# Chapter 10 Environmental Consequences of the Proposed Action

This chapter presents the potential environmental consequences of constructing and operating the new units at the ESP site. These potential consequences are presented in the following subsections:

Section 10.1 – Unavoidable Adverse Environmental Impacts. Unavoidable adverse environment impacts are those potential impacts of construction and operation of the new units that cannot be avoided and for which no practical means of mitigation are available.

Section 10.2 – Irreversible and Irretrievable Commitments of Resources. Irreversible commitments of resources applies to environmental resources that would be potentially impacted by the new units and that could not be altered at some later time to restore the current state of the resources. Irretrievable commitments of resources applies to material resources that would be used for the new units in such a way that they could not, by practical means, be recycled or restored for other uses.

Section 10.3 – Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment. Short-term uses and long-term productivity refer to the analyses of unavoidable adverse or beneficial environmental impacts of the construction and operation of the new units during the period of construction, operation, and through decommissioning.

Section 10.4 – Benefit -Cost Balance. This section contains a brief description explaining why cost-benefit information is not included in this ESP application.

## 10.1 Unavoidable Adverse Environmental Impacts

This section summarizes those adverse environmental impacts due to the construction and operation of the new units that cannot be avoided and for which no practical means of mitigation are available. Part of this summary includes identification of mitigation actions that have been proposed to reduce the impacts and would be reasonable and practical to implement. Information provided in Section 4.6 and Section 5.10 has been used in preparing this section.

### 10.1.1 Unavoidable Adverse Environmental Impacts During Construction

The potential adverse environmental impacts from construction of the new units are described in Chapter 4. The measures and controls to reduce or eliminate these impacts are identified in Section 4.6. The expected impacts and the mitigation measures that are practical to reduce these impacts are identified and summarized in Table 10.1-1. Those instances where adverse environmental impacts would remain after all reasonable means have been taken to avoid or mitigate them are also identified in Table 10.1-1, under the column labeled “Unavoidable Adverse Impacts”, where “Y” means there are such impacts and “N” means the specified mitigation measures are sufficient to reduce the impacts to insignificant or small. For many of the impacts related to construction activities, mitigation measures that would be applied are referred to as “best

management practices." Typically, their use is determined by the types of activities that are to be performed, and frequently, they are implemented through plans and procedures developed at the time of construction.

### 10.1.2 **Unavoidable Adverse Environmental Impacts During Operation**

The potential adverse environmental impacts from operation of the new units are described in Chapter 5. The measures and controls to reduce or eliminate these impacts are identified in Section 5.10. The expected impacts and the mitigation measures that are practical to reduce these impacts are identified and summarized in Table 10.1-2. Those instances where adverse environmental impacts would remain after all practical means to avoid or mitigate them have been applied are also identified in Table 10.1-2, under the column labeled "Unavoidable Adverse Impacts," where "Y" means there are such impacts, and "N" means the specified mitigation measures are sufficient to reduce the impacts to insignificant or small. Again, the environmental impacts and related mitigation measures identified in this ER are based on the PPE approach. Because the type of reactor and associated ancillary equipment have not yet been selected, the impacts and mitigation measures identified in Table 10.1-2 should be considered as bounding cases.

### 10.1.3 **Summary of Adverse Environmental Impacts**

As can be seen from Table 10.1-1 and Table 10.1-2, most of the adverse environmental impacts are reduced to insignificance or eliminated through the application of the listed mitigation measures. Those that are not entirely eliminated are discussed further in this section.

During construction, the primary adverse environmental impacts would be related to land use. Much of the NAPS site would undergo a change from unused property to industrial use associated with operation of the new units at the site. While these changes would result in the movement of wildlife from the NAPS site, the changes are in keeping with the current industrial use zoning. Furthermore, the original selection and review of the NAPS site was based on building four units at the site. Therefore, the changes, while small, are compatible with the long-term use of the site. Furthermore, Dominion and Virginia Power have the long-term intention of continuing energy production on the NAPS site into the foreseeable future, which is compatible with the industrial use zoning and the current use of the site.

Many of the expected construction impacts on the terrestrial ecology of the site would be short-term impacts. The numbers of wildlife, especially of the larger animals, and the amount of vegetation that would decrease because of the construction activities, would not fully recover, because the land used for new structures and operational activities, including parking, would effectively eliminate the possibility of restoring the acreage to its pre-construction condition. However, the conclusions of the ecological studies for this ER are that: 1) there are no important species currently on site, 2) some of the species would return to the areas of the site that are restored to their previous state, and

3) areas outside the site would be generally unaffected with regard to terrestrial wildlife and vegetation. Therefore, while there would be noticeable changes due to construction of the new units, the immediate area surrounding the site would not experience any long-term impacts due to the construction and operation of the new units.

