE already owns the Portsmouth site, there should be no preemptive land use issues. Any commercial nuclear capacity would be built on the existing site, so there would be no negative economic impacts on the local community with respect to alternative uses of the land. However, there would be a significant short-term positive economic impact on the local community from the large construction force necessary to construct the units. During the 1980s, approximately 5000 people were employed at the site while centrifuge construction was underway. As a result, the region has a highly skilled craft labor force available for nuclear construction. Depending on the number of units built, this benefit could be sustained for 8 to 10 years.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.3.3 Evaluation of the Savannah River Site

The Savannah River site has demonstrated significant socioeconomic benefits for the surrounding communities over the last five decades. The facility injects about $1.5 billion annually into the economies of the two states bordering the site, South Carolina and Georgia. The facility provides thousands of jobs with above average salaries, conducts environmental and nuclear technology research, and offers business development programs for local communities.

In lieu of property taxes, the SRS pays a fee to the localities bordering the site. For 2002, Barnwell County will receive a fee of approximately $2 million, Aiken County approximately $800,000, and Allendale County approximately $100,000. Adding commercial nuclear capacity to the Savannah River Site would be expected to increase the fee base for these localities for the life of the new units.

The SRS currently provides employment for more than 13,000 people. The site employs a highly skilled work force, the majority of which is college educated. This results in above average salaries for employees. During the last decade, the SRS has undergone a major downsizing due to the end of the Cold War. The addition of commercial nuclear generation would be expected to add jobs of similar quality to the existing work force, many of which could be filled by current or former SRS employees. In excess of 800 people are usually employed at a two-unit commercial nuclear site. Additional units would increase this total. These jobs would provide economic benefits to the local communities for the life of the units, approximately 60 years.

SRS employees have demonstrated a strong commitment to local communities through volunteer programs, charitable contributions, and active participation in local politics. Many employees have held leadership positions in civic, cultural, youth, religious or political organizations, and some have even held elected offices in county and municipal governments. In 1999, SRS employees made $2.14 million in contributions to the United Way, donated more than 150,000 pounds of food and gave 4,000 units of blood. Commercial power companies have similar records of long-standing community involvement, so the additional employees necessary to operate commercial nuclear units at SRS would be expected to continue and enhance these commitments.

SRS has a long history of actively supporting educational and research programs in South Carolina and Georgia. Research opportunities are made available to regional universities, as well as cooperative education and internship opportunities to students. Educational outreach programs provide students with first hand knowledge of careers in science, math, engineering, and technology. These programs are vital to maintaining a well-educated and well-trained work force for the commercial nuclear power industry, and would be enhanced for commercial nuclear application.

Because of downsizing, SRS has contracted many nonclassified operations to private companies. This program has created jobs in the local economy. Commercial nuclear capacity at SRS could be expected to make use of some of these private companies for support services.

Because DOE already owns the SRS, there should be no preemptive land use issues. Any commercial nuclear capacity would be built on the existing site, so there would be no negative economic impacts on the local community with respect to alternative uses of the land. However, there would be a significant short-term positive economic impact on the local community from the large construction force necessary to construct the units. Depending on the number of units built, this benefit could be sustained for 8 to 10 years.

Based on the above evaluation, a ranking of 5 is assigned for SRS for all reactor types and the Bounding Plant.

5.3.4 References

1. “Target Industry Analysis for the Southern Ohio Diversification Initiative,” RKG Associates, Inc., September 1999.

2. “Economic Impact of the Savannah River Site on South Carolina and Georgia,” H. S. Grewal and J. C. Noah, Second Edition, July 2001.

3. “Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site,” Halliburton NUS Corp., June 1997.

5.4 Agricultural / Industrial

Certain land uses are incompatible with the industrial development of nuclear power plants. Construction of a nuclear power plant might create a stigma effect on the value of adjacent land uses based on perceived concepts. Therefore, agricultural lands and commercial fisheries could become less valuable because of nuclear power plant operation. This is a public concern related to siting. On the other hand, industries that are power-consumptive tend to be near major, reliable power sources. Therefore, the potential for induced growth might increase the local industrial productivity. However, the induced growth could be limited by existing conditions in the area such as limited water resources or severe housing shortage.

5.4.1 Evaluation of the INEEL Site

The INEEL site is large and remote and is situated on an expanse of otherwise undeveloped, high-desert terrain. No displacement of prime agriculture lands is expected due to its remoteness and high-desert terrain. No ordinary industrial facilities are near the INEEL site (Reference 1). Sufficient public transportation routes and the controlled access roads to the INEEL site are available. Because of the remoteness of the site, no significant industrial growth is expected due to the construction of the proposed power plant. The site has no prime agriculture lands, no local commercial fisheries or coral reefs, and there are not a significant number of competitive water users.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.4.2 Evaluation of the Portsmouth Site

Economic activities near the Portsmouth site consist primarily of farming, lumbering, and small businesses. The only significant industry in the vicinity is an industrial park south of Waverly. The industries include a cabinet manufacturer and an automotive parts manufacturer (Reference 2). The site has no prime agriculture lands, no local commercial fisheries or coral reefs, and there are not a significant number of competitive water users. Sufficient public transportation routes and the controlled access roads to the Portsmouth site are available. No significant industrial growth is expected due to the construction of the proposed power plant.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.4.3 Evaluation of the Savannah River Site

The SRS is a large site covering 310 square miles. Various industrial, manufacturing, medical, and farming operations are conducted near the site. Major industrial and manufacturing facilities in the area include textile mills, polystyrene form and paper products plants, chemical-processing facilities, and the Vogtle nuclear plant (Reference 3). The site has no prime agriculture lands, no local commercial fisheries or coral reefs, and there are not a significant number of competitive water users. Because the preferred location on the site is at least 6 miles from the closest SRS property boundary, the construction of the proposed nuclear power plant is not expected to have any significant impact on the operation of nearby industrial facilities.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.4.4 References

1. INEEL, TMI-2 Safety Analysis Report, Rev. 2A, 2001.

2. Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, 2002.

3. WSRC-TR-2000-00328, Savannah River Site, Environmental Report for 2000.

4. DOE/EIS-0270D, Accelerator Production of Tritium at the SRS, Draft EIS, 1997.

5.5 Aesthetics

Regulatory Guides 1.70 and 1.47 require an assessment of the visual impacts of the plant and transmission line on nearby valued culture, scenic, historic, and recreation areas. Residential properties could decline in value due to the view of the nuclear station and its transmission lines.

The heights of the reactor/containment buildings for the different reactor types are discussed below.

- ABWR

The top of the ABWR containment building is approximately 165 feet above grade. This building has a rectangular shape that does not identify it as a reactor from a distance. There is some flexibility for the height of the building that must be above ground. This building would have hoists for removal of equipment from the lower elevations, but the equipment hatch elevation could be designed to allow the building to be placed lower in the ground.

- AP1000

The AP1000 has a tall containment building, approximately 234 feet above grade. The design of this building has a hatch that sets the height that must be above ground. This building would be expensive to redesign to allow the building to be placed lower in the ground.

- GT-MHR

The GT-MHR has a relatively small containment building. The design of this building is a rectangular shape that does not identify the building as a reactor from a distance. In addition, most of the building is designed to be below grade elevation in a silo. This design still results in a building with a height of about 100 feet above grade.

- IRIS

The auxiliary building for the IRIS plant covers the containment building and is approximately 105 feet above grade. The design of the auxiliary building is a rectangular shape that does not identify the building as a reactor from a distance. There may be some flexibility for reducing the height of the building that must be aboveground.

- PBMR

The PBMR has a relatively small reactor/containment building. The standard design of this building is a rectangular shape that does not identify the building as a reactor from a distance. While the height is not yet known, there may be some flexibility for minimizing the height of the building that must be aboveground.

5.5.1 Evaluation of the INEEL Site

INEEL is about 100 miles from Grand Teton and Yellowstone National Parks. A Class I area—Craters of the Moon National Monument—is about 30 miles west-southwest of the preferred site (Reference 3). No public amenity areas are within 2 miles of the preferred site. The preferred site is situated in an open terrain area, and no residential area is within 2 miles of the site.

If necessary, drift eliminators could be installed on the proposed mechanical cooling towers to reduce long visible plumes. Air-cooled condensers would be an alternative method for plant cooling.

The site is remote; therefore, offsite observers would not have a distinguishable view of associated transmission facilities. In addition, because of the long distance from the preferred site to the site boundary, offsite observers would not have an obvious identifiable view of a new nuclear power generating facility.

Based on the above evaluation and the heights of the reactor/containment buildings, a ranking of 5 is assigned for the ABWR, GT-MHR, IRIS, and PBMR reactors. Because of the height of the AP1000 containment building, a ranking of 4 is assigned to the AP1000 and the Bounding Plant.

5.5.2 Evaluation of the Portsmouth Site

Offsite recreational areas include the Brush Creek State Forest, approximately 5 miles south-southwest, and Lake White State Park, about 5 miles north (Reference 4). There are no significant recreational areas within 2 miles. The preferred site is situated in an open terrain site.

Within 2 miles of the preferred site, there are no major residential areas. If necessary, drift eliminators could be installed on the proposed mechanical cooling towers to reduce long visible plumes. Air-cooled condensers would be an alternative method for plant cooling. Nearby trees would serve as a visual buffer for the transmission facilities. Because the preferred site is close to the northeast corner of the existing site boundary, it is possible that the proposed reactor would have an identifiable nuclear power plant view offsite.

Based on the above evaluation and the heights of the reactor/containment buildings, a ranking of 4 is assigned for the ABWR, GT-MHR, IRIS, and PBMR reactors. Because of the height of the AP1000 containment building, a ranking of 3 is assigned to the AP1000 and the Bounding Plant.

5.5.3 Evaluation of the Savannah River Site

The preferred site is more than 6 miles from the closest site boundary. Therefore, no public amenity areas are within 2 miles of the preferred site. If necessary, drift eliminators could be installed on the proposed mechanical cooling towers to reduce long visible plumes. Air-cooled condensers would be an alternative method for plant cooling. The majority of the site is dense forest; therefore, nearby trees would provide a visual buffer for the proposed facilities to the public. Since the preferred site is at least 6 miles away from the existing site boundary, offsite observers would not have an identifiable nuclear power plant view.

Based on the above evaluation and the heights of the reactor/containment buildings, a ranking of 5 is assigned for the ABWR, GT-MHR, IRIS, and PBMR reactors. Because of the height of the AP1000 containment building, a ranking of 4 is assigned to the AP1000 and the Bounding Plant.

5.5.4 References

1. Regulatory Guide 1.70, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, LWR Edition, Rev. 3, U.S. NRC, November 1978.

2. Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Plants, Rev. 2, U.S. NRC, 1998.

3. INEEL, TMI-2 Safety Analysis Report 2001.

4. Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, 2001.

5. DOE/EIS-0270D, Accelerator Production of Tritium at the Savannah River Site, Draft, 1997.

5.6 Historic and Archaeological Sites

Construction, operation, or eventual decommissioning of the plant may affect properties included in the National Register of Historic Places. Transmission lines and corridor right-of-ways also should be identified to determine their potential impacts on the historic sites or facilities.

Paleontological resources must be given consideration under the National Environmental Policy Act, the Federal Land Policy and Management Act, and under some state culture resources regulations.

5.6.1 Evaluation of the INEEL Site

The preferred site has been subject to multiple archaeological field investigations, beginning with a survey in 1983-1984. In 1989, six randomly selected 16-ha sample units within the NPR site were intensively surveyed to evaluate the results of the earlier survey. During 1990-1991, an intensive survey was completed for the preferred site; 10 more sites were tested. 153 archaeological localities (prehistoric and historic) have been recorded within the preferred site. Of the total, 106 localities consist of isolated surface founds or surface artifact scatters; these sites either have been or are likely to be determined ineligible for the NRHP. During archaeological surveys at the NPR site, no tubes, caves, or rocks shelters were visible on the surface. However, no historic structures are present, and no paleontological localities have been identified (Reference 1). The closest national park is the Craters of the Moon National Monument located approximately 30 miles west-southwest. Thus, because of its remoteness, the preferred site is not adjacent to any landmark or monument.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.6.2 Evaluation of the Portsmouth Site

Archaeological resources were identified in site Quadrants I, II, and IV. No archaeological resources have been identified in Quadrant III (Reference 2). Three archeological sites were found near the preferred site; however, they are situated to the northeast edge of the site. The closest site is Holt Cemetery, which is 600 feet away from the eastern boundary of the preferred site.

No national landmarks are reported near the site. No NRHPs are presently within the reservation. The nearest are Buzzardroost Rock and Lynx Prairie in Adams County, about 30 miles southeast of the site (Reference 3).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.6.3 Evaluation of the Savannah River Site

Sixteen archaeological sites, ranging in age from the idle Archaic period to the 20^{th} century, are situated within the site (Reference 4). During the May 2002 walkdown, the SRS staff stated that no archaeological resources were found within the preferred site. In 1966, the NRHP listed 101 properties in the region of influence for the SRS (Reference 5). However, the SRS staff stated that no historic properties exist within the preferred site. The preferred site is more than 278 feet above MSL, well above any recorded exposures of paleontological materials at SRS (Reference 4).

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.6.4 References

1. Environmental and Other Evaluations or Alternatives for Siting, Constructing, and Operating NPR Capacity, DOE/NP-0014, 1992.

2. DOE/EA-1346, Environmental Assessment, Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, 2002.

3. ERDA-1549, Portsmouth Gaseous Diffusion Plant Expansion, Final Environmental Statement, 1977.

4. DOE/NP-0014, Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating new Production Reactor Capacity, 1992.

5. Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the SRS, 1997.

5.7 Transportation Network

This section evaluates the impacts on existing transportation networks of providing and maintaining adequate access to the sites during construction and operation of the proposed new generation plants.

Depending on the particular situation, there may be adverse public reaction to alterations of the existing vehicular traffic network, especially during construction of the new generation plants.

The criteria being evaluated are:

- Existing traffic patterns and network capacity
- Daily workforce commuter traffic
- Water, rail, or truck delivery of materials
- Time delays and congestion

The construction of new power plants would require additions to the workforce. In addition, construction materials, wastes, and excavated materials would be transported both on- and offsite. These activities would result in increases in operation of personal-use vehicles by commuting construction workers, in commercial truck traffic, and in traffic associated with daily operations; however, the five reactor types under consideration for this project are generally smaller and modular in nature. Consequently, transportation of plant equipment will be less challenging and workforce requirements are expected to be less than those for the conventional nuclear plants.

5.7.1 Evaluation of the INEEL Site

Roads and railway are both available at the INEEL site. Roads are the primary mode of transportation to and from the site. Approximately 14 miles of railway cross the southern portion of the site and connect with a DOE-owned spur line on site. Some bulk materials are shipped by rail. Barge transportation is not possible, since no navigable waterways exist on or adjacent to the INEEL site.

Two interstate highways serve INEEL. I-15, a north-south route, connects several cities along the Snake River and is approximately 15 miles east of the site. Approximately 35 miles south of INEEL, I-15 intersects I-86 providing a primary linkage from I-15 to points west. Highways US 20 and US 26 connect INEEL with I-15.

The INEEL site is served by more than 230 miles of roadways consisting of principal arterial and major collector routes. There are 139 miles of DOE-owned and DOE–controlled paved roads on site. Ninety miles of paved federal and state highways that are open for public use pass through the site. U.S. 20 and U.S. 26 cross the southern portion of the site, while Idaho State Route (SR) 22, SR 28, and SR 33 cross the northeastern part.

General weight, width, and speed limits have been established for highways in the INEEL vicinity. However, no usual laws or restrictions that have been identified would significantly influence general regional transportation.

The general transportation network in the INEEL vicinity serves six Idaho counties (Bannock, Bingham, Bonneville, Butte, Jefferson, and Madison), from which 99 percent of INEEL commuter traffic is generated.

The nearby towns are Idaho Falls (42 miles southeast in Bonneville County) and Blackfoot (36 miles south-southeast in Bingham County). In 1988, 70 percent of the workforce associated with INEEL worked at the site, with the remainder at Idaho Falls. Approximately 81 percent of the workforce resided in Bingham and Bonneville counties. Approximately 4,000 of the employees on site used bus transportation.

Level of Service (LOS) on the regional transportation network is good except traffic congestion on roadways connected to the INEEL site occurs during peak traffic periods. The implementation of staggered work hours and reduced workdays has already mitigated some of the congestion along US 20 and US 26, particularly at access points to the INEEL facilities.

INEEL has experienced a steady decline in employment in the recent years. The current workforce is approximately 9000. During peak new plant construction, up to 3000 to 3500 craft and an additional 800 to 1000 nonmanual personnel could be required. Although this is a significant increase in the number of people accessing the site, impacts resulting from this additional workforce commuting to and from the site are expected not to be significant because of the extensive existing roadway system in the vicinity and within the site and the great physical separation between the INEEL facilities.

Based on the information discussed above and the implementation of a well-planned traffic mitigation program to mitigate any impacts at the critical access points, it is concluded that the construction and operation of new nuclear power facilities at the preferred site would result in acceptable impacts on existing traffic pattern, work force commute traffic, and rail/truck delivery of materials.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.7.2 Evaluation of the Portsmouth Site

The primary roadways near the Portsmouth site are US 23 and SR 35, which traverse a roughly north-south course, and SR 32, which traverses an east-west course just north of the Portsmouth site.

The Portsmouth site is in a rural, low-population area. The regional transportation network is adequate for commuter and transient traffic in the area.

Rail transportation in the area is provided by the N&S Railway, which runs north south and passes west of the site boundary, and the CSX Railway, running north south and passing 4 miles north of the site.

The total workforce at the Portsmouth site was about 3000 in 1995. The Portsmouth site has experienced a 25 percent reduction in workforce in recent years. The current plant employment level is about 1800. All workers reside in nearby towns.

During peak new plant construction, up to 3000 to 3500 craft and an additional 800 to 1000 non-manual personnel could be required. However, the total workforce was about 5,000 during the peak Portsmouth site operational period between the 1970s and 1985. Based on this previous peak, nearby access roads should be capable of supporting commuter traffic of this level with some roadway upgrades and traffic signal improvements. In addition, there are adequate transportation routes in the area to handle transportation of bulk materials to and from the site.

Based on the above evaluation, a ranking of 4 is assigned for all reactor types and the Bounding Plant.

5.7.3 Evaluation of the Savannah River Site

Personnel and most materials are transported at and around the Savannah River site by road. Rail transportation is used to move irradiated fuel and certain high-level radioactive wastes and to transport coal for steam plants. Barge transport of heavy equipment requiring a draft of less than 5 feet on the Savannah River is possible; however, because of continued low river water levels neither SRS nor commercial shippers are using this stretch of the river for material transport.

Two interstate highways serve the SRS area. I-20 provides a primary east-west corridor in the region, and I-520 links I-20 with Augusta. US 1 and US 25/SR 121 are principal north-south routes in the region, and US 78 provides east-west connections. Several other highways (US 221, US 301, US 321, and US 601) provide additional transport routes for the area.

The regional transportation networks in the SRS vicinity serve four South Carolina counties (Aiken, Allendale, Bamberg, and Barnwell) and two Georgia counties (Columbia and Richmond), from which 88 percent of SRS commuter traffic is generated.

General weight, width, and speed limits have been established for highways in the SRS vicinity. However, no unusual laws or restrictions that have been identified would significantly influence general regional transportation.

The SRS is served by more than 200 miles of primary roads and more than 1000 miles of unpaved secondary roads: however, access to SRS is controlled. Approximately 13,000 people work on the SRS and 84 percent of the SRS workforce resides in Aiken and Barnwell counties in South Carolina and Columbia and Richmond counties in Georgia.

For the roads in the general region, the worse case LOS is associated with routes near the Savannah River bridges, including I-20 and US 1 and urban routes in North Augusta and Aiken, including SC 230, SC 25, SC 19, and SC 118. Significant congestion occurs during peak traffic period on site on road 1-A and on SR 19, SR 125, and US 278 at SRS access points. Long delays are also experienced offsite along routes I-20, US-25, and US 1 where they cross the Savannah River. The SRS has implemented changes to remedy the congestion at some access points.

During peak new plant construction, up to 3000 to 3500 craft and an additional 800 to 1000 non-manual personnel could be required. This increase is less than 30 percent of the existing site workforce. The extensive existing roadway network in the area and the sufficient rail lines near the preferred site are expected to be capable of handling the additional 30 percent workforce commuting and transportation of bulk materials to and from the site.

With implementation of traffic mitigation measures, the construction and operation of new nuclear power facilities at the preferred site will result in minimal impacts on existing traffic patterns, work force commute traffic, and rail/truck delivery of materials.

Based on the above evaluation, a ranking of 5 is assigned for all reactor types and the Bounding Plant.

5.7.4 References

1. 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities.

2. 10 CFR Part 52, Early Site Permits; Standard Design Certificates; and Combined Licenses for Nuclear Power Plants.

3. 10 CFR Part 100, Reactor Site Criteria.

4. NRC Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations, Revision 2, April 1998.

5. U.S. Department of Commerce, Bureau of the Census, 1990 Census of Population.

6. USGS Maps for Idaho, Ohio, Georgia, and South Carolina.

7. U.S. DOE Solicitation DE-PS07-011D14135 – Study of Potential Sites for the Deployment of New Nuclear Power Plants in the United States.

8. Portsmouth Gaseous Diffusion Plant Site, Final Environmental Impact Statement, May 1977.

9. Application for USNRC Certification, Portsmouth Gaseous Diffusion Plant Safety Analysis Report, Rev. 57, April 2002.

10. DOE/EA-1346, Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, 2002.

11. U.S. DOE Portsmouth Annual Environmental Report for 2000, Piketon, Ohio, December 2001.

12. Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site, June 1997.

13. DOE/EIS-0270D, Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site, December 1977.

5.8 Environmental Justice

Environmental justice refers to a federal policy intended to ensure that federal actions not result in disproportionately high and adverse environmental impacts on low-income or minority populations. President Clinton issued Executive Order 12898 in 1994 focusing federal agency attention on the issue.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

5.8.1 Evaluation of the INEEL Site

Environmental justice is assigned a ranking of 5 for all reactor types and the Bounding Plant.

The Region of Influence for INEEL consists of six counties (Bonneville, Bingham, Bannock, Jefferson, Butte, and Madison) and seven cities (Idaho Falls, Blackfoot, Pocatello, Ammon, and Rigby). In general, the region of interest is sparsely populated and homogeneous. There appears to be no basis to consider that a disproportionate impact on any low-income or minority population would occur because of the proposed siting activity.

5.8.2 Evaluation of the Portsmouth Site

Environmental justice is assigned a ranking of 5 for all reactor types and the Bounding Plant.

The environmental justice evaluation is performed by the appropriate federal agency. DOE recently performed an environmental assessment (Reference 1) for the Portsmouth site as part of its winterization activities for placing the facility in cold standby. As part of that assessment, an evaluation of potential environmental justice impacts was conducted.

The distribution of minority and economically disadvantaged populations in the Portsmouth area was studied to address environmental justice concerns. A four-county region of interest was identified. A minority population was defined as any area in which minority representation was greater than the national average of 24.2 percent. In all four counties, minority populations are smaller than the national average, ranging from a high of 8.9 percent to a low of 1.2 percent.

Since any adverse health or environmental impacts were postulated to fall most heavily on the individuals nearest the Portsmouth facility, it was deemed appropriate to examine the populations in the closest census tracts. The minority populations in the census tracts immediately surrounding the facility were examined. None of the tracts closest to the site had minority representation greater than the national average of 24.2 percent.

Individuals with income below the poverty level were identified in the four-county region of interest. For the study, a low-income population included any census tract (1990 data) in which the percentage of people with income below the poverty level was greater than the national average of 13.1 percent. The Ohio average in 1990 was 12.5 percent. Nearly all (41 of 48) of the census tracts in the four-county area qualified as low-income populations. The study concluded that no environmental justice impacts were expected because of the proposed action.

5.8.3 Evaluation of the Savannah River Site

Environmental justice is assigned a ranking of 5 for all reactor types and the Bounding Plant.

The environmental justice evaluation is performed by the appropriate federal agency. DOE has performed a number of environmental justice evaluations for the Savannah River Site. DOE prepared an environmental impact statement for the APT site, the primary focus of this assessment, which included an environmental justice evaluation.

The action proposed in the APT EIS (Reference 2) was the construction and operation of a linear accelerator that would produce tritium, a gaseous radioactive isotope of hydrogen essential to the operation of the weapons in the nation's nuclear arsenal. DOE's environmental justice evaluation examined whether minorities or low-income communities could receive disproportionately high and adverse human health and environmental impacts. Minority and low-income populations were identified by census tract. The DOE evaluated predicted average radiation doses received by minority and low-income individuals in those communities and compared them to the predicted per capita doses that other communities in a 50-mile region could receive. DOE also evaluated impacts of doses that downstream communities could receive from liquid effluents from all alternatives and potential impacts from non-radiological problems.

DOE's analysis concluded that releases would not disproportionably affect minority communities (population equal to or greater than 35 percent of the total population) or low-income (equal to or greater than 25 percent of the total population) in the 50-mile region because the compared per capita doses did not vary significantly. In addition, regarding downstream communities, DOE evaluated doses to people using the Savannah River for drinking water, sports, and food. Because the identified communities in the areas downstream from the SRS are well distributed, there were no disproportionate impacts among minority and low-income communities.

5.8.4 References

1. DOE/EA-1392, June 2001.

2. DOE/EIS-0270, March 1999.

6. Ranking and Selection of Preferred DOE Site

Site merit scores for the INEEL, Portsmouth, and Savannah River sites are listed in Table 6-1. These scores are based on the detailed spreadsheets presented in Tables 6-3 through 6-5. Table 6-2 identifies the order of site ranking for each criterion.

Table 6-1. Site Merit Scores[1]

Score	ABWR	AP1000	GT-MHR	IRIS	PBMR	Bounding Plant
INEEL Site						
Economic	198	198	188	198	198	188
Engineering	359	362	353	359	353	350
Environmental	419	419	419	419	419	419
Sociological	488	477	488	488	488	477
TOTAL SCORE	332	331	327	332	331	324
Portsmouth Site						
Economic	331	331	321	331	331	321
Engineering	360	371	351	368	365	348
Environmental	345	345	345	345	345	345
Sociological	477	453	477	477	477	453
TOTAL SCORE	369	366	363	370	370	358
Savannah River Site						
Economic	333	333	323	333	333	323
Engineering	389	394	385	391	388	382
Environmental	344	344	344	344	344	344
Sociological	500	489	500	500	500	489
TOTAL SCORE	380	379	375	380	380	372

[1] 500 is the maximum Site Merit score that can be achieved for the Total Site Merit or any criteria subgroup.

Table 6-2. Order of Site Ranking by Criterion

Criterion	Order of Site Ranking
Economic Criteria	
1. Electricity Projections	(1) Savannah River, (2) Portsmouth, (3) INEEL
2. Transmission System	(1) Portsmouth, (2) Savannah River, (3) INEEL
3. Stakeholder Support	(1) Savannah River, (2) Portsmouth, (3) INEEL
4. Site Development Costs	(1) Portsmouth and Savannah River, (2) INEEL
Engineering Criteria	
1. Site Size	(1) Savannah River and INEEL, (2) Portsmouth
2. Site Topography	(1) INEEL and Savannah River, (2) Portsmouth
3. Environmentally Sensitive Areas	All 3 sites ranked the same.
4. Emergency Planning	(1) INEEL, (2) Portsmouth and Savannah River
5. Labor Supply	(1) Savannah River, (2) Portsmouth, (3) INEEL
6. Transportation Access	(1) Portsmouth, (2) Savannah River, (3) INEEL
7. Security	(1) INEEL, (2) Portsmouth and Savannah River
8. Hazardous Land Uses	All 3 sites ranked the same.
9. Ease of Decommissioning	(1) Portsmouth and Savannah River, (2) INEEL
10. Water Rights and Air Permits	(1) Savannah River, (2) INEEL and Portsmouth
11. Regulatory	(1) Savannah River, (2) INEEL, (3) Portsmouth
12. Schedule	All 3 sites ranked the same.
13. Geologic Hazards	Exclusionary only; no rankings assigned.
14. Site-Specific SSE	(1) Portsmouth, (2) Savannah River, (3) INEEL
15. Capable Faults	(1) Savannah River, (2) Portsmouth, (3) INEEL
16. Liquefaction Potential	(1) INEEL and Portsmouth, (2) Savannah River
17. Bearing Material	(1) Portsmouth, (2) INEEL and Savannah River
18. Near Surface Material	(1) INEEL, (2) Portsmouth, (3) Savannah River
19. Groundwater	(1) INEEL, (2) Portsmouth, (3) Savannah River
20. Flooding Potential	(1) Portsmouth and Savannah River, (2) INEEL
21. Ice Formation	(1) Savannah River, (2) INEEL, (3) Portsmouth
22. Cooling Water Source	(1) Savannah River, (2) INEEL, (3) Portsmouth
23. Temperature & Moisture	(1) Portsmouth and Savannah River, (2) INEEL
24. Winds	(1) INEEL, (2) Portsmouth, (3) Savannah River
25. Rainfall	(1) INEEL and Portsmouth, (2) Savannah River
26. Snow	(1) Savannah River, (2) Portsmouth, (3) INEEL
27. Atmospheric Dispersion	All 3 sites ranked the same.

Table 6-2. Order of Site Ranking by Criterion

Criterion	Order of Site Ranking
Environmental Criteria	
1. Terrestrial Habitat	(1) INEEL and Savannah River, (2) Portsmouth
2. Terrestrial Vegetation	(1) INEEL and Portsmouth, (3) Savannah River
3. Aquatic Habitat/Organisms	(1) Portsmouth, (2) INEEL and Savannah River
4. Groundwater	(1) INEEL, (2) Portsmouth and Savannah River
5. Surface Water	(1) INEEL and Savannah River, (2) Portsmouth
6. Population	(1) INEEL, (2) Portsmouth and Savannah River
Sociological Criteria	
1. Present/Planned Land Use	All 3 sites ranked the same.
2. Demography	(1) Portsmouth and Savannah River, (2) INEEL
3. Socioeconomic Benefits	All 3 sites ranked the same.
4. Agricultural/Industrial	All 3 sites ranked the same.
5. Aesthetics	(1) INEEL and Savannah River, (2) Portsmouth
6. Historic/Archaeological	All 3 sites ranked the same.
7. Transportation Network	(1) Savannah River, (2) INEEL and Portsmouth
8. Environmental Justice	All 3 sites ranked the same.

The results of the ranking indicate that:

- The Savannah River and Portsmouth sites have the highest weighted scores for Economic criteria, followed by INEEL.
- The Savannah River site has the highest weighted score for Engineering criteria, followed by INEEL and Portsmouth.
- The INEEL site has the highest weighted score for Environmental criteria, followed by almost identical scores for Portsmouth and Savannah River.
- The Savannah River site has the highest weighted score for Sociological criteria, followed by INEEL and Portsmouth.
- The Savannah River site has the highest overall Site Merit score, followed by Portsmouth and INEEL.

Based on the results of the Part 2 evaluations, the Savannah River site ranks higher than INEEL and Portsmouth and, thus, is the preferred DOE site selected to prepare an Early Site Permit cost estimate.

It should be noted that this ranking is strongly dependent on the economic factors for construction of a large commercial power facility. The near-term electric market projections for Portsmouth and INEEL are not as strong as for the Savannah River site. For INEEL, transmission access is another concern that would have to be resolved for a large commercial power facility. The ranking of the sites for a small demonstration reactor could be significantly different than the above ranking for a commercial nuclear power facility because power market factors would likely be assigned a lower weighting and transmission access would be less of an issue for a lower plant output.

Table 6-3. INEEL Site Merit Calculation
(Sheet 1 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ECONOMIC (0.4)	1. Electricity Projections	40	1.7	68	1.7	68	1.7	68	1.7	68	1.7	68	1.7	68
	2. Transmission System	30	1	30	1	30	1	30	1	30	1	30	1	30
	3. Stakeholder Support	20	4	80	4	80	4	80	4	80	4	80	4	80
	4. Site Development Costs	10	2	20	2	20	1	10	2	20	2	20	1	10
	Subtotal	100	--	198	--	198	--	188	--	198	--	198	--	188
ENGINEERING (0.2)	1. Site Size	6	5	30	5	30	5	30	5	30	5	30	5	30
	2. Site Topography	3	5	15	5	15	5	15	5	15	5	15	5	15
	3. Environmentally Sensitive Areas	6	5	30	5	30	5	30	5	30	5	30	5	30
	4. Emergency Planning	6	5	30	5	30	5	30	5	30	5	30	5	30
	5. Labor Supply	3	1	3	1	3	1	3	1	3	1	3	1	3
	6. Transportation Access	3	1	3	1	3	1	3	1	3	1	3	1	3
	7. Security	3	5	15	5	15	5	15	5	15	4	12	4	12
	8. Hazardous Land Uses	3	5	15	5	15	5	15	5	15	5	15	5	15
	9. Ease of Decommissioning	3	3	9	3	9	2	6	2	6	2	6	2	6
	10. Water and Air	5	4	20	4	20	4	20	4	20	4	20	4	20
	11. Regulatory	5	4.2	21	4.2	21	4.2	21	4.2	21	4.2	21	4.2	21
	12. Schedule	5	3	15	3	15	3	15	3	15	3	15	3	15
	13. Geologic Hazards	---	---	---	---	---	---	---	---	---	---	---	---	---
	14. Site-Specific SSE	6	1	6	1	6	1	6	1	6	1	6	1	6

Table 6-3. INEEL Site Merit Calculation
(Sheet 2 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ENGINEERING (0.2)	15. Capable Faults	6	1	6	1	6	1	6	1	6	1	6	1	6
	16. Liquefaction Potential	5	5	25	5	25	5	25	5	25	5	25	5	25
	17. Bearing Material	3	2	6	3	9	1	3	3	9	3	9	1	3
	18. Near-Surface Material	2	4	8	4	8	4	8	4	8	4	8	4	8
	19. Groundwater	3	5	15	5	15	5	15	5	15	5	15	5	15
	20. Flooding Potential	5	3	15	3	15	3	15	3	15	3	15	3	15
	21. Ice Formation	2	3	6	3	6	3	6	3	6	3	6	3	6
	22. Cooling Water Source	6	3	18	3	18	3	18	3	18	3	18	3	18
	23. Temperature & Moisture	2	4.5	9	4.5	9	4.5	9	4.5	9	4.5	9	4.5	9
	24. Winds	2	5	10	5	10	5	10	5	10	5	10	5	10
	25. Rainfall	2	5	10	5	10	5	10	5	10	5	10	5	10
	26. Snow	2	2	4	2	4	2	4	2	4	2	4	2	4
	27. Atmospheric Dispersion	3	5	15	5	15	5	15	5	15	5	15	5	15
	Subtotal	100	---	359	---	362	---	353	---	359	---	353	---	350

Table 6-3. INEEL Site Merit Calculation
(Sheet 3 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ENVIRONMENTAL (0.2)	1. Terrestrial Habitat	14	4	56	4	56	4	56	4	56	4	56	4	56
	2. Terrestrial Vegetation	14	5	70	5	70	5	70	5	70	5	70	5	70
	3. Aquatic Habitat/Organisms	17	4	68	4	68	4	68	4	68	4	68	4	68
	4. Groundwater	17	3	51	3	51	3	51	3	51	3	51	3	51
	5. Surface Water	16	4	64	4	64	4	64	4	64	4	64	4	64
	6. Population	22	5	110	5	110	5	110	5	110	5	110	5	110
	Subtotal	100	--	419	--	419	--	419	--	419	--	419	--	419
SOCIOLOGICAL (0.2)	1. Present/Planned Land Use	13	5	65	5	65	5	65	5	65	5	65	5	65
	2. Demography	12	4	48	4	48	4	48	4	48	4	48	4	48
	3. Socioeconomic Benefits	17	5	85	5	85	5	85	5	85	5	85	5	85
	4. Agricultural/Industrial	10	5	50	5	50	5	50	5	50	5	50	5	50
	5. Aesthetics	11	5	55	4	44	5	55	5	55	5	55	4	44
	6. Historic/Archaeological	12	5	60	5	60	5	60	5	60	5	60	5	60
	7. Transportation Network	12	5	60	5	60	5	60	5	60	5	60	5	60
	8. Environmental Justice	13	5	65	5	65	5	65	5	65	5	65	5	65
	Subtotal	100	---	488	---	477	---	488	---	488	---	488	---	477
SITE MERIT (SM)			332		331		327		332		331		324	

Table 6-4. Portsmouth Site Merit Calculation
(Sheet 1 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ECONOMIC (0.4)	1. Electricity Projections	40	2.5	100	2.5	100	2.5	100	2.5	100	2.5	100	2.5	100
	2. Transmission System	30	4	120	4	120	4	120	4	120	4	120	4	120
	3. Stakeholder Support	20	4.3	86	4.3	86	4.3	86	4.3	86	4.3	86	4.3	86
	4. Site Development Costs	10	2.5	25	2.5	25	1.5	15	2.5	25	2.5	25	1.5	15
	Subtotal	100	--	331	--	331	--	321	--	331	--	331	--	321
ENGINEERING (0.2)	1. Site Size	6	3	18	4	24	3	18	4	24	4	24	3	18
	2. Site Topography	3	4	12	4	12	4	12	4	12	4	12	4	12
	3. Environmentally Sensitive Areas	6	5	30	5	30	5	30	5	30	5	30	5	30
	4. Emergency Planning	6	4	24	4	24	4	24	4	24	4	24	4	24
	5. Labor Supply	3	2	6	2	6	2	6	2	6	2	6	2	6
	6. Transportation Access	3	5	15	5	15	5	15	5	15	5	15	5	15
	7. Security	3	4	12	4	12	4	12	4	12	3	9	3	9
	8. Hazardous Land Uses	3	5	15	5	15	5	15	5	15	5	15	5	15
	9. Ease of Decommissioning	3	4	12	4	12	3	9	3	9	3	9	3	9
	10. Water and Air	5	4	20	4	20	4	20	4	20	4	20	4	20
	11. Regulatory	5	3.4	17	3.4	17	3.4	17	3.4	17	3.4	17	3.4	17
	12. Schedule	5	3	15	3	15	3	15	3	15	3	15	3	15
	13. Geologic Hazards	---	---	---	---	---	---	---	---	---	---	---	---	---
	14. Site-Specific SSE	6	2	12	2	12	2	12	2	12	2	12	2	12

Table 6-4. Portsmouth Site Merit Calculation
(Sheet 2 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ENGINEERING (0.2)	15. Capable Faults	6	2	12	2	12	2	12	2	12	2	12	2	12
	16. Liquefaction Potential	5	5	25	5	25	5	25	5	25	5	25	5	25
	17. Bearing Material	3	3	9	4.5	13.5	1	3	4.5	13.5	4.5	13.5	1	3
	18. Near-Surface Material	2	3.5	7	3.5	7	3.5	7	3.5	7	3.5	7	3.5	7
	19. Groundwater	3	3	9	3	9	3	9	3	9	3	9	3	9
	20. Flooding Potential	5	5	25	5	25	5	25	5	25	5	25	5	25
	21. Ice Formation	2	2	4	2	4	2	4	2	4	2	4	2	4
	22. Cooling Water Source	6	2	12	2	12	2	12	2	12	2	12	2	12
	23. Temperature & Moisture	2	5	10	5	10	5	10	5	10	5	10	5	10
	24. Winds	2	4	8	4	8	4	8	4	8	4	8	4	8
	25. Rainfall	2	5	10	5	10	5	10	5	10	5	10	5	10
	26. Snow	2	3	6	3	6	3	6	3	6	3	6	3	6
	27. Atmospheric Dispersion	3	5	15	5	15	5	15	5	15	5	15	5	15
	Subtotal	100	---	360	---	370.5	---	351	---	367.5	---	364.5	---	348