Depending on the selected reactor design and its related ancillary equipment (e.g., use of dry cooling towers) there could be a noticeable visual change obvious to lake users and line-of-sight residences around the lake. Completion of a visual impact study once technologies and equipment are selected, however, would identify mitigation measures that could reduce visual impacts, through configuration of the structures on the ESP site. The conclusion is that visual impacts would not have any short- or long-term impacts to local residents or tourists, and are therefore small.

The use of new reactor technologies would reduce the amount of radioactive waste generated that would need to be disposed of when compared to the volume of waste currently generated at existing nuclear power plants.

### 10.1.4 **Irreversible and Irretrievable Commitment of Resources**

As presented in Section 10.2, during construction there would be very little commitment of significant resources that are irreversible or irretrievable. Those that would be committed are the typical construction resources of steel, piping, and concrete. The latter, while large, is not atypical of other types of power plants such as hydroelectric and coal-fired plants, nor of many large industrial facilities (e.g., refineries and steel plants) that are constructed throughout the United States.

During operation, as presented in Section 10.2, the main resource that is irreversibly and irretrievably committed is the uranium that is consumed in the power production process. However, the use of new, more efficient reactor technologies by the nuclear power industry would result in lower consumption of uranium in the form of enriched $UF_6$. This reduced demand for enriched $UF_6$ would result in a reduction in the amount of uranium ore that has to be mined for production of yellowcake that is subsequently converted into $UF_6$. Because the mining of uranium ore, the production of yellowcake and its conversion to $UF_6$, and the subsequent enrichment of the $UF_6$ so that it can be used as fuel, all require energy, a reduction in the amount of uranium ore required would also serve to reduce the amount of energy consumed in the production of the fuel.

## Section 10.1 References

None

## Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

| Category/ ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Land Use/ Section 4.1.1 | Construction of new units and related parking | Comply with requirements of applicable federal, state and local construction permits/approvals and local ordinances. | Y |
| Section 4.1.1 | Construction of power plant | Construct only in area approved by federal, state, and local agencies for installation of the power plant. | Y |
| Section 4.1.1 | Earthmoving activities (e.g., grading, re-contouring of disturbed areas) | Restrict activities to actual construction site and construction access road from Route 700.<br>Install fence along southern and eastern boundaries, which includes the boundary with the existing units. | N |
| Section 4.1.1 | Construction and maintenance of soil stockpiles | Locate soil stockpiles on the construction site only. | N |
| Atmospheric/ Section 4.1.1 | Fugitive dust and/or gaseous emissions from the operating vehicles and equipment | Apply measures from the fugitive dust control plan and maintain vehicles and equipment in good working order. | N |
| Historic, Cultural, and Archaeological Resources/ Section 4.1.3 | Potential for destruction of archaeological, historic, or cultural resources in areas suspected or known to have artifacts | Conduct sub-surface testing prior to start of any onsite work to identify buried archaeological or cultural resources. | N |
| Section 4.1.3 | Unanticipated discovery of archaeological or cultural resources or hazardous waste during construction | Require construction contractor and subcontractors to develop and follow procedures (or use applicable existing procedures) to handle potential unanticipated discoveries, including stopping work immediately and notifying appropriate agencies. | N |
| Hydrologic Alterations/ Section 4.2.1 | Potential affect of dewatering on some existing NAPS potable water wells | Maintain flows required by existing units by using unaffected wells. | N |

## Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

| Category/ ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Section 4.2.1 | Erosion and sedimentation impacts on Lake Anna due to storm water runoff from the construction site | Obtain Storm Water Construction General Permit, the VPDES permit.<br>Apply Storm Water Pollution Prevention Plan developed as part of the Storm Water Construction General Permit application.<br>Use best management practices (BMPs) described in Virginia Erosion and Sediment Control Handbook. | N |
| Section 4.2.1 | Migration of turbid water into the lake due to removal of existing cofferdam after construction of new water intake | Design and install appropriate barrier (e.g., turbidity curtain in Lake Anna near cofferdam) to prevent migration of turbid water into Lake. | N |
| Section 4.2.1 | Impacts to intermittent stream channel on site | Obtain and comply with VPDES permit. Adhere to seasonal restrictions for in-water work.<br>Install erosion control measures.<br>Install drainage controls to convey stream flow.<br>Follow construction stormwater management requirements. | N |
| Water Use/ Section 4.2.2 | Increased sediment loading to surface water due to dewatering activities | Limit dewatering activities to what is needed.<br>Require application of erosion and sediment controls to such activities (e.g., bag filter, flow spreader, retention basin). | N |
| Section 4.2.2 | Contamination of surface water or groundwater from releases of fuel, oils, or chemicals during construction. | Develop and implement a spill control and response plan in addition to the SWPPP. | N |
| Terrestrial Ecology/ Section 4.3.1 | Removal of existing trees and vegetation | Restrict removal of trees and vegetation to the construction site.<br>Leave greenbelt of trees along southern boundary of construction site.<br>Avoid sensitive areas if any are protected by law, permit, or approval process. | Y |
| Section 4.3.1 | Loss of habitat due to clearing and grading, which would result in movement of wildlife from area during construction | Re-establish areas, where possible, when construction is completed so that wildlife should return. | Y |

## Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

| Category/ ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Section 4.3.1 | Migration of wildlife away from undisturbed areas onsite or close to site during time when there are high levels of noise generated by construction activities | Maintain vehicles and equipment as per manufacturer's requirements. | Y |
| Aquatic Ecology/ Section 4.3.2 | Disturbance, or destruction, of wetlands by working in, over, or in proximity to these areas | Avoid, if possible.<br>Otherwise minimize disturbance, and compensate for any destruction of wetlands as per VDEQ regulations.<br>Compensation would require creation or expansion of another, larger, wetland area. | N |
| Section 4.3.2 | Disturbance of intermittent streams by working in, over, or in proximity to these areas | Avoid, or else work in the dry season, if possible, and restore streambed.<br>Divert stream around construction and use settling basins, as needed, to remove sediment prior to re-connecting downstream of construction.<br>Reconnect original streambed after construction activities, if possible. Install permanent diversion to restore the streambed, if necessary.<br>Minimize disturbance and compensate for any destruction of streambed as per VDEQ regulations. Compensating for the loss of the intermittent stream would replace the loss. | Y |
| Section 4.3.2 | Degradation of water quality in lake during in-water and shoreline work | Design and install barrier (e.g., turbidity curtain) to prevent turbid water from entering lake. | N |
| Section 4.3.2 | Temporary loss of benthic habitat and organisms during construction, as benthic organisms and fish should recolonize the intake channel cove after completion of construction activities | Adhere to any seasonal restrictions of working in-water if stipulated in approval of ER or of any required permits. | N |

## Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

| Category/ ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Socioeconomic/ Section 4.4.1 | Relatively higher noise levels offsite in residential areas | Restrict noisier construction activities to daytime hours.<br>Notify general public when activities with atypically loud noise levels would occur.<br>Develop and implement a plan to manage and respond to concerns of citizens about noise. | N |
| Section 4.4.1 | Offsite effects of gaseous emissions from vehicles and diesel -powered equipment which should be small due to distance to nearest residences | Proper maintenance of vehicles and equipment should be sufficient to avoid noticeable impacts.<br>Respond to concerns of citizens about gaseous emissions from the construction site via the complaint management plan. | N |
| Section 4.4.1 | Transport of high dust levels offsite into residential areas | Develop and apply dust control plan that includes the following: Speed controls for onsite vehicles, covers for truck loads; use of water or approved chemicals on soil stockpiles and disturbed areas.<br>Stop work on dust-generating activities under high wind conditions.<br>Respond to concerns of citizens about high dust levels via the complaint management plan. | N |
| Section 4.4.1, Section 4.4.2 | Traffic congestion and/or accidents from increased commuting construction workers, especially on local roads | Develop and implement a construction traffic management plan to reduce the numbers of vehicles being used on the local roads through use of buses, increased carpooling and vanpooling.<br>Post signs in the local area to make the public and passers-by aware of the high construction traffic associated with the site<br>Perform a traffic study and implement recommendations with regard to upgrades needed to Route 700 between the NAPS and the intersection with Route 652.<br>Coordinate work shifts so that the construction workers and the existing units personnel do not have simultaneous or overlapping shift changes. | N |
| Section 4.4.2 | Traffic congestion due to slow moving construction equipment deliveries | Schedule such deliveries on off hours or via rail. | N |

## Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

| Category/ ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Aesthetics/ Section 4.4.2 | Visual Impact | Leave a 50–100 foot greenbelt of trees along the southern boundary as a visual shield for the construction site. | N |
| Environmental Justice/ Section 4.4.3 | No impacts predicted based on use of local workforce | None Required | N |
| Radiation Exposure/ Section 4.5 | Increased exposure of workers to radiation from existing units | Less than the acceptable annual value for the general public, therefore, no mitigation needed. | N |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Land Use/ Section 5.1.1 | Potential for additional waste heat to affect recreational use of Lake Anna | The change in temperature at the discharge point of WHTF due to operation of new units would be negligible. Design/operate cooling system to comply with VPDES permit requirements. | N |
| Section 5.1.1 | Increased traffic could create need for changes to local road system | Effective traffic management should avoid need for changes. | N |
| Transmission Lines/ Section 5.1.2 | Based on an initial evaluation, the existing transmission lines and corridors have sufficient capacity for the total output of the existing and new units. | None required. | N |
| Historic, Cultural, or Archaeological Resources/ Section 5.1.3 | None expected | None required. | N |
| Hydrological Alterations and Water Supply/ Section 5.2.1 | Potential reduction in available water released from the North Anna Dam from current values (permit limits maintained) | Assess practices to minimize the hydrologic alterations and their implementation. | Y |
| Section 5.2.1 | Potential reduction in Lake Anna water levels from current values during periods of extended drought with existing and new units operating | During periods of extended drought, dry cooling towers would be put into service to dissipate a portion of waste heat from Unit 3 to minimize the make-up water requirements. | N |
| Water-Use Impacts/ Section 5.2.2 | Discharge of dissolved solids above ambient levels | There would be no appreciable water quality impacts due to blowdown from the Unit 3 wet cooling towers. There would be no blowdown from the Unit 3 and Unit 4 dry cooling towers. | N |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Make-up Water Intake System Physical Impacts/ Section 5.3.1.1 | Scouring of the lake bottom and erosion of shoreline due to operation of new unit(s)' intake system | As for existing units, construct new make-up water intake system and intake structure in a cove on the south shore of Harris Creek.<br>Install intake system for new units in area planned for intake system of previously abandoned Units 3 and 4.<br>Stabilize the banks of the channel to the screens and pump house during construction. | N |
| Make-up Water Intake System Aquatic Impacts/ Section 5.3.1.2 | Increased impingement of fish and increased entrainment of larva | Predicted effects are minimal for increased impingement and small for increased entrainment due to stable, healthy, and diverse fish population in Lake Anna. | N |
| Blowdown Water Discharge System/ Thermal Description and Physical Impacts/ Section 5.3.2.1 | Installation of Unit 3 dry and wet cooling system and Unit 4 dry cooling tower would result in negligible temperature increases in the North Anna Reservoir and the WHTF. | The cooling system for the new units will not have an adverse effect on the North Anna reservoir and the WHTF. Blowdown from the Unit 3 wet cooling towers will be discharged to the WHTF at the cold water temperature of the cooling tower. | N |
| Section 5.3.2.1 | Potential for scouring of lake bed or erosion of shoreline at Dike 3 if multiple units are constructed with wet and dry cooling system would be very small. | The first new unit would use a combination wet and dry cooling system. The second unit would be designed with dry towers as the cooling system. The intake flow rate would be for wet cooling tower make-up and the velocity would be relatively low. | N |
| Section 5.3.2.1 | Potential increased turbidity due to blowdown flows from discharges of new units would be very small. | Design new cooling systems' blowdown such that the flow velocities are low to minimize the potential for increased turbidity. | N |
| Aquatic Ecosystem Impacts/ Section 5.3.2.2 | Scouring and sediment transport due to water discharge flows is very low due to combination wet and dry cooling towers. | None required. Flow velocities associated with cooling tower blowdown will be relatively low. | N |
| Section 5.3.2.2 | Impacts due to increase in chemicals and other pollutants contained in discharge from new units | Maintain compliance with VPDES water quality standards and permitted discharge limits for cooling water discharges to Lake Anna. | N |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Section 5.3.2.2 | Impacts due to increase in thermal discharges or sudden changes in discharge temperatures | Maintain compliance with VPDES water quality standards and permitted discharge limits for cooling water discharges to Lake Anna.<br>No impact on overall fish population in Lake Anna. Most temperature-sensitive species, would be expected to move away from discharge area.<br>Typical operations of a nuclear power plant would limit sudden changes in discharge temperatures as such units do not come on and off-line regularly. | N |