Table 6-4. Portsmouth Site Merit Calculation
(Sheet 3 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ENVIRONMENTAL (0.2)	1. Terrestrial Habitat	14	3	42	3	42	3	42	3	42	3	42	3	42
	2. Terrestrial Vegetation	14	5	70	5	70	5	70	5	70	5	70	5	70
	3. Aquatic Habitat/Organisms	17	5	85	5	85	5	85	5	85	5	85	5	85
	4. Groundwater	17	2	34	2	34	2	34	2	34	2	34	2	34
	5. Surface Water	16	3	48	3	48	3	48	3	48	3	48	3	48
	6. Population	22	3	66	3	66	3	66	3	66	3	66	3	66
	Subtotal	100	--	345	--	345	--	345	--	345	--	345	--	345
SOCIOLOGICAL (0.2)	1. Present/Planned Land Use	13	5	65	4	52	5	65	5	65	5	65	4	52
	2. Demography	12	5	60	5	60	5	60	5	60	5	60	5	60
	3. Socioeconomic Benefits	17	5	85	5	85	5	85	5	85	5	85	5	85
	4. Agricultural/Industrial	10	5	50	5	50	5	50	5	50	5	50	5	50
	5. Aesthetics	11	4	44	3	33	4	44	4	44	4	44	3	33
	6. Historic/Archaeological	12	5	60	5	60	5	60	5	60	5	60	5	60
	7. Transportation Network	12	4	48	4	48	4	48	4	48	4	48	4	48
	8. Environmental Justice	13	5	65	5	65	5	65	5	65	5	65	5	65
	Subtotal	100	---	477	---	453	---	477	---	477	---	477	---	453
SITE MERIT (SM)			369		366		363		370		370		358	

Table 6-5. Savannah River Site Merit Calculation
(Sheet 1 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ECONOMIC (0.4)	1. Electricity Projections	40	3.7	148	3.7	148	3.7	148	3.7	148	3.7	148	3.7	148
	2. Transmission System	30	2	60	2	60	2	60	2	60	2	60	2	60
	3. Stakeholder Support	20	5	100	5	100	5	100	5	100	5	100	5	100
	4. Site Development Costs	10	2.5	25	2.5	25	1.5	15	2.5	25	2.5	25	1.5	15
	Subtotal	100	--	333	--	333	--	323	--	333	--	333	--	323
ENGINEERING (0.2)	1. Site Size	6	5	30	5	30	5	30	5	30	5	30	5	30
	2. Site Topography	3	5	15	5	15	5	15	5	15	5	15	5	15
	3. Environmentally Sensitive Areas	6	5	30	5	30	5	30	5	30	5	30	5	30
	4. Emergency Planning	6	4	24	4	24	4	24	4	24	4	24	4	24
	5. Labor Supply	3	4	12	4	12	4	12	4	12	4	12	4	12
	6. Transportation Access	3	4	12	4	12	4	12	4	12	4	12	4	12
	7. Security	3	4	12	4	12	4	12	4	12	3	9	3	9
	8. Hazardous Land Uses	3	5	15	5	15	5	15	5	15	5	15	5	15
	9. Ease of Decommissioning	3	4	12	4	12	3	9	3	9	3	9	3	9
	10. Water and Air	5	4.5	22.5	4.5	22.5	4.5	22.5	4.5	22.5	4.5	22.5	4.5	22.5
	11. Regulatory	5	4	20	4	20	4	20	4	20	4	20	4	20
	12. Schedule	5	3	15	3	15	3	15	3	15	3	15	3	15
	13. Geologic Hazards	---	---	---	---	---	---	---	---	---	---	---	---	---
	14. Site-Specific SSE	6	1.5	9	1.5	9	1.5	9	1.5	9	1.5	9	1.5	9

Table 6-5. Savannah River Site Merit Calculation
(Sheet 2 of 3)

CRITERIA			REACTOR TYPE											
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR		AP1000		GT-MHR		IRIS		PBMR		Bounding Plant	
			R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$	R_j	$SW_{ij}R_j$
ENGINEERING (0.2)	15. Capable Faults	6	4	24	4	24	4	24	4	24	4	24	4	24
	16. Liquefaction Potential	5	3	15	3	15	3	15	3	15	3	15	3	15
	17. Bearing Material	3	1.5	4.5	3	9	1	3	3	9	3	9	1	3
	18. Near-Surface Material	2	2.5	5	2.5	5	2.5	5	2.5	5	2.5	5	2.5	5
	19. Groundwater	3	2	6	2	6	2	6	2	6	2	6	2	6
	20. Flooding Potential	5	5	25	5	25	5	25	5	25	5	25	5	25
	21. Ice Formation	2	5	10	5	10	5	10	5	10	5	10	5	10
	22. Cooling Water Source	6	4	24	4	24	4	24	4	24	4	24	4	24
	23. Temperature & Moisture	2	5	10	5	10	5	10	5	10	5	10	5	10
	24. Winds	2	3	6	3	6	3	6	3	6	3	6	3	6
	25. Rainfall	2	4	8	4	8	4	8	4	8	4	8	4	8
	26. Snow	2	4	8	4	8	4	8	4	8	4	8	4	8
	27. Atmospheric Dispersion	3	5	15	5	15	5	15	5	15	5	15	5	15
	Subtotal	100	---	389	---	393.5	---	384.5	---	390.5	---	387.5	---	381.5

Table 6-5. Savannah River Site Merit Calculation
(Sheet 3 of 3)

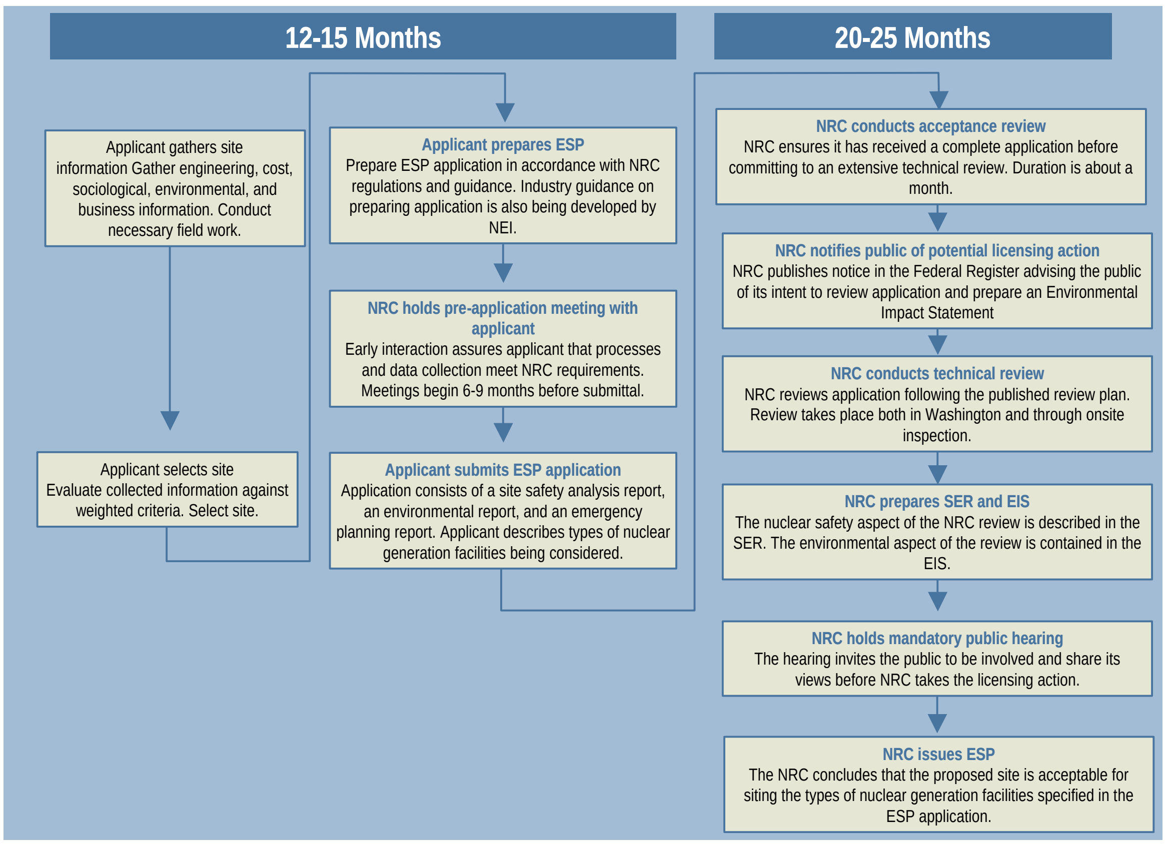
GROUP & WEIGHT W_i	CRITERION b_j	Weighting SW_{ij}	ABWR R_j	ABWR $SW_{ij}R_j$	AP1000 R_j	AP1000 $SW_{ij}R_j$	GT-MHR R_j	GT-MHR $SW_{ij}R_j$	IRIS R_j	IRIS $SW_{ij}R_j$	PBMR R_j	PBMR $SW_{ij}R_j$	Bounding Plant R_j	Bounding Plant $SW_{ij}R_j$
ENVIRONMENTAL (0.2)	1. Terrestrial Habitat	14	4	56	4	56	4	56	4	56	4	56	4	56
	2. Terrestrial Vegetation	14	4	56	4	56	4	56	4	56	4	56	4	56
	3. Aquatic Habitat/Organisms	17	4	68	4	68	4	68	4	68	4	68	4	68
	4. Groundwater	17	2	34	2	34	2	34	2	34	2	34	2	34
	5. Surface Water	16	4	64	4	64	4	64	4	64	4	64	4	64
	6. Population	22	3	66	3	66	3	66	3	66	3	66	3	66
	Subtotal	100	--	344	--	344	--	344	--	344	--	344	--	344
SOCIOLOGICAL (0.2)	1. Present/Planned Land Use	13	5	65	5	65	5	65	5	65	5	65	5	65
	2. Demography	12	5	60	5	60	5	60	5	60	5	60	5	60
	3. Socioeconomic Benefits	17	5	85	5	85	5	85	5	85	5	85	5	85
	4. Agricultural/Industrial	10	5	50	5	50	5	50	5	50	5	50	5	50
	5. Aesthetics	11	5	55	4	44	5	55	5	55	5	55	4	44
	6. Historic/Archaeological	12	5	60	5	60	5	60	5	60	5	60	5	60
	7. Transportation Network	12	5	60	5	60	5	60	5	60	5	60	5	60
	8. Environmental Justice	13	5	65	5	65	5	65	5	65	5	65	5	65
	Subtotal	100	---	500	---	489	---	500	---	500	---	500	---	500
SITE MERIT (SM)			380		379		375		380		380		372	

7. ESP Estimate for the Preferred DOE Site

The Early Site Permit process has been assessed to estimate the resources required to prepare an ESP Application for the Savannah River site and support the NRC review and approval process, including a mandatory public hearing. Figure 7-1 shows the overall process for an Early Site Permit.

Table 7-1 provides a breakdown of the estimated resources necessary to prepare an ESP Application

Figure 7-1. Early Site Permit Process



for the Savannah River site and support the NRC review and approval process, including the mandatory hearing. For each section of the ESP Application, Table 7-1 estimates the resources to: (1) collect data; (2) perform necessary analyses, evaluations, and calculations; and (3) write the section. A description of the work scope for each section of the ESP Application is provided. Levels of effort activities, such as project management, project engineering, administration, etc., are also specified. Table 7-2 outlines the overall resources by type over the project duration based on the schedule shown in Figure 7-2. Table 7-3 provides an order-of-magnitude cost estimate for the ESP effort.

Preparation of the ESP Application

Based on a review of 10 CFR 52 and related NRC and industry guidance documents, and participation in the Nuclear Energy Institute (NEI) ESP Task Force, a detailed outline of an ESP Application for the Savannah River site has been developed and is presented in Table 7-1. Major parts of the ESP Application are described below; detailed descriptions of each section of the ESP Application are provided in Table 7-1. Based on interactions between the NEI ESP Task Force and the NRC Staff over the next several months, changes to the ESP Application outline are expected.

- Part 0 – Transmittal Letter

A transmittal letter is prepared in accordance with the requirements of 10 CFR 50.30(b) and signed by a company executive under oath or affirmation.

- Part 1 – Administrative Information

This section of the ESP Application contains basic information about the applicant such as name, address, and company information. In the regulated electric industry, this section was relatively straightforward. However, with the advent of deregulation, competition, and merchant plants, it is expected that the NRC will give greater scrutiny to this section. The NRC's legal and financial requirements are addressed.

- Part 2 – Site Safety Analysis Report

Key topics addressed in the Site Safety Analysis Report (SSAR) include the description of the site, a description of the proposed facilities sufficient to evaluate various site characteristics, an assessment of site features affecting the facility design(s), and the seismic, meteorological, hydrologic, and geologic characteristics of the site.

An important element of the SSAR that requires substantial analysis and evaluation is the identification and characterization of seismic sources and the determination of the seismic response spectra for the site. The assessment of earthquake potential in accordance with the applicable NRC requirements and guidance as outlined in 10 CFR 52, 10 CFR 100.23, 10 CFR 50 Appendix S, Regulatory Guide 1.165, etc., is a carefully planned activity relying on industry experts in this field.

Existing guidance, such as Regulatory Guide 1.70, "Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants," Regulatory Guide 4.7, “General Site Suitability Criteria for Nuclear Power Plants,” and NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants” is used in the preparation of the SSAR. Careful consideration is given to the fact that a significant portion of the NRC guidance is dated or is written to support the Part 50 licensing process.

- Part 3 – Environmental Report

A complete Environmental Report (ER) is required by NRC regulations to support an ESP Application. The ER must focus on the environmental impacts of construction and operation of the proposed facilities.

The Environmental Report includes these descriptions and assessments:

- Purpose of the proposed facility and associated transmission
- Site and environmental interfaces
- Environmental impacts of site preparation, plant construction, and transmission facilities
- Environmental impacts of plant operations
- Effluent and environmental measurement and monitoring programs
- Economic and social impacts of station construction and operation
- Alternate energy sources and sites
- Station design alternatives
- Summary cost-benefits analyses

Existing environmental information for the site is used to the extent applicable.

Again, careful consideration is given to the fact that a significant portion of the NRC guidance is dated or is written to support the Part 50 licensing process.

- Part 4 – Major Features Emergency Plan

Part 52 requires that an ESP Application "identify physical characteristics unique to the proposed site, such as egress limitations from the area surrounding the site, that could pose a significant impediment to the development of emergency plans." The Application may also either:

- Propose major features of an emergency plan, such as exact sizes of the emergency planning zones; or

- Propose complete and integrated emergency plans for review and approval by the NRC, in consultation with the Federal Emergency Management Agency.

Developing a complete and integrated plan requires detailed design information on the specific reactor technologies. Because this level of detail may not be available during the Savannah River ESP process, a Major Features Emergency Plan is prepared.

A focus of the Major Features Emergency Plan is to identify any physical characteristics unique to the site, such as egress limitations from the area surrounding the site, which could pose a significant impediment to the development of a final emergency plan.

- Part 5 – Programs and Plans

For Early Site Permit Applications, two plans have been identified as required:

- Quality Assurance Program (QAP) to govern ESP activities. The ESP Application includes a summary of the stand-alone QAP.
- Site Redress Plan per 10 CFR 52.25 that would allow for limited site preparation activities after the NRC issues the Early Site Permit, but before issuing a combined license.

* * *

Also included as part of the preparation of the ESP Application are the following activities:

- Development of a Plant Parameters Envelope (PPE) for each of the reactor types under consideration including a Bounding PPE that envelopes all of the reactor types and forms the basis for the SSAR and ER evaluations. The Bounding PPE approach is currently under discussion between the NEI ESP Task Force and the NRC Staff and may change in the upcoming months.

- Development of a Writer's Guide for the ESP Application.

- Development and implementation of a Communication Plan that identifies affected stakeholders, their role, their information requirements, and appropriate schedules for maintaining good communications.

- Routine interaction with the NRC Staff, the NEI ESP Task Force, and other industry groups to identify and resolve generic and site-specific issues affecting the ESP process.

Support of the NRC Review and Hearing Process

The NRC has developed substantial information to guide its staff in the review of safety analysis reports, environmental reports, emergency plans, quality assurance programs, etc. Additional guidance specific to ESP Applications is being prepared.

Interactions with the NRC Staff in the ESP process are expected to proceed in a manner similar to that used by the NRC and industry for license renewal. That is, the NRC will identify issues on an ongoing basis during the course of their review and informal communication (e.g., e-mail, telephone calls) will be used to quickly resolve those items. Formal communications (e.g., NRC letters requesting additional information) will be reserved for those instances where the informal means are insufficient to successfully resolve the issue.

Major parts of the NRC's review process are shown in Figure 7-1 and described below.

- Site Safety Review

The NRC Staff's Site Safety Review will encompass characteristics and phenomena associated with the site and vicinity that may adversely affect plant operation or, in the worst case, initiate a major core damage accident. The NRC Staff review will address:

- Geography and demography
- Nearby industrial, transportation, and military facilities
- Meteorology
- Hydrology
- Geology and seismology

The NRC Staff will publish the results of their review in a Safety Evaluation Report.

- Environmental Review

The NRC Staff is required to examine the impacts of the proposed plant on the environment. Although the specific reactor type or design will not be known at the time of the review, the ESP Application will provide adequate information so that the NRC Staff can evaluate the environmental impacts of construction and operation of a reactor or reactors that have characteristics that fall within the Bounding PPE. Those parameters include the number, type, and thermal power level of the facilities for which the site may be used, the site boundary, the proposed general location of facilities within such boundaries, the anticipated maximum radiological and thermal effluent each facility will produce, and the type of cooling systems, intakes, and outflows of each facility. The NRC Staff will evaluate this and other relevant information to prepare an Environmental Impact Statement.

- Emergency Preparedness Review

The NRC Staff is required to make a finding with regard to site emergency preparedness. Under the "major features" alternative of 10 CFR 52, the NRC will review the exact sizes of the emergency planning zones and the contacts and arrangements made with local, state, and federal governmental agencies with emergency planning responsibilities. The NRC is expected to approve those plans and arrangements in consultation with FEMA (Federal Emergency Management Agency).

- Hearing Process

The Early Site Permit process requires an adjudicatory hearing, which is currently subject to the NRC's formal Rules of Practice, contained in subpart G of 10 CFR Part 2. The complexity and length of the hearing will depend on the level of public intervention in the hearing process, the quality of the application, the effectiveness of public communications both before and during the application review, and the degree of public confidence in the applicant and its existing operations. The complexity and length of any hearing is also greatly affected by the discipline of the Atomic Safety and Licensing Board (ASLB) empanelled to conduct the hearing and the degree of oversight by the Commissioners.

Through pre-application interactions, the NRC will be encouraged to apply case management techniques similar to those that were successfully used by the NRC to conduct efficient hearings during license renewal proceedings. Clear direction to the ASLB concerning the scope and duration of any hearing, as well as continuing oversight of the board during any hearing, will be critical. It is assumed that the Commission will issue a case management order to (1) clearly define the scope of the hearing, (2) limit admission of contentions seeking to reopen matters already resolved in the licensing basis of the site, (3) set specific milestones for the hearing, (4) use established case management procedures to place reasonable limits on discovery, and (5) apply the principles of the NRC's Statement of Policy on Conduct of Adjudicatory Proceedings including electronic service of all pleadings to improve the efficiency of the hearing.

Efficient conduct of the hearing requires:

— Intervenors to plead their contentions within a reasonable time after the application is publicly available so that the NRC Staff can consider the contentions while it is performing its technical and environmental review.

— Making information on admitted contentions readily available shortly after a contention is admitted to decrease the need for formal discovery.

— Placing reasonable limits on formal discovery requests.

— Beginning evidentiary hearings on contested issues as soon as practicable after the NRC Staff has reached a position on those contentions–ideally very shortly after the NRC Staff issues its initial Safety Evaluation Report and draft Environmental Impact Statement.

— Setting a specific milestone by which the ASLB would issue its decision after the completion of any evidentiary hearing. A 90-day period is considered reasonable.

An uncontested case is assumed for the Savannah River ESP. As such, the NRC will be requested to establish a milestone schedule to support a decision by the ASLB within 60 days after the issuance of the final Safety Evaluation Report and Final Environmental Impact Statement.

The proactive approach described above, which builds off of successful experience with license renewal, should minimize the potential of hearing delay. Beyond establishing this framework for success, necessary steps must be taken during the hearing to resolve all admitted contentions correctly and expeditiously, through response to contentions, summary disposition, or evidentiary hearing, as appropriate.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
PART 0 – TRANSMITTAL LETTER						
---	Transmittal Letter – Signed under Oath or Affirmation	10 CFR 50.30(b)	0	0	0	0
PART 1 – ADMINISTRATIVE INFORMATION						
---	Table of Contents List of Tables List of Figures Abbreviations and Acronyms	• 10 CFR 52.17 • 10 CFR 50.33 • NEI 01-02, Section 3.1	0	0	0	0
1.	INTRODUCTION	None	0	0	LIC 60	60 hours
2	APPLICATION FORMAT AND CONTENT This section provides a general introduction to the parts of the ESP Application and describes the control of revisions.	None	0	0	Included in Section 1.	Included in Section 1.
3.	INFORMATION REQUIRED BY 10 CFR 50.33(a) THROUGH (d) This section provides the following information required by 10 CFR 50.33(a) through (d): • Name of Applicant • Address of Applicant • Description of Business or Occupation of Applicant • Applicant Information	• 10 CFR 50.33(a) • 10 CFR 50.33(b) • 10 CFR 50.33(c) • 10 CFR 50.33(d)	0	0	Included in Section 1.	Included in Section 1.
4.	REFERENCES	None	0	0	Included in Section 1.	Included in Section 1.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
PART 2 – SITE SAFETY ANALYSIS REPORT						
---	Table of Contents List of Tables List of Figures Abbreviations and Acronyms	• 10 CFR 52.17(a)(1) • 10 CFR 50.34(a)(1) • 10 CFR 100 • Regulatory Guide 1.70 • NEI 01-02, Section 3.2	0	0	0	0
1.	INTRODUCTION AND GENERAL DESCRIPTIONS This section provides an introduction to the material in Sections 1.1 through 1.4.	• Regulatory Guide 1.70, Chapter 1	0	0	0	0
1.1	Introduction This section provides an introduction to the SSAR.	• Regulatory Guide 1.70, Section 1.1	0	0	0	0
1.2	General Site Description This section provides a general description of the site and environs. Issues that will be addressed include distances to major towns, rivers, and other geographical features; figure(s) showing the location of the significant plant facilities; site ownership; site environment; and maps showing land use, meteorology, hydrology, geology, seismology, monitoring, other issues. 2 to 3 paragraphs are written on each issue. Reference is made to Section 2 for detailed site information.	None	0	0	ENV2 16 ENV4 8 GHES2 16 GHES5 8	48 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
1.3	General Plant Descriptions This section provides an introduction to the new reactor facilities under consideration (ABWR, AP1000, GT-MHR, IRIS, and PBMR) based on information and descriptions provided by the reactor vendors. The level of detail included throughout Section 1.3 is consistent with typical UFSAR Chapter 1 descriptions. Issues addressed are expected to include number of units, power level, plant location and arrangement, principal structures, reactor system, power conversion system, plant cooling systems, safety features, auxiliary systems, effluents, shared facilities and equipment, etc. 1 to 3 pages are written for each reactor type based on information from the reactor vendors. Much of this information is also used in Environmental Report Section 3. Also included in support of this section and others is the effort to perform the detailed siting, layout, and arrangement evaluations for each reactor design. Site layout drawings are produced for each design.	• 10 CFR 52.17(a)(1)(i) • Regulatory Guide 1.70, Section 1.2 • NEI 01-02, Section 3.2.1	TECH 620	MECH 800 CIV 1000 ELEC 400 CONS 200	TECH 400	3420 hours
1.3.1	Advanced Boiling Water Reactor	See Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.
1.3.2	AP1000	See Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.
1.3.3	Gas Turbine – Modular Helium Reactor	See Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.
1.3.4	International Reactor Innovative and Secure	See Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.
1.3.5	Pebble Bed Modular Reactor	See Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.	Included in Section 1.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
1.4	Site Safety Assessment This section contains an analysis and evaluation of the major structures, systems, and components of the facility that bear significantly on the acceptability of the site under the radiological consequence evaluation factors identified in 10 CFR 50.34(a)(1).	• 10 CFR 52.17(a)(1) • 10 CFR 50.34(a)(1) • 10 CFR 100	NUC 24	ENV3 12 NUC 24	NUC 32	92 hours
1.5	Site Conformance With Part 100 Criteria The results of evaluations of offsite dose consequences from bounding design basis accidents and severe accidents are presented based on input from the reactor vendors. This section is similar in scope to ER Sections 7.1 and 7.2.	• 10 CFR 52.17(a)(1) • 10 CFR 50.34(a)(1) • 10 CFR 100	NUC 100	ENV2 24 ENV4 24 NUC 160	NUC 60	368 hours
1.6	Plant Parameters Envelope Data Based on Sections 1.3.1 through 1.3.5, input from the reactor vendors, and the EPRI plant parameter envelope effort, the PPEs for each reactor type are presented. In addition, the PPEs for a bounding plant, intended to envelope all 5 of the reactor types are also presented. The table format provided in Appendix C to NEI 01-02 is used to present the PPEs.	• NEI 01-02, Section 3.2.1.1 • NEI 01-02, Appendix C	TECH 40	0	TECH 40	80 hours
2.	SITE CHARACTERISTICS This section provides an introduction to the material in Sections 2.1 through 2.5.	• Regulatory Guide 1.70, Chapter 2	0	0	0	0
2.1	Geography and Demography This section provides an introduction to the material in Sections 2.1.1 through 2.1.3.	• Regulatory Guide 1.70, Section 2.1	ENV1 18 ENV2 36 ENV3 14 ENV4 24	ENV1 20 ENV2 40 ENV3 16 ENV4 24	ENV1 12 ENV2 24 ENV3 10 ENV4 14	252 hours
2.1.1	Site Location and Description This section provides site information based on existing SRS documents.	• 10 CFR 52.17(a)(1)(ii) • Regulatory Guide 1.70, Section 2.1.1 • NUREG-0800, Section 2.1.1	Included in Section 2.1.	Included in Section 2.1.	Included in Section 2.1.	Included in Section 2.1.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
2.1.2	Exclusion Area Authority and Control This section determines the exclusion area boundary authority and control, surface and mineral rights, and easements.	• Regulatory Guide 1.70, Section 2.1.2 • NUREG-0800, Section 2.1.2	Included in Section 2.1.	Included in Section 2.1.	Included in Section 2.1.	Included in Section 2.1.
2.1.3	Population Distribution This section updates existing population distribution information. Population distribution data for up to 50 miles is included using Year 2000 census data. The Low Population Zone (LPZ), population centers, population density, and public facilities are identified. Local agencies are contacted to assess transient population and to identify local public facilities and institutions.	• 10 CFR 52.17(a)(1)(viii) • Regulatory Guide 1.70, Section 2.1.3 • NUREG-0800, Section 2.1.3	Included in Section 2.1.	Included in Section 2.1.	Included in Section 2.1.	Included in Section 2.1.
2.2	Nearby Industrial, Transportation, and Military Facilities This section provides an introduction to the material in Sections 2.2.1 through 2.2.3 regarding the potential impacts of industrial facilities and transportation in the site area relative to the safe operation of the new nuclear facility.	• 10 CFR 52.17(a)(1)(vii) • Regulatory Guide 1.70, Section 2.2 • NUREG-0800, Section 2.2	ENV1 20 ENV2 40	ENV1 24 ENV2 120 ENV3 20 ENV4 20	ENV1 40 ENV2 48 ENV3 20 ENV4 20	372 hours
2.2.1	Locations and Routes This section describes transportation-related information for the site from existing SRS documents.	• Regulatory Guide 1.70, Section 2.2.1 • NUREG-0800, Section 2.2.1 – 2.2.2	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.
2.2.2	Descriptions This section uses recent site evaluation information on facilities, products, materials, pipelines, waterways, airports, and industrial growth. This section updates information on facilities, products, materials, pipelines, waterways, airports, and industrial growth.	• Regulatory Guide 1.70, Section 2.2.2 • NUREG-0800, Section 2.2.1 – 2.2.2	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.2.3	Evaluation of Potential Accidents This section uses updated information on traffic and facility operation related accidents involving potential accidental releases of toxic chemicals. Control room toxic gas exposure due to accidental releases of hazardous chemicals stored and/or transported on site and offsite is analyzed.	• Regulatory Guide 1.70, Section 2.2.3 • NUREG-0800, Section 2.2.3	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.
2.3	Meteorology This section provides an introduction to the material in Sections 2.3.1 through 2.3.5.	• 10 CFR 52.17(a)(1)(vi) • Regulatory Guide 1.70, Section 2.3 • NUREG-0800, Section 2.3 • NEI 01-02, Section 3.2.2.2 • Regulatory Guides 1.3, 1.4, 1.23, 1.27, 1.76, 1.145, 1.117	ENV1 32 ENV2 32	ENV1 40 ENV2 120 ENV4 24	ENV1 40 ENV2 48 ENV3 20 ENV4 20	376 hours
2.3.1	Regional Climatology This section describes the regional climate and provides meteorological conditions for design and operating bases.	• Regulatory Guide 1.70, Section 2.3.1 • NUREG-0800, Section 2.3.1	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.
2.3.2	Local Meteorology This section describes the normal and extreme values of meteorological parameters at the site.	• Regulatory Guide 1.70, Section 2.3.2 • NUREG-0800, Section 2.3.2	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.
2.3.3	Onsite Meteorological Measurements Program This section addresses the addition of new nuclear units to the existing SRS onsite meteorological monitoring program and includes an evaluation of the appropriateness of using the existing meteorological tower. This section is based on the current meteorological measurements program and information on data processing (including software), collection, instrumentation inspection, and maintenance.	• Regulatory Guide 1.70, Section 2.3.3 • NUREG-0800, Section 2.3.3	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.3.4	Short-Term Diffusion Estimates This section provides short-term diffusion estimates. The estimates of X/Qs at the exclusion area boundary and low population zone are performed using the NRC PAVAN (Regulatory Guide Section 1.145) dispersion model. The appropriate, most recent 3 years of combined joint frequency of wind speed, wind direction, and atmospheric stability class data are extracted from the existing SRS onsite meteorological program.	• Regulatory Guide 1.70, Section 2.3.4 • NUREG-0800, Section 2.3.4 • Regulatory Guide 1.145	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.
2.3.5	Long-Term Diffusion Estimates This section provides long-term diffusion estimates. The estimates of X/Qs from routine releases at the LPZ and out to 50 miles are determined using the NRC-approved, XOQDOQ (NUREG-0324, Reg. Guide 1.111) dispersion model. The appropriate, most recent 3 years of combined joint frequency of wind speed, wind direction, and atmospheric stability class data are extracted from the existing SRS onsite meteorological program.	• Regulatory Guide 1.70, Section 2.3.5 • NUREG-0800, Section 2.3.5	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.
2.4	Hydrology This section provides an introduction to the material in Sections 2.4.1 through 2.4.14. Section 2.4 is prepared based on information from the existing SRS and published documents, using Regulatory Guides 1.59 and 1.102, and U.S. National Weather Service Hydromet Reports No. 51 and 52 as guidance.	• 10 CFR 52.17(a)(1)(vi) • Regulatory Guide 1.70, Section 2.4 • NUREG-0800, Section 2.4 • Regulatory Guides 1.59, 1.102 • NEI 01-02, Section 3.2.2.2	GHES1 160 GHES2 180 GHES3 120 GHES5 110 PROC 32	GHES1 120 GHES2 470 GHES3 860 GHES5 1060 GHES6 20 S/C: $10,000	GHES1 120 GHES2 100 GHES3 380 GHES5 510 GHES6 20	4262 hours S/C: $10,000
2.4.1	Hydrologic Description This section updates all water users and the amounts of usage in the area, flood data, and the site hydrosphere using the SAR and other studies for SRS.	• Regulatory Guide 1.70, Section 2.4.1 • NUREG-0800, Section 2.4.1	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.2	Floods This section evaluates floods based on the data collected in Section 2.4.1.	• Regulatory Guide 1.70, Section 2.4.2 • NUREG-0800, Section 2.4.2	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.4.3	Probable Maximum Flood (PMF) on Streams and Rivers This section provides an update of the PMF. The PMF is for Tinker Creek and Mill Creek, which are tributaries to Upper Three Runs Creek, using U.S. National Weather Service (NWS) Hydromet No. 51 & 52. The winter PMP is also analyzed for the determination of snow loading on roofs and the impact on drainage due to icing. Cross sectional surveys along the tributaries are required for the study. The PMF levels in the Savannah River are obtained from the data in the SAR for SRS.	• Regulatory Guide 1.70, Section 2.4.3 • NUREG-0800, Section 2.4.3	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.4	Potential Dam Failures, Seismically Induced This section describes the impacts on the SRS Plant in the event that dams on the Savannah River fail. The site is situated on high ground and flooding from dam failure will not be a concern. Information from the analyses presented in the current SRS SAR will be used for the discussion.	• Regulatory Guide 1.70, Section 2.4.4 • NUREG-0800, Section 2.4.4	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.5	Probable Maximum Surge and Seiche Flooding This topic is not applicable to SRS since the selected site is adjacent to small streams and not subject to surge or seiche flooding.	• Regulatory Guide 1.70, Section 2.4.5 • NUREG-0800, Section 2.4.5	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.6	Probable Maximum Tsunami Flooding This topic is not applicable for SRS since it is a river site.	• Regulatory Guide 1.70, Section 2.4.6 • NUREG-0800, Section 2.4.6	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.7	Ice Effects This section updates information on ice formation at the site, based on historical data from SRS. Historical meteorological data collected at the SRS is reviewed to determine climatological changes that may lead to ice formation. An assessment of ice impacts to the cooling water and service water systems is made. Also, the impacts to structures and transmission towers are discussed.	• Regulatory Guide 1.70, Section 2.4.7 • NUREG-0800, Section 2.4.7	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.4.8	Cooling Water Canals and Reservoirs This section discusses the plant cooling system that uses the Savannah River as the cooling makeup water source for a closed loop wet cooling tower to provide heat dissipation. The performance of the system is discussed. Data from the hydrographic survey performed for Section 3.4 of the ER will be used to obtain data for the analysis. It is assumed that the existing Savannah River intake structure can be used with an upgrade of equipment. Additionally, a discussion of the UHS for the plant is presented in this section.	• Regulatory Guide 1.70, Section 2.4.8 • NUREG-0800, Section 2.4.8	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.9	Channel Diversions The only channel that affects the new power generation facility is the intake channel. This section describes the channel and its required upgrades to meet the new plant requirements.	• Regulatory Guide 1.70, Section 2.4.9 • NUREG-0800, Section 2.4.9	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.10	Flooding Protection Requirements This section is based on Regulatory Guide 1.102 and the results from Sections 2.4.2 and 2.4.3. Site drainage from a localized PMP is discussed in this section, along with measures implemented to protect safety-related facilities from localized flooding. No protection of the main plant facilities from flooding on the Savannah River is needed.	• Regulatory Guide 1.70, Section 2.4.10 • NUREG-0800, Section 2.4.10	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.11	Low Water Considerations This section provides the results of existing and updated analyses of water supply availability during prolonged periods of drought. See Section 3.4 of the Environmental Report.	• Regulatory Guide 1.70, Section 2.4.11 • NUREG-0800, Section 2.4.11	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.4.12	Dispersion, Dilution, and Travel Times of Accidental Releases of Liquid Effluents in Surface Waters In this section, the impacts of an accidental release to the adjacent surface waters of nearby tributaries are discussed. A dispersion and dilution model is required. The parameters for the model are obtained from the results of the hydrographic survey conducted for Section 3.4 of the ER. Additional parameters are added to the survey for the requirements of this section.	• Regulatory Guide 1.70, Section 2.4.12 • NUREG-0800, Section 2.4.13	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.4.13	Groundwater This section describes the regional and local groundwater conditions, existing and projected future groundwater use, and impacts of proposed plant groundwater withdrawal, if any. Assessment of a postulated accidental release of liquid radioactive material at the site is also presented. Safeguards to protect the groundwater resources and future monitoring are discussed. It is assumed that no new hydrogeologic field investigations are required and that the data in existing SRS publications are largely adequate for preparing this section. Regional and local hydrogeologic descriptions will be supplemented where necessary based on a review of other recent literature. A well inventory is conducted to determine existing groundwater use in the area. Projected future groundwater use in the site vicinity is estimated based on existing demographic data. Four rounds of synoptic groundwater level measurements are conducted, using existing monitoring wells, to characterize the seasonal variations in groundwater levels. These new data, along with historical data, are used to evaluate groundwater levels and flow paths. The impact of an accidental radionuclide spill at the site relevant to downgradient groundwater users and/or discharge points is analyzed using a comprehensive flow and transport model.	• Regulatory Guide 1.70, Section 2.4.13 • NUREG-0800, Section 2.4.12	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.4.13	Groundwater *(continued)* Should existing site-specific geologic boreholes and groundwater monitoring wells be determined to be deficient with respect to providing the data required to adequately characterize site groundwater conditions, a field investigation would be required at additional cost. This estimate also does not include the evaluation of radioactive dose levels based on a postulated release to the environment.					
2.4.14	Technical Specification and Emergency Operation Requirements This section identifies if there are any adverse hydrometeorologically related events that would be expected to have an impact on safety-related facilities.	• Regulatory Guide 1.70, Section 2.4.14 • NUREG-0800, Section 2.4.14	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.
2.5	Geology, Seismology, and Geotechnical Engineering This section provides an introduction to and summary of the discussions presented in Sections 2.5.1 through 2.5.6. The discussions in Section 2.5 are based on information presented in existing SRS documents, other applicable recent literature, and on new data developed in accordance with the requirements of Regulatory Guides 1.165 and 1.70. Included in the estimate for this section is preparation of a proposed approach to satisfy the Regulatory Guide 1.165 guidelines and implementation of this approach. An early estimate of the results of this proposed approach is discussed with the NRC Staff to confirm the acceptability of this Regulatory Guide 1.165 interpretation and its planned implementation.	• 10 CFR 52.17(a)(1)(vi) • 10 CFR 100.23 • 10 CFR 50, Appendix S • Regulatory Guide 1.70, Section 2.5 • NUREG-0800, Section 2.5 • Regulatory Guide 1.165 • NEI 01-02, Section 3.2.2.5 • Regulatory Guide 1.132 (Draft Guide DG-1101)	GHES1 480 GHES2 600 GHES3 450 GHES4 40 GHES5 420 CONS 180 PROC 120 S/C: $280,000	GHES1 420 GHES2 500 GHES3 380 GHES5 560	GHES1 230 GHES2 100 GHES3 290 GHES5 490	5260 hours S/C: $280,000

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.5.1	Basic Geologic and Seismic Information This section discusses the regional and site geologic conditions, including physiography, geomorphology, geologic history, stratigraphy, lithology, structure, tectonics, and potential hazards associated with these conditions. Also presented is the basis for discussions of site seismicity in subsequent sections. For nuclear power plants licensed after Jan-10-97, uncertainty in design ground motion evaluation must be explicitly considered per 10 CFR 100.23. Methods acceptable to the NRC are specified in Regulatory Guide 1.165. These methods require consideration of regional and local site characterization of potential earthquake sources, comparison of these sources with an existing Probabilistic Seismic Hazards Analysis (LLNL or EPRI), and modification of the LLNL/EPRI source models if new information since the completion of these studies would significantly increase these earlier estimates. Regulatory Guide 1.165 anticipates that for existing nuclear facility sites where new nuclear power plants are planned, the geosciences technical information originally used to validate those sites may be inadequate. It is assumed that this is the case. This assumption is based on the rapid increase in published information on earthquake sources in the Central and Eastern United States and on the more than 15 years that have passed since most of the LLNL/EPRI studies were done.	• Regulatory Guide 1.70, Section 2.5.1 • NUREG-0800, Section 2.5.1 • Regulatory Guide 1.165	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.5.2	Vibratory Ground Motion Fundamental earthquake hazard curves for the adjacent Vogtle plant site have been published based on LLNL and EPRI studies. It is anticipated that some modification, extrapolation, and/or sensitivity studies of these curves will be necessary to comply with Regulatory Guide 1.165 requirements. It is assumed that the results of this analysis will lead to the conclusion that existing LLNL/EPRI results are valid for the SRS site or that standard design spectra envelope any existing LLNL/EPRI or modified LLNL/EPRI PSHA results. It is also assumed that no new geotechnical field investigations will be required to characterize site-specific subsurface conditions as they affect design ground motions. If either of these assumptions is not valid, additional cost items would likely be incurred.	• Regulatory Guide 1.70, Section 2.5.2 • NUREG-0800, Section 2.5.2	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.
2.5.3	Surface Faulting No surface faulting potential appears to exist for this site. However, a review of existing data and a field reconnaissance of the area within several km of the site will be performed per Appendix D of Regulatory Guide 1.165.	• Regulatory Guide 1.70, Section 2.5.3 • NUREG-0800, Section 2.5.3	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.5.4	Stability of Subsurface Materials and Foundations The extensive existing geotechnical data for SRS are considered excellent background materials for use in developing this section. The APT site has already been generally characterized from a geotechnical standpoint. However, detailed geotechnical investigation is needed in the selected location of the new reactor and support structures, including the UHS (pond/buried storage). The investigation is performed in accordance with proposed Rev. 2 of Regulatory Guide 1.132 (Draft Guide DG-1101), and includes borings, CPTs, shear wave velocity measurements, and supporting laboratory testing. The focus of the investigation is to establish the allowable bearing capacity and estimated settlement of the foundation soils, their liquefaction potential, and dynamic response parameters. Detailed investigation is performed under the reactor footprint to determine if there are solutioning problems in the underlying carbonate-rich deposits (Santee Formation), requiring remedial action. Ground improvement, if required, and subsurface instrumentation is discussed.	• Regulatory Guide 1.70, Section 2.5.4 • NUREG-0800, Section 2.5.4 • Regulatory Guide 1.132 (Draft Guide DG-1101)	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.
2.5.5	Stability of Slopes Slope stability analysis is needed for cut slopes for UHS pond(s).	• Regulatory Guide 1.70, Section 2.5.5 • NUREG-0800, Section 2.5.5	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.
2.5.6	Embankments and Dams Slope stability analysis will be needed for embankments used for extended/additional UHS pond(s).	• Regulatory Guide 1.70, Section 2.5.6	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.
2.5.7	Information Required by 10 CFR 50.34(a)(12) and (b)(10) Based on the evaluations performed in SSAR Sections 1.4 and 1.5, this section provides the information and evaluations required by 10 CFR 50.34(a)(12) and (b)(10).	• 10 CFR 52.17(a)(1)	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
3.	IMPACTS ON EXISTING SITE FACILITIES This section describes and assesses the potential impacts of the new unit(s) on the existing nuclear units, ISFSI, etc.	None	MECH 40 ELEC 24	ENV4 24 GHES4 24 MECH 40 ELEC 24 CIV 24 CONS 24	ENV4 8 GHES4 8 MECH 80 ELEC 32 CIV 24 CONS 16	392 hours
4.	CONFORMANCE WITH REGULATORY REQUIREMENTS AND GUIDANCE This section identifies the conformance (compliance) with applicable regulatory requirements (e.g., 10 CFR) and regulatory guidance documents (e.g., Regulatory Guides, NUREGs, etc.)	• Regulatory Guide 1.70, Section 1.8	0	0	LIC 40 ENV1 40 ENV2 80 ENV3 30 ENV4 50 GHES1 80 GHES2 80 GHES5 80 NUC 160	640 hours
--	Compile and Issue Revision A SSAR Review Revision A SSAR Resolve Comments and Issue Revision B SSAR	N/A	0	0	LIC 360 ENV1 32 ENV4 120 GHES2 32 GHES5 160 MECH 48 ELEC 48 CIV 24 NUC 36 CONS 48	908 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
PART 3 – ENVIRONMENTAL REPORT						
---	Table of Contents List of Tables List of Figures Abbreviations and Acronyms	• 10 CFR 52.17(a)(2) • 10 CFR 51.45 • 10 CFR 51.50 • NUREG-1555	0	0	0	0
1.	INTRODUCTION	• NUREG-1555, Section 1.0	ENV4 24	0	ENV4 24	48 hours
1.1	The Proposed Project This section summarizes the scope of the project to add new commercial power reactors to an existing federal nuclear site. Data requested per NUREG-1555 is provided.	• NUREG-1555, Section 1.1	Included in Section 1.	Included in Section 1.	Included in Section 1.	Included in Section 1.
1.2	Status of Reviews, Approvals, and Consultations This section summarizes the status of reviews and consultations to obtain the approvals to proceed with the addition of new nuclear plants at the site.	• NUREG-1555, Section 1.2	Included in Section 1.	Included in Section 1.	Included in Section 1.	Included in Section 1.
2.	ENVIRONMENTAL DESCRIPTION This section provides an introduction to the material in Sections 2.1 through 2.8.	• NUREG-1555, Section 2.0	0	0	0	0
2.1	Station Location This section provides the site description to include a new reactor(s).	• NUREG-1555, Section 2.1	ENV1 16 ENV2 16	0	ENV1 16 ENV2 16	64 hours
2.2	Land This section provides an introduction to the material in Sections 2.2.1 through 2.2.3.	• NUREG-1555, Section 2.2	ENV1 60 ENV2 60 ENV3 20 ENV4 24	0	ENV1 60 ENV2 60 ENV3 20 ENV4 24	328 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.2.1	The Site and Vicinity This section provides land use data regarding surface water and groundwater uses, terrestrial ecology, community characteristics, historical and archeological sites, natural landmarks, new plant and related off-site structures, construction impact assessments for land use, historical and archaeological sites, socioeconomics, construction impacts on water use, operational impact assessments for land use, and radiological impacts of normal operations. Data is obtained from existing SRS documents, and federal, state, and local county agencies for agricultural production, and fishing and hunting activities within 50 miles. Maps are provided to show land use within the site boundary and major land uses in the site vicinity with land uses, as well as maps to show highways, railroads, utilities, right-of-way.	• NUREG-1555, Section 2.2.1	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.
2.2.2	Transmission Corridors and Offsite Areas This section describes land use of transmission corridors and other offsite areas that will be modified for the new plant. The characteristics of the access corridors and offsite areas are identified. Per NEI 01-02, Section 3.3.4, only a general discussion of transmission corridor impacts is provided. It is assumed that the existing transmission systems for both SRS and the Vogtle nuclear plant will be upgraded to serve the new plant, and the transmission system, corridor, and potential impact information is available from others.	• NUREG-1555, Section 2.2.2	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.2.3	The Region This section establishes the nature and extent of existing and planned land use within the region (50-mile radius) that might be impacted or modified by the proposed plant. The principal agricultural products of the region and average annual yields are provided. Major waterways, highways, roads, railroads, airports, and other transportation routes within the region are identified. Maps are provided to show major transportation and utility networks, as well as major public and trust land areas in the region.	• NUREG-1555, Section 2.2.3	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.	Included in Section 2.2.
2.3	Water This section provides an introduction to the material in Sections 2.3.1 through 2.3.3.	• NUREG-1555, Section 2.3	GHES2 80 GHES5 20		GHES2 120 GHES5 50	270 hours
2.3.1	Hydrology This section is prepared from data developed in Section 3.4.	• NUREG-1555, Section 2.3.1	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.
2.3.2	Water Use This section is prepared from water use data developed in Section 3.4 and from results of updated survey of water users and usage and from water use by SRS.	• NUREG-1555, Section 2.3.2	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.
2.3.3	Water Quality This section updates or redevelops the tables of surface water characteristics and groundwater characteristics. The update includes information obtained in the hydrographic survey, which includes surface water quality sampling, performed for Section 3.4. Other site-specific water quality characteristics and any preexisting environmental stresses are summarized from the SRS monitoring data. The existing pollutant discharge sources are described and the Section 303(d) listed impaired waters are identified.	• NUREG-1555, Section 2.3.3	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.	Included in Section 2.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.4	Ecology This section provides an introduction to the material in Sections 2.4.1 and 2.4.2 and describes the types of information to be presented and their relationships to information presented earlier in the relevant SRS environmental studies and environmental impact documents for the area of the proposed plant. It is assumed that ecology studies associated with transmission line corridors are performed by others and can be referenced if needed.	• NUREG-1555, Section 2.4	ENV1 48 ENV2 48 ENV3 16 ENV4 8	ENV1 40 ENV2 40 ENV3 16 ENV4 24	ENV1 40 ENV2 40 ENV4 40	360 hours
2.4.1	Terrestrial Ecology This section describes the terrestrial environment and biota of the site likely to be impacted by the new plant. Existing information on species composition; spatial and temporal distributions; abundance; important terrestrial natural resources; federal/State-listed threatened and endangered species; critical habitats; unique, rare or priority habitats; key terrestrial indicators to gauge population changes; and wetlands has been the subject of many previous studies over the past two decades. This material is updated, as required, for the immediate area of the proposed site. The updated information is primarily extracted from the results of the field-monitoring program (see Section 6.5.1). Descriptions of natural and man-induced effects, preexisting environmental stresses, and the current ecological conditions that are indicative of such stresses are prepared. A description of recent or ongoing ecological or biological studies of the site and its environs is included. A summary of consultations with appropriate federal and state agencies is included.	• NUREG-1555, Section 2.4.1	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
2.4.1	Terrestrial Ecology *(continued)* It is known from the previous studies that there are commercially or recreationally valuable species in the vicinity of the site. Maps are provided to show important terrestrial habitats in the vicinity of the site, and the site topography. A specialty subcontractor provides the required information.					
2.4.2	Aquatic Ecology This section describes the aquatic environment of the site and the vicinity likely to be impacted by the new plant. Existing information on species composition; spatial and temporal distributions; abundance; important aquatic natural resources, especially in discharge areas and receiving water bodies; key aquatic indicator organisms (to gauge population changes); nuisance species; federal/State-listed threatened/endangered list; critical habitats, and unique, rare, or priority habitats is updated. The updated information is primarily extracted from the results of the field monitoring program (see Section 6.5.2). Maps showing important aquatic habitats of the site and vicinity are developed and included. Descriptions of natural and man-induced effects, preexisting environmental stresses, and the current ecological conditions that are indicative of such stresses are prepared. A description of any recent or ongoing ecological or aquatic studies of the site and its environs is included. A summary of consultations with appropriate federal and state agencies is included. It is assumed that there are commercially or recreationally valuable species in the vicinity of the site; the location and value of commercial and sport fisheries is described.	• NUREG-1555, Section 2.4.2	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.	Included in Section 2.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.4.2	Aquatic Ecology *(continued)* The aquatic environments of water bodies, taking into account biological, hydrological, and physiochemical considerations, are described. Maps to show important aquatic habitats or endangered aquatic species are provided. A specialty subcontractor provides the required information.					
2.5	Socioeconomics This section provides an introduction to the material in Sections 2.5.1 through 2.5.4.	• NUREG-1555, Section 2.5	ENV1 16 ENV2 32 ENV3 8 ENV4 20	ENV1 12 ENV2 24 ENV3 8 ENV4 16	ENV1 36 ENV2 72 ENV3 24 ENV4 44	312 hours
2.5.1	Demography This section provides sufficiently detailed information regarding the permanent and transient population distribution within 50 miles of the site for radiological, accident, and socioeconomic impact analyses. The population distribution data is updated in the SSAR using current decade census information. Demography by age, sex, transient or migrant population, racial and ethnic background, and income distribution within the plant EPZ, LPZ, EAB, and out to 50 miles is characterized.	• NUREG-1555, Section 2.5.1	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.5.2	Community Characteristics This section identifies and describes community characteristics in the region of the site likely to be affected by the new plant. The existing relevant documents are reviewed. Information is collected from SRS and others and summarized related to: (1) the area's economic base—industry category, total labor force, unemployment levels, (2) political structure, (3) population forecast, (4) social and community structure, (5) housing, (6) local education system, (7) recreational facilities, (8) tax structure, (9) land use and zoning/planning, (10) social services and public facilities, (11) transportation systems, and (12) distinctive communities. A screening analysis is performed to determine potentially affected subregions and communities. Sector charts superimposed on maps extending to a 16-km radius and to an 80-km radius are provided. A population distribution table is provided.	• NUREG-1555, Section 2.5.2	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.
2.5.3	Historic Properties This section provides a description of historic, archaeological, and traditional cultural resources that could be affected by the new plant. Historic, archaeological, and traditional cultural resources within 10 miles of the proposed site are updated using information reported in existing documents. It is assumed that new surveys do not need to be conducted.	• NUREG-1555, Section 2.5.3	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.5.4	Environmental Justice This section provides relevant information collected and compiled through reviews of the existing documents. Low-income and minority populations that could be affected by construction, maintenance, or operation are described. Minority and low-income populations are identified and located. Data analysis identifies any unique minority or low-income communities within each environmental-impact area that are likely to be disproportionately affected by the proposed project. Two maps are provided to show the location of minority and low-income population using the Year 2000 census data.	• NUREG-1555, Section 2.5.4	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.	Included in Section 2.5.
2.6	Geology This section provides a summary description of the site groundwater and geologic conditions based on information and data developed in SSAR Sections 2.4.13 and 2.5, respectively. Emphasis is placed on those features/conditions relevant to assessment of the environmental impact of the proposed facility.	• NUREG-1555, Section 2.6	GHES3 40	0	GHES3 40	80 hours
2.7	Meteorology and Air Quality This section describes the site meteorology and characterizes atmospheric dispersion processes to a distance of 50 miles. The X/Qs at the EAB and LPZ for routine and accidental radioactive releases are estimated using the NRC-approved, PAVAN dispersion model. The SRS site area is non-attainment for ozone. Although NO_x is a precursor for ozone, no comprehensive NO_x air quality impact analysis for combustion equipment employed for the new plant is proposed at this time due to their small emissions. Annual and monthly wind roses are created.	• NUREG-1555, Section 2.7	ENV1 24 ENV2 16	ENV1 16 ENV2 24	ENV1 20 ENV2 20 ENV4 20	140 hours
2.8	Related Federal Project Activities This section identifies federal activities, if any, that are related to the new plant.	• NUREG-1555, Section 2.8	0	0	ENV4 8	8 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
3.	Plant Description This section provides an introduction to the new reactor facilities under consideration. The ABWR, AP1000, GT-MHR, IRIS, and PBMR are addressed in Sections 3.1 through 3.8 based on information and descriptions provided by the reactor vendors. The level of detail included throughout Section 3 is consistent with typical UFSAR Chapter 1 descriptions. Plant layout and location are determined based on meetings with the reactor vendors. Much of this information will be similar to that Included in Section SSAR Section 1.3.	• NUREG-1555, Section 3.0	0	0	TECH 120	120 hours
3.1	External Appearance and Plant Layout This section provides descriptions and drawings of the proposed plant. Also included are topographic maps of the site and vicinity showing plant and station layout, the exclusion area, site boundary, liquid and gaseous release points (and their elevations), meteorological towers, the construction zone, land to be cleared, waste disposal areas, and other buildings and structures (both temporary and permanent).	• NUREG-1555, Section 3.1	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.2	Reactor Power Conversion System This section provides descriptions of the reactor power conversion system.	• NUREG-1555, Section 3.2	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.3	Plant Water Use This section provides an introduction to the material in Sections 3.3.1 and 3.3.2 on plant water use (e.g., circulating water system, sanitary waste system, radwaste, and chemical waste systems, and service water systems).	• NUREG-1555, Section 3.3	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.3.1	Water Consumption This section provides descriptions of the quantity of water required for plant operation, the amount of water consumed by the plant water systems, and the amount of water discharged to a water body.	• NUREG-1555, Section 3.3.1	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
3.3.2	Water Treatment This section provides descriptions of the water treatment processes.	• NUREG-1555, Section 3.3.2	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.4	Cooling System This section describes heat removal facilities. Process flow diagrams and other required drawings for structures, such as intake, outfall and cooling towers are included. The cooling system is assumed to be closed cycle, using a wet cooling tower, with makeup water from the Savannah River and blowdown returned to the river. A hydrographic survey of the intake channel and the Savannah River in the vicinity of the intake channel and outfall location is performed for this section as well as for thermal modeling and chemical plume modeling. An additional hydrographic survey is made of the streams adjacent to the site that might be affected by station construction and operations. The Savannah River hydrographic survey may include bed load and suspended sediment sampling and analysis as well as river debris characterization. Data used in this section is also be used in SSAR Section 2.4.8.	• NUREG-1555, Section 3.4	GHES2 120 GHES3 20 GHES5 60	GHES2 80 GHES3 20 GHES5 60 GHES6 20 PROC 72 S/C: $140,000	GHES3 60 GHES5 50 GHES6 10 PROC 24 S/C: $8,000	596 hours S/C: $148,000
3.4.1	Description and Operational Modes This section provides descriptions of anticipated operational modes and the estimated periods of time that the cooling system will operate in each mode. Anticipated operational modes and quantities of heat generated, dissipated to the atmosphere, and released in liquid discharges are also described. For operational modes, water source, and quantities of water withdrawn, consumed, and discharged are addressed.	• NUREG-1555, Section 3.4.1	Included in Section 3.4.	Included in Section 3.4.	Included in Section 3.4.	Included in Section 3.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
3.4.2	Component Descriptions This section provides descriptions of the intake, discharge, and heat dissipation systems including drawings of structures and descriptions of pumping facilities and performance characteristics (e.g., screens, flow rates, velocities) for the operational modes.	• NUREG-1555, Section 3.4.2	Included in Section 3.4.	Included in Section 3.4.	Included in Section 3.4.	Included in Section 3.4.
3.5	Radioactive Waste Management System This section provides descriptions of the liquid and gaseous radioactive waste management and effluent control systems.	• NUREG-1555, Section 3.5	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.6	Nonradioactive Waste Systems This section provides an introduction to the material in Sections 3.6.1 through 3.6.3 for nonradioactive waste systems.	• NUREG-1555, Section 3.6	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.6.1	Effluents Containing Chemicals or Biocides This section provides descriptions of nonradioactive effluent treatment facilities except those covered in Section 3.3.2, 3.6.2, and 3.6.3. Variations of principal constituent and trace material concentrations for normal modes of plant operation are addressed.	• NUREG-1555, Section 3.6.1	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.6.2	Sanitary System Effluents This section provides a description of the sanitary systems (both temporary and permanent), anticipated quantity and characteristics of treated effluents, and disposal.	• NUREG-1555, Section 3.6.2	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.6.3	Other Effluents This section provides estimates of gaseous emissions (e.g., from diesel engines, gas turbines, heating plants, incinerators) released during plant operation; the location and elevation of release points; the frequency of the releases and the treatment before release; and the total quantity of SO_x, NO_x, hydrocarbons, and suspended particulates to be discharged annually.	• NUREG-1555, Section 3.6.3	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
3.7	Power Transmission System This section provides basic electrical design parameters for the plant. Based on discussions with the NRC, transmission design voltage or voltages, line capacity, conductor type and configuration, spacing between phases, minimum conductor clearances to ground, maximum predicted electric-field strength(s) at 1 m above ground, the predicted electric-field strength(s) at the edge of the right-of-way in kilovolts per meter (kV/m), and the design bases for these values are described as required. Basic structural design parameters, including illustrations and descriptions of towers, conductors, and other structures, with dimensions, materials, color, and finish, are also addressed. Topographic maps or aerial photographs showing the proposed corridors and all existing major high voltage corridors in the region are included. It is assumed that information on transmission corridors and necessary system design information is available from others.	• NUREG-1555, Section 3.7	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
3.8	Transportation of Radioactive Materials This section provides a description of the proposed methods for the transportation of fuel and radioactive wastes to and from the facility.	• NUREG-1555, Section 3.8	Included in Section 3.	Included in Section 3.	Included in Section 3.	Included in Section 3.
4.	Environmental Impacts of Construction This section provides an introduction to the material in Sections 4.1 through 4.6 on environmental impacts of construction.	• NUREG-1555, Section 4.0	0	0	0	0
4.1	Land-Use Impacts This section provides an introduction to the material in Sections 4.1.1 through 4.1.3 on land use impacts of construction.	• NUREG-1555, Section 4.1	ENV1 12 ENV2 20 ENV3 12 PROC 24 S/C: $18,000	ENV1 24 ENV2 36 ENV3 16 ENV4 24	ENV1 20 ENV2 40 ENV3 15 ENV4 25	268 hours S/C: $18,000

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
4.1.1	The Site and Vicinity The information on the site and vicinity presented in Section 2.2.1 is evaluated. The updated land use information is reviewed against applicable regulatory requirements (Wetlands Management, Farmland, Floodplain, Scenic Rivers Protection, etc.) and considers the sequence, duration, and locations of onsite construction activities. Potential land use impacts regarding possible dewatering of wetlands, restricting local traffic, degrading recreational activities, reducing agricultural production, etc., are assessed, and mitigation strategies are identified. A specialty subcontractor performs wetland delineation and floodplain updates.	• NUREG-1555, Section 4.1.1	Included in Section 4.1.	Included in Section 4.1.	Included in Section 4.1.	Included in Section 4.1.
4.1.2	Transmission Corridors and Offsite Areas It is assumed that the existing SRS site and the Vogtle nuclear plant transmission system are upgraded to serve the new plant. Thus, any potential land impacts related to upgrade activities would be minimal. Per NEI 01 02, Section 3.3.4, only a general discussion of transmission corridor imparts is provided. Potential land use impacts and mitigation strategies are identified. It is assumed that transmission system, corridor, and potential impact information is available from others.	• NUREG-1555, Section 4.1.2	Included in Section 4.1.	Included in Section 4.1.	Included in Section 4.1.	Included in Section 4.1.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
4.1.3	Historic Properties Historic properties listed in the existing SRS documents are reviewed. The updated list of onsite/offsite historic properties in Section 2.5.3 is reviewed against the regulatory requirements in 36 CFR 800; Department of Interior Bulletins 15 and 38; 43 CFR 10; and NRC NRR Office Letter No. 906. It is assumed that no impact analysis is required and concurrence of the State Historic Preservation Officer is obtained on a finding of No Impact. Appropriate text, tables, and figures are included. It is assumed that no new "significant" historical properties are identified. Only those properties in the analysis for the existing facility are addressed.	• NUREG-1555, Section 4.1.3	Included in Section 4.1.	Included in Section 4.1.	Included in Section 4.1.	Included in Section 4.1.
4.2	Water-Related Impacts This section provides an introduction to the material in Sections 4.2.1 and 4.2.2.	• NUREG-1555, Section 4.2	GHES2 50 GHES5 10 PROC 24 S/C: $20,000	GHES2 190 GHES5 50	GHES2 30 GHES5 40	394 hours S/C: $20,000
4.2.1	Hydrologic Alterations This section is prepared from data developed in Section 3.4, from the construction site layout, and from results of soil erosion and sediment transport studies, and mitigation analysis. A topographic survey of the site is performed to support the development of a soil erosion control plan and site drainage controls.	• NUREG-1555, Section 4.2.1	Included in Section 4.2.	Included in Section 4.2.	Included in Section 4.2.	Included in Section 4.2.
4.2.2	Water-Use Impacts This section is based on updated data on water users and usage, project water use, and the results of impact assessments.	• NUREG-1555, Section 4.2.2	Included in Section 4.2.	Included in Section 4.2.	Included in Section 4.2.	Included in Section 4.2.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
4.3	Ecological Impacts This section provides an introduction to the material in Sections 4.3.1 and 4.3.2.	• NUREG-1555, Section 4.3	ENV1 16 ENV2 16 ENV3 16 ENV4 8	ENV1 16 ENV3 8 ENV4 16 PROC 24 S/C: $18,000	ENV1 40 ENV3 40 ENV4 40	240 hours S/C: $18,000
4.3.1	Terrestrial Ecosystems This section addresses and quantifies construction-related terrestrial impacts resulting from the addition of the new plant, using updated baseline terrestrial data and information. A site map showing proposed buildings, the land to be cleared, waste disposal areas, the construction zone, and the site boundary is included. A proposed milestone schedule of construction activities is provided. The area of each plant community and habitat type to be cleared or disturbed is described, including how much is being destroyed relative to the total amount present in the region. A map superimposing impact areas over resource areas to determine the areal extent and location is developed and an assessment of the impacts of noise on important species is prepared. It is assumed that a noise survey is not required because of recent studies performed in the past few years. Based on a recent EIS prepared for another facility proposed for the same area, no changes are anticipated in terrestrial habitat resulting from construction dewatering activities with regard to any wetland, pond, etc. A summary of consultations with appropriate federal and state agencies is included. For any commercially or recreationally valuable species in the vicinity, the magnitude of the impact for these species is estimated.	• NUREG-1555, Section 4.3.1	Included in Section 4.3.	Included in Section 4.3.	Included in Section 4.3.	Included in Section 4.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
	Terrestrial Ecosystems *(continued)* Mitigation measures are proposed and a list of commitments and practices for concurrence and adoption to limit adverse construction impacts is developed. Summaries of the unavoidable impacts predicted and the irreversible and irretrievable commitments of terrestrial resources predicted to occur during construction are prepared. A specialty subcontractor performs field data collection, if data collected by the SRS environmental staff is not sufficient or up to date, and related impact analysis.					
4.3.2	Aquatic Ecosystems This section addresses and quantifies construction-related aquatic impacts resulting from the addition of the new plant, using updated baseline aquatic data and information. A map showing the site and vicinity delineating areas of construction, particularly those where habitats of important aquatic species are expected to be altered is developed. A proposed milestone schedule of construction activities is provided. The area of disturbance for each habitat type is determined, including the total aquatic area to be disturbed and how much is being destroyed relative to the total amount present in the region. No aquatic areas are expected to be covered by permanent station facilities based on prior studies. A determination of the areal extent and location of construction activities for the linear facilities associated with the power plant are	• NUREG-1555, Section 4.3.2	Included in Section 4.3.	Included in Section 4.3.	Included in Section 4.3.	Included in Section 4.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
4.3.2	Aquatic Ecosystems *(continued)* prepared, including dredge spoils disposal and placement of fill having impacts on the aquatic environment. A map superimposing impact areas over natural resource areas is developed. A description of the magnitude, schedule, and duration of construction activities that are expected to impact important aquatic species and their habitat is provided. Changes in terrestrial habitat resulting from construction activities associated with the linear facilities that will dewater any wetland and other aquatic habitats are assessed. A summary of consultations with appropriate federal and state agencies is included. Assuming that there are commercially or recreationally valuable species in the vicinity of these linear facilities, the magnitude of the impact for these species is estimated. Mitigation measures are proposed and list of commitments and practices for concurrence and adoption to limit adverse construction impacts is developed. Brief summaries of the unavoidable impacts predicted and the irreversible and irretrievable commitments of aquatic resources predicted to occur during construction are prepared. A specialty subcontractor performs field data collection, if the data collected by the SRS environmental staff is insufficient or not up to date, and related impact analysis.					
4.4	Socioeconomic Impacts This section provides an introduction to the material in Sections 4.4.1 through 4.4.3.	• NUREG-1555, Section 4.4	ENV1 8 ENV2 16 ENV3 10 ENV4 10	ENV1 52 ENV2 104 ENV3 44 ENV4 60	ENV1 24 ENV2 48 ENV3 24 ENV4 32	432 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
4.4.1	Physical Impacts This section provides an assessment of the direct community physical impacts of construction-related activities, including noise, odor, vehicle exhaust, dust, vibration, and shock from blasting. Mitigation measures to minimize the identified adverse impacts are described. The distribution of people, buildings, roads, and recreational facilities vulnerable to impact from construction-related activities is identified. Analytical predictions of noise levels at sensitive receptors are performed. Air-modeling analysis is performed to predict air pollution levels, including dust, and vehicle and heavy construction equipment exhaust.	• NUREG-1555, Section 4.4.1	Included in Section 4.4.	Included in Section 4.4.	Included in Section 4.4.	Included in Section 4.4.
4.4.2	Social and Economic Impacts Social and economic data, and impact assessment reported in existing SRS documents are reviewed. Based on the existing information, this section provides an assessment of the social and economic impacts resulting from construction-related activities and from the activities and demands of the construction force, and a discussion of the proposed mitigation measures to minimize the identified adverse effects. The socioeconomic impacts of construction on regional housing and public services, such as safety, social services, tourism and recreation, public utilities, education, transportation, and offsite land use are identified and analyzed (where and relative magnitude). The unavoidable adverse social and economic impacts are identified and a summary of the irreversible and irretrievable commitments of social and economic resources predicted to occur is provided. It is assumed that only a qualitative assessment is made of the incremental increase in regional productivity and the expected annual tax payments to local and State governments for the construction period.	• NUREG-1555, Section 4.4.2	Included in Section 4.4.	Included in Section 4.4.	Included in Section 4.4.	Included in Section 4.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
4.4.2	Social and Economic Impacts *(continued)* Based on that assessment, the tax revenues generated are evaluated to determine if they equal the expenditures required to meet the additional demand for public facilities and services.					
4.4.3	Environmental Justice Impacts Based on the information reported in existing SRS documents, an assessment is performed to determine if there would be disproportionately high and adverse human health and environmental impacts on minority and low-income populations by construction. If so, mitigation measures to minimize the identified potentially adverse impacts are proposed. Pathways are identified where a construction-related environmental impact may interact with cultural or economic facts that may result in disproportionate environmental impacts on minority and low-income populations. Assessments are performed of the degree to which each minority or low-income population would disproportionately experience adverse health or environmental impacts or receive any benefits compared with the entire geographic area.	• NUREG-1555, Section 4.4.3	Included in Section 4.4.	Included in Section 4.4.	Included in Section 4.4.	Included in Section 4.4.
4.5	Radiation Exposure to Construction Workers Although this project is proposed to be situated on a site of existing nuclear facilities, the analysis and evaluation of the radiological impact of such a facility on the construction work force is expected to show that the regulatory requirements of 10 CFR 20 are met based on the following assumption. With respect to occupational dose limits requirements for summation of internal and external doses, the doses that the construction workers would receive will be so low as to not require their classification as radiation workers.	• NUREG-1555, Section 4.5	NUC 60	NUC 100	NUC 40	200 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
4.6	Measures and Controls to Limit Adverse Impacts During Construction This section provides a summary of the potential adverse environmental impacts of construction and the proposed mitigation measures to limit these adverse impacts as identified in Sections 4.1 through 4.5. Lists are provided of the adverse impacts and the corresponding measures and controls to limit adverse impacts. The impacts of construction that are of sufficient severity to require commitments for mitigating the impacts are tabulated.	• NUREG-1555, Section 4.6	ENV4 20	0	ENV4 60	80 hours
5.	Environmental Impacts of Station Operation This section provides an introduction to the material in Sections 5.1 through 5.10 on environmental impacts of operation.	• NUREG-1555, Section 5.0	0	0	0	0
5.1	Land-Use Impacts This section provides an introduction to the material in Sections 5.1.1 through 5.1.3 on land use impacts of operation.	• NUREG-1555, Section 5.1	ENV1 24 ENV2 24 ENV3 24	ENV1 32 ENV2 32 ENV3 16 ENV4 16	ENV1 40 ENV2 40 ENV3 16 ENV4 16	280 hours
5.1.1	The Site and Vicinity A summary of the potential air quality impacts, cooling tower effects, and nonradiological and mixed waste storage and disposal impacts due to plant operation are provided with cross references to the sections addressing these impacts in detail. The probable impacts of plant operation on crops/vegetation, transportation systems, recreation facilities and residential homes are assessed. Impacts that result in direct restrictions of land use in the site vicinity are identified and mitigated.	• NUREG-1555, Section 5.1.1	Included in Section 5.1.	Included in Section 5.1.	Included in Section 5.1.	Included in Section 5.1.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
5.1.2	Transmission Corridors and Offsite Areas It is assumed that the existing SRS site and the Vogtle nuclear plant transmission system will be upgraded to serve the new plant. The impacts due to the frequency, duration, and location of operations and maintenance at offsite areas are reviewed. Per NEI 01-02, Section 3.3.4, only a general discussion of transmission corridor impacts is provided. Potential land use impacts and mitigation strategies are identified. The relevant information is available from others.	• NUREG-1555, Section 5.1.2	Included in Section 5.1.	Included in Section 5.1.	Included in Section 5.1.	Included in Section 5.1.
5.1.3	Historic Properties The relevant information reported in existing SRS documents is reviewed. Impacts due to the frequency, duration, and location of on- and off-site operations on significant historic sites are addressed. It is assumed that no new "significant" historical properties are identified and that detailed analysis of potential impacts and mitigation strategies is not needed. Properties included in the analysis for existing facilities are addressed. It is assumed that no impact analysis is required and concurrence of the State Historic Preservation Officer is obtained on a finding of No Impact. Appropriate text, tables, and figures are included.	• NUREG-1555, Section 5.1.3	Included in Section 5.1.	Included in Section 5.1.	Included in Section 5.1.	Included in Section 5.1.
5.2	Water-Related Impacts This section provides an introduction to the material in Sections 5.2.1 and 5.2.2. Section 5.2 is prepared from data developed in Sections 3.4, 4.2.1, and 4.2.2.	• NUREG-1555, Section 5.2	GHES2 40 GHES5 20	GHES2 40 GHES5 40	GHES5 60	200 hours
5.2.1	Hydrologic Alterations and Plant Water Supply This section is based on plant operation data, current site hydrologic data, and the results of impact assessments.	• NUREG-1555, Section 5.2.1	Included in Section 5.2.	Included in Section 5.2.	Included in Section 5.2.	Included in Section 5.2.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
5.2.2	Water-Use Impacts This section is based on updated data on water user and usage in the potentially affected area, project water use, and results of the impact assessment.	• NUREG-1555, Section 5.2.2	Included in Section 5.2.	Included in Section 5.2.	Included in Section 5.2.	Included in Section 5.2.
5.3	Cooling System Impacts This section provides an introduction to the material in Sections 5.3.1 through 5.3.4. A fundamental assumption is that the cooling system for the plant is a closed cycle system consisting of cooling towers. Makeup water is withdrawn from the Savannah River. The blowdown discharge is also returned to the river. The circulating water is passed from the condenser to the cooing tower before returning to the circulating water pump intake. Additional cooling systems, if necessary, are also described. A description of the system and its impact is included.	• NUREG-1555, Section 5.3	ENV1 16 ENV2 32 ENV3 12 ENV4 20 GHES2 20 GHES3 70 GHES5 30 GHES6 20	ENV1 80 ENV2 40 ENV3 60 ENV4 60 GHES2 20 GHES3 260 GHES5 110 GHES6 20 PROC 40 S/C: $27,000	ENV1 40 ENV2 40 ENV3 30 ENV4 50 GHES3 80 GHES5 110 GHES6 60	1320 hours S/C: $27,000
5.3.1	Intake System The makeup water system intake may use the existing cooling water intake from SRS after modifications and upgrading. A description of the intake is provided. Impacts to aquatic habitats as well as water usage are discussed. The impact of low water levels on water availability is also included.	• NUREG-1555, Section 5.3.1	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.
5.3.1.1	Hydrodynamic Descriptions and Physical Impacts The hydrodynamic impacts of water withdrawal on the aquatic habitat will be discussed. The discussion will include required modifications, if any, to the existing intake channel to minimize the adverse impact on the aquatic habitat.	• NUREG-1555, Section 5.3.1.1	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
5.3.1.2	Aquatic Ecosystems A brief description of the plant cooling system and the application of best intake technology is provided. Existing aquatic studies and the NPDES permit for an existing coal-fired plant on another part of the SRS are reviewed. A specialty subcontractor addresses the impacts of entrapment, impingement, and entrainment resulting from the intake structure.	• NUREG-1555, Section 5.3.1.2	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.
5.3.2	Discharge System This section provides an introduction to the material in Sections 5.3.2.1 and 5.3.2.2.	• NUREG-1555, Section 5.3.2	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.
5.3.2.1	Thermal Description and Physical Impacts The heat discharge system to the aquatic environment is described, addressing the liquid effluent to the Savannah River.	• NUREG-1555, Section 5.3.2.1	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.
5.3.2.2	Aquatic Ecosystems A description, quantification, and assessment of potential thermal, physical, and chemical stresses to aquatic systems that may occur as a result of any plant effluent discharges to receiving water bodies is provided. Based on information in Sections 2.3.1, 2.3.3, 2.4.2, 3.6.1, 3.6.2, and 5.2.1; and on relevant existing information including the SRS current NPDES permit, the potential thermal, physical, and chemical impacts to aquatic systems resulting from effluent discharge from the new power plant are evaluated. Since the potential impacts of the discharge of heated water have been effectively minimized by the use of cooling towers, only limited thermal impacts are associated with the discharge of the heated plant discharge, and the thermal impact is expected to be relatively small. The thermal plume of the plant effluent into the Savannah River is predicted using a well-accepted numerical model and the hydrographic survey data obtained for Section 3.4.	• NUREG-1555, Section 5.3.2.2	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
5.3.2.2	Aquatic Ecosystems *(continued)* A chemical dispersion analysis is performed to evaluate the combined environmental impacts of chemical and biocide discharges resulting from the plant cooling tower blowdown. A specialty subcontractor addresses potential thermal, physical, and chemical plume impacts.					
5.3.3	Heat-Discharge System This section provides an introduction to the material in Sections 5.3.3.1 and 5.3.3.2.	• NUREG-1555, Section 5.3.3	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.
5.3.3.1	Heat Dissipation to the Atmosphere Seasonal/Annual Cooling Tower Impact (SACTI) modeling is performed to assess potential vapor plume impacts to the environment: length and frequency of elevated plumes, fogging/icing frequencies, salt deposition, and cloud shadowing. The potential impacts on transportation caused by fogging/icing, and shadowing impacts are evaluated. It is assumed that at least 3 years of the appropriate National Weather Service (NWS) hourly meteorological data are available for SACTI modeling purposes. Cooling tower data (physical dimensions, orientation, exit diameter, flow rate, height of the tower, number of fans, air exit temperature, amount of heat released, number of water cycles, temperature of water entering and leaving the tower, and drift characteristics) are extracted from Section 3.4. It is assumed that the use of meteorological data purchased from the National Climatological Data Center (NCDC) is acceptable to the NRC for the SACTI model runs. NWS data is used because onsite data does not contain the wet bulb temperature, relative humidity, and twice-daily mixing height data that are required by SACTI.	• NUREG-1555, Section 5.3.3.1	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
5.3.3.2	Terrestrial Ecosystems Cooling system impacts to the terrestrial environment, including deposition of salt drift on vegetation (by a specialty subcontractor) and fogging/icing frequency, are assessed. Drift isopleths are provided on a seasonal basis to define areas of possible botanical injury.	• NUREG-1555, Section 5.3.3.2	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.
5.3.4	Impacts to Members of the Public It is assumed that wet cooling towers are used. Estimates of the noise levels resulting from operation of the cooling towers at the site boundary and at the nearest offsite residence are made. Potential noise impacts are addressed with respect to State regulations and limits and mitigated, if required. The cooling tower-induced fogging and icing impacts on motorists' safety at the nearby roads are assessed.	• NUREG-1555, Section 5.3.4	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.	Included in Section 5.3.
5.4	Radiological Impacts of Normal Operation This section provides an introduction to the material in Sections 5.4.1 through 5.4.4 that describe radiological impacts of normal operation.	• NUREG-1555, Section 5.4	TECH 8 NUC 160	TECH 8 NUC 350	TECH 8 NUC 60	594 hours
5.4.1	Exposure Pathways Pathways by which radiation and radioactive effluents can be transmitted from the proposed plant to living organisms are identified and described. The pathways by which gaseous and liquid radioactive effluents can be transported to the individual receptors and the location of these receptors are identified. Quantitative information on the production of major types of foods within 50 miles of the plant and the expected consumption of these foods by the local population is provided.	• NUREG-1555, Section 5.4.1	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours): Collect Data	Perform Analyses	Write Section	Total
5.4.2	Radiation Doses to Members of the Public Estimates of individual and collective doses due to radioactive gaseous and liquid effluents released from the plant in the course of normal plant operation are provided. Calculations of the maximum individual doses and the total collective doses to the population within a 50-mile radius of the plant for 5 years after the time of the licensing action are provided.	• NUREG-1555, Section 5.4.2	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.
5.4.3	Impacts to Members of the Public The radiological impacts on individuals of radioactive effluents released from the plant in the course of normal operation are evaluated. The calculated doses are compared to the acceptance criteria in 10 CFR 20 and 10 CFR 50.	• NUREG-1555, Section 5.4.3	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.
5.4.4	Impacts to Biota Other than Members of the Public It is determined if there is any potential for significant radiological impacts to biota other than members of the public and, if so, the nature and magnitude of the impact are estimated. The biota considered includes those in the pathways identified in Section 5.4.1 as well as those appearing on the endangered species list.	• NUREG-1555, Section 5.4.4	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.	Included in Section 5.4.
5.5	Environmental Impacts of Waste This section provides an introduction to the material in Sections 5.5.1 and 5.5.2.	• NUREG-1555, Section 5.5	ENV1 10 ENV2 20 ENV3 8 ENV4 12	ENV1 24 ENV2 48 ENV3 18 ENV4 30	ENV1 16 ENV2 32 ENV3 12 ENV4 20	250 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
5.5.1	Nonradioactive-Waste-System Impacts The information from Sections 3.6.1, 3.6.2, and 3.6.3 is reviewed against the regulatory requirements for air quality, water, solid waste, and hazardous waste. Acquisition of individual permits and consultations with the various governmental agencies are provided. It is assumed that there will be no liquid or solid waste disposal on site and that nonhazardous and hazardous waste is disposed of offsite in licensed facilities. Nonradiological waste streams addressed include air emissions, waste water discharges, storm water discharges, cooling system effluent, nonhazardous domestic (trash) and industrial (trash rack debris, spent materials and debris, etc.), hazardous waste, laboratory waste.	• NUREG-1555, Section 5.5.1	Included in Section 5.5.	Included in Section 5.5.	Included in Section 5.5.	Included in Section 5.5.
5.5.2	Mixed Waste Impacts The addition of the new unit(s) to the mixed waste program of the existing plant is addressed. It is assumed that a mixed waste plant parameter envelope is available and/or an estimate based on existing programs.	• NUREG-1555, Section 5.5.2	Included in Section 5.5.	Included in Section 5.5.	Included in Section 5.5.	Included in Section 5.5.
5.6	Transmission System Impacts This section will provide an introduction to the material in Sections 5.6.1 through 5.6.3.	• NUREG-1555, Section 5.6	ENV1 16 ENV3 16 ENV4 8	ENV1 8 ENV2 8 ENV4 8	ENV1 20 ENV2 20 ENV3 16 ENV4 16	176 hours
5.6.1	Terrestrial Ecosystems It is assumed that the existing transmission system for the SRS site and Vogtle will be upgraded to serve the new plant. Also, there will need to be a transmission line installed to connect the new plant to the existing transmission system. The terrestrial ecosystem impacts due to the frequency, duration, and location of operations and maintenance at offsite areas are reviewed. Per NEI 01-02, Section 3.3.4, only a general discussion of transmission corridor impacts is provided.	• NUREG-1555, Section 5.6.1	Included in Section 5.6.	Included in Section 5.6.	Included in Section 5.6.	Included in Section 5.6.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
5.6.2	Aquatic Ecosystems It is assumed that a review of transmission corridor impacts on aquatic ecosystems is not required based on NEI 01-02, Section 3.3.4. It is assumed that the impact analysis developed by others and a summary of the impact analysis report is provided in this section.	• NUREG-1555, Section 5.6.2	Included in Section 5.6.	Included in Section 5.6.	Included in Section 5.6.	Included in Section 5.6.
5.6.3	Impacts to Members of the Public It is assumed that a review of transmission corridor impacts on members of the public is not required based on NEI 01-02, Section 3.3.4. A general discussion of transmission corridor impacts is provided.	• NUREG-1555, Section 5.6.3	Included in Section 5.6.	Included in Section 5.6.	Included in Section 5.6.	Included in Section 5.6.
5.7	Uranium Fuel Cycle Impacts This section provides a description of the expected impacts on the uranium fuel cycle based on a specialty subcontractor analysis.	• NUREG-1555, Section 5.7	ENV4 40 NUC 40	ENV4 40 NUC 40 PROC 30 S/C: $53,000	ENV4 24 NUC 32	246 hours S/C: $53,000
5.8	Socioeconomic Impacts This section provides an introduction to the material in Sections 5.8.1 through 5.8.3.	• NUREG-1555, Section 5.8	ENV1 18 ENV2 36 ENV3 14 ENV4 24	ENV1 42 ENV2 84 ENV3 30 ENV4 52	ENV1 36 ENV2 72 ENV3 24 ENV4 40	472 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
5.8.1	Physical Impacts of Station Operation An assessment of the direct physical impacts of plant operation on the community, including noise, odors, exhaust, and visual intrusion is provided. A discussion of the proposed mitigation measures to minimize the identified adverse impacts is included. The distribution of people, buildings, roads, and recreational facilities vulnerable to impact from operation-related activities is identified. Predicted noise levels at sensitive receptors, e.g., hospitals, residences, and recreational areas are identified. The plant visual appearance from sensitive surrounding areas is evaluated considering visual aesthetic and visibility impacts of visual plumes. Air-modeling analysis is performed to predict nonradiological air pollution (e.g., emergency diesel generator emissions). It is assumed that the emergency diesel generator is a major source that requires a permit in accordance with the applicable state air quality regulations.	• NUREG-1555, Section 5.8.1	Included in Section 5.8.	Included in Section 5.8.	Included in Section 5.8.	Included in Section 5.8.
5.8.2	Social and Economic Impacts of Station Operation Information reported in existing SRS documents is reviewed. The socioeconomic impacts from plant operation on regional labor and housing, tax revenues to local jurisdictions, social or economic consequences of water-use or land-use impacts, and public services, such as safety, social services, tourism and recreation, public utilities, education, and transportation are identified. It is assumed that some results from the analyses performed in Section 4.4.2 and the existing reports can be extrapolated or modified. Significant impacts are identified and mitigation measures to minimize the adverse impacts are developed. Unavoidable adverse social and economic impacts are identified.	• NUREG-1555, Section 5.8.2	Included in Section 5.8.	Included in Section 5.8.	Included in Section 5.8.	Included in Section 5.8.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
5.8.3	Environmental Justice Impacts The pathways where any station-operation-related environmental impact may interact with cultural or economic facts that may result in disproportionate environmental impacts on minority and low-income populations are identified. An assessment is provided of the degree to which each minority or low-income population is disproportionately receiving adverse human health or environmental (including socioeconomic) impacts during plant operations and reasonably anticipated accidents as compared with the entire geographic area. Mitigation measures to minimize the identified adverse impacts are proposed. The unavoidable adverse environmental justice impacts are identified and a summary of the irreversible and irretrievable commitments that disproportionately affect minority and low-income populations is provided.	• NUREG-1555, Section 5.8.3	Included in Section 5.8.	Included in Section 5.8.	Included in Section 5.8.	Included in Section 5.8.
5.9	Decommissioning This section contains a certification that financial assurance for radiological decommissioning will be provided.	• NUREG-1555, Section 5.9	PM 80	PM 80	PM 80	240 hours
5.10	Measures and Controls to Limit Adverse Impacts During Operation This section provides a summary of the potential adverse environmental impacts of operation and the proposed mitigation measures to limit these adverse impacts as identified in Sections 5.1 through 5.9. The impacts of operation that are of sufficient severity to require commitments for mitigating the impacts of operation are tabulated.	• NUREG-1555, Section 5.10	0	0	ENV1 16 ENV2 32 ENV3 12 ENV4 20	80 hours
6.	Environmental Measurements and Monitoring Programs This section provides an introduction to the material in Sections 6.1 through 6.7.	• NUREG-1555, Section 6.0	0	0	0	0

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
6.1	Thermal Monitoring A thermal monitoring plan is developed for use during operation of the plant to monitor the thermal plume. A baseline monitoring plan is also developed for collecting data and processing by a subcontractor. Existing monitoring data collected by SRS, since it covers a long period, will be obtained and evaluated. This information is the basis for defining the scope and frequency of the collection of additional baseline data. The sampling is performed on a quarterly basis.	• NUREG-1555, Section 6.1	GHES5 100 GHES6 40 PROC 40 S/C: $42,000	GHES5 20 GHES6 20	GHES5 20 GHES6 20	260 hours S/C: $42,000
6.2	Radiological Monitoring The addition of the new plant to the radiological monitoring program of the existing plant is addressed.	• NUREG-1555, Section 6.2	0	0	0	0
6.3	Hydrological Monitoring A potential impact assessment based on site hydrologic conditions is performed. The monitoring locations are determined and specifications of monitoring equipment and data collections are prepared for subcontractor work.	• NUREG-1555, Section 6.3	GHES2 50 GHES5 40 PROC 40 S/C: $40,000	GHES2 40 GHES5 40	GHES2 10 GHES5 20	244 hours S/C: $40,000
6.4	Meteorological Monitoring The Meteorological Monitoring Program at the SRS is reviewed. It is assumed that for the existing meteorological tower: (1) the location is acceptable for use with the new plant (that the tower(s) will not have to be relocated), (2) the meteorological tower data is used for all phases of construction and operation, and (3) the data from the meteorological tower is representative of dispersion conditions at the site and to 80 km. Validation of the assumptions is made.	• NUREG-1555, Section 6.4	ENV1 8 ENV2 16 ENV3 6 ENV4 10	ENV1 10 ENV2 20 ENV3 8 ENV4 12	ENV1 6 ENV2 8 ENV3 6 ENV4 8	122 hours
6.5	Ecological Monitoring This section provides an introduction to the material in Sections 6.5.1 and 6.5.2.	• NUREG-1555, Section 6.5	ENV1 20 ENV3 16 ENV4 28 PROC 40 S/C: $65,000	ENV1 40 ENV2 24 ENV3 36 ENV4 24	ENV1 24 ENV3 20 ENV4 8	308 hours S/C: $65,000

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
6.5.1	Terrestrial Ecology and Land Use The Terrestrial Ecological Monitoring Programs at the SRS are reviewed. Guidance for developing the scope of the Pre-Application Monitoring Programs is derived from the Environmental Monitoring Program for the SRS. Pre-application monitoring activities are based on 9 months (3 seasons) of data to support submittal of the ESP Application in 15 months. It is assumed that annual cycles can be addressed by extrapolation of information from the years of monitoring for the existing SRS Environmental Monitoring Program. It is assumed that laboratory analyses are not required. A specialty subcontractor performs data collection and data analysis.	• NUREG-1555, Section 6.5.1	Included in Section 6.5.	Included in Section 6.5.	Included in Section 6.5.	Included in Section 6.5.
6.5.2	Aquatic Ecology The existing Aquatic Ecological Monitoring Programs are reviewed. Guidance for developing the scope of the Monitoring Programs is derived from the existing SRS Environmental Monitoring Program. Pre-application monitoring activities are based on 9 months (3 seasons) of data to support submittal of the ESP Application in 15 months. It is assumed that annual cycles can be addressed by extrapolation of information from the Operations Monitoring Program. A specialty subcontractor performs data collection and data analysis.	• NUREG-1555, Section 6.5.2	Included in Section 6.5.	Included in Section 6.5.	Included in Section 6.5.	Included in Section 6.5.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
6.6	Chemical Monitoring The information from Sections 2.3.2, 2.3.3, 3.3, 3.6, and 5.3 are reviewed against the regulatory requirements for water quality. Water Quality Monitoring Program Plans (for Construction, Preoperational, and Operational) are prepared. It is assumed that a Pre-Application Monitoring Program is not required; rather information that is required is available from Section 2.3.3, as updated from the existing SRS Environmental Monitoring Program. The Preoperational Monitoring Program is required to conform to the latest regulations and current NPDES conditions. A specialty subcontractor performs data collection and data analysis.	• NUREG-1555, Section 6.6	ENV1 8 ENV2 16 ENV3 6 ENV4 10	ENV1 28 ENV3 36 ENV4 36	ENV1 12 ENV2 20 ENV3 8 ENV4 16	200 hours
6.7	Summary of Monitoring Programs The tabular listings of the Environmental Monitoring Programs in Sections 6.1 through 6.6 are reviewed. One table per program is prepared including all phases. Programs or program elements that are required by other regulatory agencies are identified, including which element(s) are from existing programs or represent commitments. When detailed program elements will be available for the Operational phase is identified.	• NUREG-1555, Section 6.7	ENV2 4 ENV4 8	0	ENV1 12 ENV2 24 ENV3 8 ENV4 16	72 hours
7.	Environmental Impacts of Postulated Accidents Involving Radioactive Materials This section provides an introduction to the material in Sections 7.1 through 7.4 that describes radiological impacts of postulated accidents.	• NUREG-1555, Section 7.0	0	0	0	0
7.1	Design Basis Accidents The results of evaluations of offsite dose consequences from bounding design basis accidents are presented based on input from the reactor vendors.	• NUREG-1555, Section 7.1	0	0	0	0

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
7.2	Severe Accidents Dose consequence analysis for severe accidents are presented, including the socioeconomic impacts and the impact to biota, based on input from the reactor vendors.	• NUREG-1555, Section 7.2	NUC 60	NUC 80	NUC 60	200 hours
7.3	Severe Accident Mitigation Alternatives This section is not applicable to Early Site Permit Applications per NRC SECY-91-041, dated February 13, 1991.	• NUREG-1555, Section 7.3	0	0	0	0
7.4	Transportation Accidents This section describes postulated transportation accidents based on a subcontractor analysis.	• NUREG-1555, Section 7.4	ENV4 40 NUC 40	ENV4 40 NUC 80 PROC 30 S/C: $52,000	ENV4 24 NUC 32	286 hours S/C: $52,000
8.	Need for Power This section of NUREG-1555 is not applicable to the ESP Environmental Report based on the requirements of 10 CFR 52.17(a)(2).	• NUREG-1555, Section 8.0	0	0	0	0
9.	Alternatives to the Proposed Action This section provides an introduction to the material in Sections 9.1 through 9.4. The extent of consideration of alternatives to the proposed action is being discussed between the NRC and industry representatives	• NUREG-1555, Section 9.0	0	0	0	0
9.1	No-Action Alternative This section describes evaluations performed by the Applicant, the state, and others regarding the need for power and energy supply alternatives.	• NUREG-1555, Section 9.1	LIC 8	LIC 8	LIC 24	40 hours
9.2	Energy Alternatives This section provides an introduction to the material in Sections 9.2.1 through 9.2.3.	• NUREG-1555, Section 9.2	LIC 8	LIC 8	LIC 24	40 hours

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
9.2.1	Alternatives Not Requiring New Generating Capacity This section evaluates the economic and technical feasibility of supplying the projected demand for electrical energy without constructing a new plant and initiating energy conservation measures that would avoid the need for a new plant.	• NUREG-1555, Section 9.2.1	Included in Section 9.2.	Included in Section 9.2.	Included in Section 9.2.	Included in Section 9.2.
9.2.2	Alternatives Requiring New Generating Capacity This section evaluates alternative sources of energy that could reasonably be expected to meet the demand from both a load and economic standpoint.	• NUREG-1555, Section 9.2.2	Included in Section 9.2.	Included in Section 9.2.	Included in Section 9.2.	Included in Section 9.2.
9.2.3	Assessment of Alternative Energy Sources and Systems This section evaluates if one or more of the alternatives can be expected to provide an appreciable reduction in the overall environmental impact or offer solutions to potential adverse impacts predicted for the proposed plant.	• NUREG-1555, Section 9.2.3	Included in Section 9.2.	Included in Section 9.2.	Included in Section 9.2.	Included in Section 9.2.
9.3	Alternative Sites This section includes a discussion of this study. Other potential sites are not evaluated.	• NUREG-1555, Section 9.3	ENV2 24 ENV4 24	ENV2 24 ENV4 24	ENV2 30 ENV4 40	166 hours
9.4	Alternative Plant and Transmission Systems This section provides an introduction to the material in Sections 9.4.1 through 9.4.3.	• NUREG-1555, Section 9.4	ENV2 24 ENV4 24 MECH 12 ELEC 24	ENV2 24 ENV4 24 MECH 12 ELEC 24	ENV2 30 ENV4 40 MECH 12 ELEC 16	266 hours
9.4.1	Heat Dissipation Systems This section evaluates alternatives to the planned heat dissipation system to determine if there are alternatives that are environmentally preferable or equivalent to the proposed system.	• NUREG-1555, Section 9.4.1	Included in Section 9.4.	Included in Section 9.4.	Included in Section 9.4.	Included in Section 9.4.
9.4.2	Circulating Water Systems This section evaluates alternatives to the planned circulating water system to determine if there are alternatives that are environmentally preferable or equivalent to the proposed system.	• NUREG-1555, Section 9.4.2	Included in Section 9.4.	Included in Section 9.4.	Included in Section 9.4.	Included in Section 9.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
9.4.3	Transmission Systems This section evaluates alternatives to the planned transmission system to determine if there are alternatives that are environmentally preferable or equivalent to the proposed system.	• NUREG-1555, Section 9.4.3	Included in Section 9.4.	Included in Section 9.4.	Included in Section 9.4.	Included in Section 9.4.
10.	Environmental Consequences of the Proposed Action This section provides an introduction to the material in Sections 10.1 through 10.4.	• NUREG-1555, Section 10.0	0	0	0	0
10.1	Unavoidable Adverse Environmental Impacts The information in Sections 4.6 and 5.10 is reviewed. Unavoidable adverse environmental impacts are identified in appropriate text and summary tables.	• NUREG-1555, Section 10.1	ENV1 4 ENV2 8 ENV3 4 ENV4 8	ENV1 4 ENV3 8 ENV4 4	ENV1 4 ENV2 8 ENV3 4 ENV4 8	64 hours
10.2	Irreversible and Irretrievable Commitments of Resources The information in Section 4 for construction and Section 5 for operation is reviewed. Irreversible and irretrievable commitments of resources are identified in appropriate text and summary tables.	• NUREG-1555, Section 10.2	ENV1 4 ENV2 8 ENV3 4 ENV4 8	ENV1 4 ENV3 8 ENV4 4	ENV1 4 ENV2 8 ENV3 4 ENV4 8	64 hours
10.3	Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment Sections 10.1, 10.2, and the applicable portions of Sections 4.0 and 5.0 are reviewed. Local short-term uses of the environment and the impacts of these uses on long-term environmental productivity are reviewed.	• NUREG-1555, Section 10.3	ENV1 4 ENV2 8 ENV3 4 ENV4 8	ENV1 4 ENV3 8 ENV4 4	ENV1 4 ENV2 8 ENV3 4 ENV4 8	64 hours
10.4	Benefit-Cost Balance This section provides an introduction to the material in Sections 10.4.1 through 10.4.3.	• NUREG-1555, Section 10.4	0	0	LIC 20	20 hours
10.4.1	Benefits This section identifies and tabulates the benefits of construction and operation of the proposed units.	• NUREG-1555, Section 10.4.1	0	0	Included in Section 10.4.	Included in Section 10.4.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
10.4.2	Costs This section identifies and tabulates the internal and external costs of construction and operation of the proposed units.	• NUREG-1555, Section 10.4.2	0	0	Included in Section 10.4.	Included in Section 10.4.
10.4.3	Summary This section analyzes and evaluates the benefits and costs of the project.	• NUREG-1555, Section 10.4.3	0	0	Included in Section 10.4.	Included in Section 10.4.
--	Compile and Issue Revision A ER Review Revision A ER Resolve Comments and Issue Revision B ER	N/A	0	0	LIC 360 ENV2 64 ENV4 160 GHES2 48 GHES5 120 MECH 48 ELEC 28 CIV 32 NUC 48	908 hours
PART 4 – EMERGENCY RESPONSE PLAN						
---	Table of Contents List of Tables List of Figures Abbreviations and Acronyms	• 10 CFR 52.17(b)(1) • 10 CFR 52.17(b)(2)(i) • 10 CFR 52.17(b)(3) • NUREG-0654, Revision 1, Supplement 2	0	0	0	0
1.	IDENTIFICATION OF PHYSICAL CHARACTERISTICS The physical characteristics unique to the site are identified, such as egress limitations from the area surrounding the site that could pose a significant impediment to the development of an Emergency Plan.	• NUREG-0654, Revision 1, Supplement 2, Section II	0	0	EP 440	440 hours
1.1	Site Description	• NUREG-0654, Revision 1, Supplement 2, Section II	0	0	Included in Section 1.	Included in Section 1.
1.2	Evacuation Time Estimate Analysis An evacuation time estimate analysis is provided consistent with the existing SRS Site Emergency Plan.	• NUREG-0654, Revision 1, Supplement 2, Section II.A	0	0	Included in Section 1.	Included in Section 1.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.	MAJOR FEATURES OF THE EMERGENCY PLAN Proposed major features of the Emergency Plan are identified.	• NUREG-0654, Revision 1, Supplement 2, Section III	0	0	Included in Section 1.	Included in Section 1.
2.1	Emergency Planning Zones The size of the EPZs are described.	• NUREG-0654, Revision 1, Supplement 2, Section III.A	0	0	Included in Section 1.	Included in Section 1.
2.2	Planning Standards and Evaluation Criteria This section provides an introduction to the material in Sections 2.2.1 through 2.2.14.	• NUREG-0654, Revision 1, Supplement 2, Section III.B	0	0	Included in Section 1.	Included in Section 1.
2.2.1	Assignment of Responsibility (Organization Control) Primary responsibilities for emergency response are identified by the Applicant and by state and local organizations.	• NUREG-0654, Revision 1, Supplement 2, Section V.A	0	0	Included in Section 1.	Included in Section 1.
2.2.2	Onsite Emergency Organization Interfaces among various onsite response activities and offsite support and response activities are identified.	• NUREG-0654, Revision 1, Supplement 2, Section V.B	0	0	Included in Section 1.	Included in Section 1.
2.2.3	Emergency Response Support and Resources Arrangements for requesting assistance resources are described, and organizations capable of augmenting the planned response are identified.	• NUREG-0654, Revision 1, Supplement 2, Section V.C	0	0	Included in Section 1.	Included in Section 1.
2.2.4	Emergency Classification System A standard emergency classification scheme is specified.	• NUREG-0654, Revision 1, Supplement 2, Section V.D	0	0	Included in Section 1.	Included in Section 1.
2.2.5	Notification Methods and Procedures The means are described for notification by the Applicant of state and local response organizations, and for notification of emergency personnel and the populace within the plume exposure pathway EPZ.	• NUREG-0654, Revision 1, Supplement 2, Section V.E	0	0	Included in Section 1.	Included in Section 1.
2.2.6	Emergency Communications Provisions are described for prompt communications among principal response organizations to emergency personnel and to the public.	• NUREG-0654, Revision 1, Supplement 2, Section V.F	0	0	Included in Section 1.	Included in Section 1.
2.2.7	Public Education and Information An emergency planning program for the public and news media is described.	• NUREG-0654, Revision 1, Supplement 2, Section V.G	0	0	Included in Section 1.	Included in Section 1.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.2.8	Emergency Facilities and Equipment Adequate emergency facilities and equipment to support the emergency response are described.	• NUREG-0654, Revision 1, Supplement 2, Section V.H	0	0	Included in Section 1.	Included in Section 1.
2.2.9	Accident Assessment Adequate methods, systems, and equipment are described for assessing and monitoring actual or potential offsite consequences of a radiological emergency condition.	• NUREG-0654, Revision 1, Supplement 2, Section V.I	0	0	Included in Section 1.	Included in Section 1.
2.2.10	Protective Response A range of protective actions is described for the plume exposure pathway EPZ for the public and emergency workers.	• NUREG-0654, Revision 1, Supplement 2, Section V.J	0	0	Included in Section 1.	Included in Section 1.
2.2.11	Radiological Exposure Control Means are described for controlling radiological exposures to emergency workers in an emergency.	• NUREG-0654, Revision 1, Supplement 2, Section V.K	0	0	Included in Section 1.	Included in Section 1.
2.2.12	Medical and Public Health Support Contacts and arrangements are described for medical services for contaminated injured individuals.	• NUREG-0654, Revision 1, Supplement 2, Section V.L	0	0	Included in Section 1.	Included in Section 1.
2.2.13	Recovery and Reentry Planning and Postaccident Operations Per NUREG-0654 (R1/S2), this section is not applicable to ESPs.	• NUREG-0654, Revision 1, Supplement 2, Section V.M	0	0	Included in Section 1.	Included in Section 1.
2.2.14	Exercises and Drills Per NUREG-0654 (R1/S2), this section is not applicable to ESPs.	• NUREG-0654, Revision 1, Supplement 2, Section V.N	0	0	Included in Section 1.	Included in Section 1.
2.2.15	Radiological Emergency Response Training A radiological emergency response training program is described for those who may be called on to assist in an emergency.	• NUREG-0654, Revision 1, Supplement 2, Section V.O	0	0	Included in Section 1.	Included in Section 1.
2.2.16	Responsibility for the Planning Effort Responsibilities are established for plan development and review and for distribution of emergency plans, and training is described for planners.	• NUREG-0654, Revision 1, Supplement 2, Section V.P	0	0	Included in Section 1.	Included in Section 1.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
3.	CONTACTS AND ARRANGEMENTS This section describes contacts and arrangements made for the Emergency Plan.	• 10 CFR 52.17(b)(3) • NUREG-0654, Revision 1, Supplement 2, Sections II.B and III.C	0	0	Included in Section 1.	Included in Section 1.
4.	CONFORMANCE WITH REGULATORY REQUIREMENTS AND GUIDANCE This section identifies the conformance (compliance) with applicable regulatory requirements (e.g., 10 CFR) and regulatory guidance documents (e.g., Regulatory Guides, NEI 01-02, NUREGs, etc.)	None	0	0	Included in Section 1.	Included in Section 1.
5.	REFERENCES	None	0	0	Included in Section 1.	Included in Section 1.
NA	Compile and Issue Revision A ERP Review Revision A ERP Resolve Comments and Issue Revision B ERP	N/A	0	0	LIC 60	60 hours
PART 5 – PROGRAMS AND PLANS						
---	**Table of Contents**	None				
Plan 1	QUALITY ASSURANCE PROGRAM A Quality Assurance Program for the Savannah River ESP project is developed and submitted to the NRC for review. A summary of the detailed QAP is Included in Section this part of the ESP Application.	• 10 CFR 50.34(a)	0	0	QA 320	320 hours
Plan 2	SITE REDRESS PLAN	• 10 CFR 52.17(c) • 10 CFR 50.10(e)(1) • NEI 01-02, Section 3.2.3 • Reference 1, Section 5	0	0	0	0

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours) Collect Data	Perform Analyses	Write Section	Total
1.	DESCRIPTION OF SITE PREPARATION ACTIVITIES This section describes the site preparation activities that are planned for each reactor type based on the evaluations and engineering performed in support of SSAR Section 1.3 and ER Section 3.	• 10 CFR 50.10(e)(1) • 10 CFR 52.25	GHES5 16 MECH 16 ELEC 16 CIV 16 CONS 40	GHES5 12 MECH 8 ELEC 8 CIV 32	GHES5 32 MECH 8 ELEC 8 CIV 60 CONS 48	352 hours
2.	SITE REDRESS PLAN This section introduces the material in Sections 2.1 through 2.6.	• Reference 1, Section 5	GHES5 16 MECH 16 ELEC 16 CIV 16	LIC 32 ENV1 12 ENV2 24 ENV3 10 ENV4 14 GHES5 32 CONS 20	LIC 20 ENV1 2 ENV2 4 ENV3 2 ENV4 4 GHES5 12 MECH 16 ELEC 16 CIV 32 CONS 24	340 hours
2.1	General This section outlines the overall objectives for the redress plan and the conceptual options that were considered.	• Reference 1, Section 5.1	Included in Section 2.	Included in Section 2.	Included in Section 2.	Included in Section 2.
2.2	Site Redress Criteria This section identifies the criteria that govern the redress plan and activities.	• Reference 1, Section 5.2	Included in Section 2.	Included in Section 2.	Included in Section 2.	Included in Section 2.
2.3	Description of Redress Plan This section describes the activities that will be implemented to redress the site including: • Physical Activities • Future Site Ownership and Use • Use of Applicant-Constructed Facilities for Future Use • Habitat Replacement • Restoration of Sensitive Water Resource Features • Recontouring, Revegetation, and Replanting Cleared Areas • Potential Liabilities • Potential Contamination	• NEI 01-02, Section 3.2.3 • Reference 1, Section 5.3	Included in Section 2.	Included in Section 2.	Included in Section 2.	Included in Section 2.

Table 7-1. Savannah River ESP Resource Estimate

Section	Section Title and Scope of Work	Regulatory Requirements Applicable Guidance	Resource Requirements (Hours)			
			Collect Data	Perform Analyses	Write Section	Total
2.4	Impacts on Existing Redress and Decommissioning Plans This section identifies and evaluates any impacts on plans for the existing units and the ISFSI.	• NEI 01-02, Section 3.2.3	Included in Section 2.	Included in Section 2.	Included in Section 2.	Included in Section 2.
2.5	Financial Capability This section describes the Applicant's financial capability to complete the redress of the site if the unit(s) should not be built.	• Reference 1, Section 5	Included in Section 2.	Included in Section 2.	Included in Section 2.	Included in Section 2.

Table 7-1. Savannah River ESP Resource Estimate

Number	Activity	Resource Requirements (Hours)	
		Resources	Total
OTHER PROJECT ACTIVITIES			
1.	PREPARE PROJECT PROCEDURES, QA PLAN, ETC.	QA 360	360 hours
2.	NRC REVIEW AND APPROVAL • Compile and Submit Revision 0 ESP Application • NRC Review Costs including NRC Subcontractor costs • Respond to NRC Requests for Additional Information (RAIs) • Prepare Revisions to the ESP Application • Attend Meetings • Support Hearings NRC hours based on Table V.D-1 in NRC SECY-01-0188, dated October 12, 2001, “Future Licensing and Inspection Readiness Assessment.” 20 FTEs x 2080 hours/yr x 0.33 (1/3 of costs for 3 lead applicants) = 13867 NRC review hours. $1,700,000 x 0.33 = $567,000 in NRC subcontractor costs.	LIC 644 LEG1 120 LEG2 120 ENV1 500 ENV4 500 GHES2 500 GHES5 500 MECH 200 ELEC 120 NUC 200 CONS 60 PROC 80 S/C: $15,000 NRC 13867 NRC S/C: $567,000	3504 hours S/C: $15,000 NRC: 13867 hours NRC S/C: $567,000
3.	PROJECT MANAGEMENT 0.5 FTE for Applicant and Contractor for 33 months	PM 2695 CPM 2695	5390 hours
4.	PROJECT ENGINEER 1.0 FTE for Applicant and Contractor for 15 months, 0.5 FTE for 18 months	PE 3920 CPE 3920	7840 hours
5.	TECHNOLOGY ENGINEER 0.25 FTE for 33 months	TECH 1350	1350 hours

Table 7-1. Savannah River ESP Resource Estimate

Number	Activity	Resource Requirements (Hours)	
		Resources	Total
6.	LICENSING 0.7 FTE for Applicant for 15 months, 1.0 FTE for Contractor for 15 months, 0.5 FTE for Applicant and Contractor for 18 months	LIC 3220 CLIC 3920	7140 hours
7.	PROJECT CONTROLS 0.5 FTE for 33 months.	PRC 2695	2695 hours
8.	QUALITY ASSURANCE	QA 1000	1000 hours
9.	LEGAL	LEG1 240 LEG2 240	480 hours
10.	PUBLIC RELATIONS	PRL 572	572 hours
11.	ADMINISTRATION 1.0 FTE for 15 months, 0.5 FTE for 18 months	ADM 3920	3920 hours
12.	CONFIGURATION CONTROL 2.0 FTE for 15 months, 1.0 FTE for 18 months	CONF 6370	6370 hours
13.	ENVIRONMENTAL PROJECT ENGINEER 0.5 FTE for 33 months	EPE 2695	2695 hours

Table 7-1. Savannah River ESP Resource Estimate.

Definition of Resource Types

ADM	Administration	GHES4	Senior Geotechnical/Hydrological Engineer II
CLIC	Contractor Senior Licensing Engineer	GHES5	Senior Principal Geotechnical/Hydrological Engineer I
CONF	Configuration Engineer	GHES6	Senior Principal Geotechnical/Hydrological Engineer II
CONS	Construction Manager	LEG1	Legal Counsel
CPE	Contractor PE	LEG2	Senior Legal Counsel
CPM	Contractor PM	LIC	Applicant Senior Licensing Engineer
ELEC	Senior Electrical Engineer	NRC	U.S. Nuclear Regulatory Commission
ENV1	Environmental Engineering Specialist	NUC	Senior Nuclear Engineer
ENV2	Senior Environmental Engineer I	PE	Applicant PE
ENV3	Senior Environmental Engineer II	PM	Applicant PM
ENV4	Senior Principal Environmental Engineer	PRC	Project Controls Manager
EP	Emergency Planning Specialist	PRL	Public Relations Manager
EPE	Environmental Project Engineer	PROC	Procurement Manager
GHES1	Geotechnical/Hydrological Engineer	QA	Quality Assurance
GHES2	Geotechnical/Hydrological Engineering Specialist	TECH	Senior Technology Engineer
GHES3	Senior Geotechnical/Hydrological Engineer I		

References

1. March 5, 1984 letter from Francis X. Gavigan, Director, Office of Breeder Demonstration Projects, Office of Nuclear Energy, U.S. Department of Energy, to Mr. Thomas King, Acting Director, CRBR Program Office, U.S. Nuclear Regulatory Commission, Subject: Clinch River Breeder Reactor Plant (CRBRP) Site Redress Plan.

Table 7-2. Savannah River ESP Jobhour Resources (Hours by Quarter)

Resource	1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q	9Q	10Q	11Q	12Q	Total
ADM Administration	333	333	323	328	333	333	328	328	333	333	323	292	3920
CIV Senior Civil Engineer	853	157	48	170	43	18	18	18	18	18	18	11	1390
CLIC Contractor Senior Lic. Engr.	333	333	323	328	333	333	328	328	333	333	323	292	3920
CONF Configuration Engineer	816	816	796	806	816	383	328	328	333	333	333	292	6370
CONS Construction Manager	227	154	40	158	22	9	9	9	9	9	9	5	660
CPE Contractor Project Engineer	333	333	323	328	333	333	328	328	333	333	323	292	3920
CPM Contractor Project Manager	230	230	223	227	230	230	227	227	231	230	223	187	2695
ELEC Senior Electrical Engineer	378	86	24	155	42	18	18	18	18	18	18	18	804
ENV1 Environmental Engineer	597	608	226	147	21	74	75	76	74	74	76	48	2096
ENV2 Environmental Engineer	980	791	353	211	39	0	0	0	0	0	0	0	2374
ENV3 Environmental Engineer	277	391	180	102	3	0	0	0	0	0	0	0	953
ENV4 Environmental Engineer	552	734	407	334	158	74	75	76	74	74	76	47	2681
EP Emergency Planning Specialist	123	317	0	0	0	0	0	0	0	0	0	0	440
EPE Environ. Project Engineer	230	230	223	227	230	230	227	227	231	230	223	187	2695
GHES1 Geotech/Hydro Engineer	217	578	673	142	0	0	0	0	0	0	0	0	1610
GHES2 Geotech/Hydro Engineer	458	1296	1082	135	46	74	75	76	74	74	76	50	3516

Table 7-2. Savannah River ESP Jobhour Resources (Hours by Quarter)

Resource	1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q	9Q	10Q	11Q	12Q	Total
GHES3 Geotech/Hydro Engineer	277	1212	1397	184	0	0	0	0	0	0	0	0	3070
GHES4 Geotech/Hydro Engineer	13	28	0	31	0	0	0	0	0	0	0	0	72
GHES5 Geotech/Hydro Engineer	298	1483	2134	527	150	74	75	76	74	74	76	47	5088
GHES6 Geotech/Hydro Engineer	29	102	109	10	0	0	0	0	0	0	0	0	250
LEG1 Legal Counsel	21	21	20	21	21	20	20	21	28	54	18	15	280
LEG2 Senior Legal Counsel	21	21	20	21	21	20	20	21	28	54	18	15	280
LIC Applicant Sr. Licensing Engr.	308	368	353	373	318	433	388	448	453	453	443	338	4676
MECH Senior Mechanical Engineer	694	141	24	245	52	30	30	31	30	30	31	18	1356
NUC Senior Nuclear Engineer	537	838	368	88	48	31	30	30	30	31	30	17	2078
PE Applicant PE	333	333	323	328	333	333	328	328	333	333	323	292	3920
PM Applicant PM	381	318	360	270	260	230	257	227	231	230	223	188	3175
PRC Project Controls Manager	230	230	223	227	230	230	227	227	231	230	223	187	2695
PRL Public Relations Manager	48	48	47	47	48	49	48	47	48	48	48	46	572
PROC Procurement Manager	107	250	157	24	4	12	12	12	12	12	12	6	620
QA Quality Assurance	509	175	174	162	84	84	84	84	82	84	84	38	1680
TECH Senior Technology Engineer	260	270	245	227	230	230	227	198	198	198	170	141	2594
TOTAL HOURS	10932	13204	11268	6606	4427	3863	3805	3811	3793	3868	3755	3118	72450

Table 7-3. Order of Magnitude Cost Estimate

	Hours	Labor Dollars	Travel and Subcontract Dollars	Total Dollars
Part 1 Introduction	60	7,410	0	7,410
Part 2 Site Safety Analysis Report	16440	2,030,500	290,000	2,320,500
Part 3 Environmental Report	11122	1,373,600	483,000	1,856,600
Part 4 Major Features Emergency Response Plan	500	61,800	0	61,800
Part 5 Programs and Plans	1012	125,000	0	125,000
Other Project Activities				
Applicant	43316	5,350,000	156,500	5,506,500
NRC	13867	2,250,000	567,000	2,817,000
TOTAL	86317	11,198,310	1,496,500	12,694,810

Figure 7-2. Schedule for Savannah River Early Site Permit

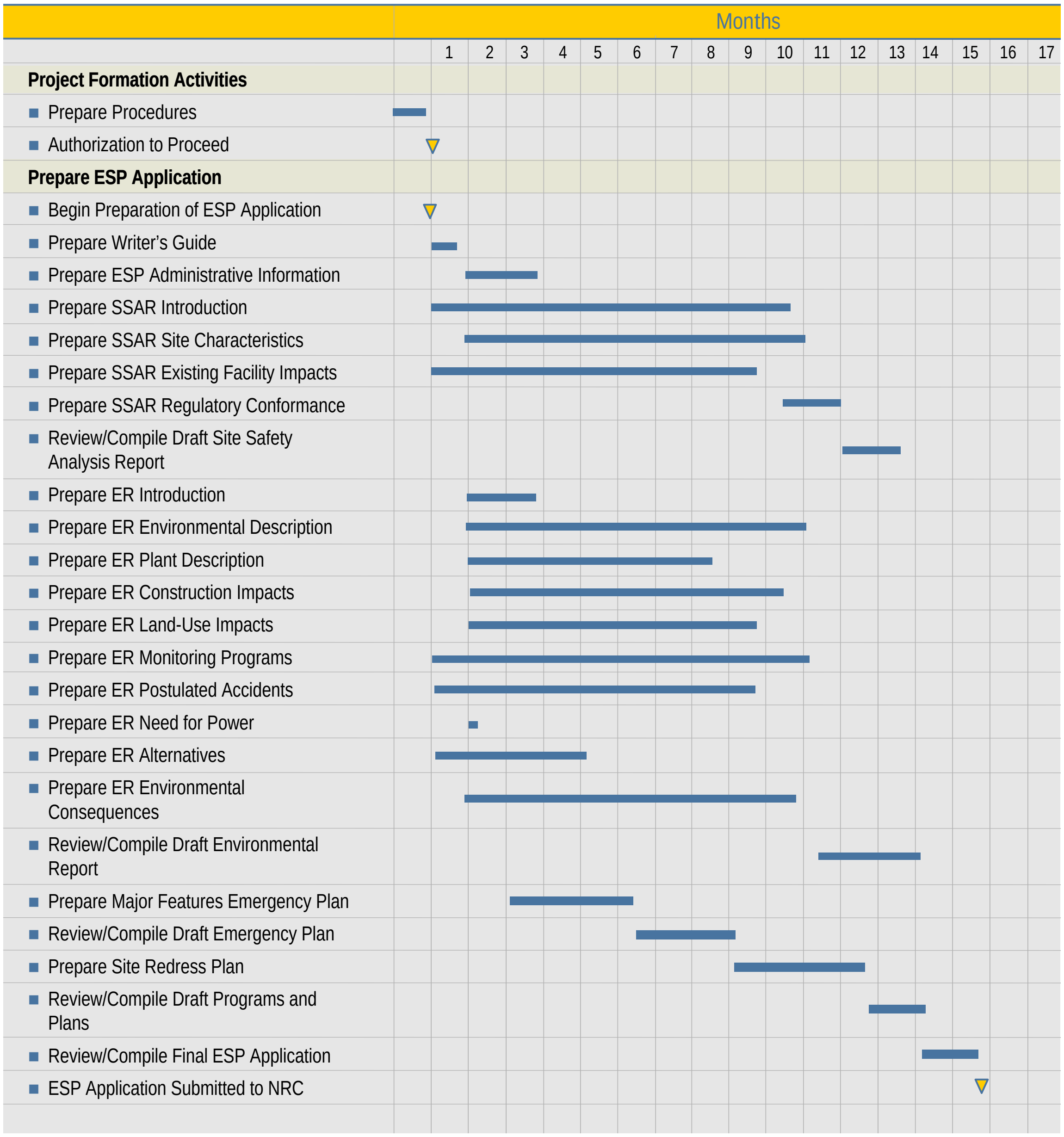


Figure 7-2. Schedule for Savannah River Early Site Permit *(cont.)*