| Heat Discharge System/ Dissipation to Atmosphere/ Section 5.3.3.1 | Visual impact of wet and dry towers, e.g., visible plumes and steam fog, and icing and salt deposition | Design and install the wet and dry towers incorporating industrial standard measures indicated from the visual impact study to be performed during the design phase of the project.<br>Most of the fogging from the wet cooling tower would occur within the site boundary in winter and spring seasons No icing is anticipated within or beyond site boundary.<br>Salt deposition rates would be below threshold value beyond the site boundary at ground levels. | N |
| Terrestrial Ecology/ Section 5.3.3.2 | Noise from wet and dry cooling towers could cause some wildlife to avoid the site | Wildlife expected to adapt to normal operating noise variations as for existing units. | N |
| Section 5.3.3.2 | Reduction in moisture content of the air due to the dry hot exhaust from cooling tower could result in dieback of vegetation | None. If there are any impacts, they would be close to the dry towers, and there are no important species near the cooling towers. | N |
| Section 5.3.3.2 | Decreased local precipitation due to hot exhaust from dry towers | Any impacts from decreased precipitation would be localized to the NAPS site, which does not contain important species. | N |
| Section 5.3.3.2 | Avian collisions with cooling towers | Negligible impacts from collisions with dry towers that would be lower in height than existing or proposed onsite structures. | N |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Impacts to Members of the Public/ Section 5.3.4 | Increased thermal discharges from wet cooling towers could affect composition micro-organisms in Lake Anna, thereby also affecting recreational use of the lake | Analyses show that there would be no significant alteration of the temperature regime in the lake or the surrounding environment and that the additional units would not contribute to an environment conducive to the reproduction and growth of thermophilic micro-organisms. | N |
| Section 5.3.4 | Discharge of pathogenic materials in wastewater and/or sanitary wastes | The recently upgraded onsite sewage treatment plant that includes disinfection to reduce coliform bacteria and other micro-organisms to levels that meet Virginia water quality standards, would prevent adverse impacts from sanitary wastes. | N |
| Section 5.3.4 | Offsite noise impacts from cooling system operation | Modeled peak noise levels from operation of all of the cooling systems are below the applicable NRC-defined significance levels at the EAB | N |
| Radiological Impacts from Normal Operations/ Exposure Pathways/ Section 5.4.1 | Direct dose to population and environment | Shielding of new units would be at least as effective of that of existing units so direct dose contribution from the new units is expected to be negligible compared to those from liquid and gaseous effluent pathways or from natural and artificial sources outside the NAPS site | N |
| Impacts to Members of the Public/ Section 5.4.3 | Doses due to liquid effluent releases to the discharge canal and the WHTF and from gaseous pathway releases | Calculated doses to public via liquid and gaseous pathways are within the design objectives of 10 CFR 50 Appendix I and within regulatory limits of 40 CFR 190. | N |
| Impacts to Biota Other Than Members of the Public/ Section 5.4.4 | Doses to biota from liquid radwaste effluent releases to the discharge canal, WHTF, and the North Anna Reservoir | There are no acceptance criteria specifically for biota. However, there is no scientific evidence that chronic dose rates below 100 mrad/day are harmful to plants and animals and all biota doses are calculated to be less than 1 mrad/day.<br>No mitigation measures or controls are proposed. | N |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Environmental Impacts of Waste/ Nonradioactive Waste System Impacts/ Section 5.5.1 | Potential impacts to Lake Anna and North Anna River from increased volume of effluent discharged and increased amounts of chemicals and other pollutants in the discharged effluent as well as increased storm water discharge | Comply with applicable VPDES water quality standards for discharges from Dike 3.<br>Prepare and implement a Storm Water Pollution Prevention Plan for the operation of the existing and new units to avoid and/or minimize releases of contaminated storm water. | N |
| Section 5.5.1 | Potential increase in impacts due to increase in gaseous and particulate emissions | Operate new minor air emission sources in accordance with applicable regulations and permits. | N |
| Section 5.5.1 | Increase in total volume of solid and sanitary wastes | Continue use of approved transporters and offsite landfills for disposal of solid wastes.<br>Continue existing units program for reuse and recycling of non-radwastes.<br>Modify existing sanitary waste treatment systems, as required, to accommodate increased volume. | N |
| Mixed Wastes Impacts/ Section 5.5.2 | Potential hazardous chemical and occupational exposure to radiological materials during handling and storage of 15-30 cubic feet of mixed liquid waste and 5-10 cubic feet of mixed solid waste generated by operation activities for new unit(s) | Limit amounts of mixed waste to be handled and disposed of through source reduction, recycling, and treatment, to the extent practical and feasible.<br>Develop a Waste Minimization Program that includes new and existing units.<br>Construct temporary onsite storage facilities, as needed, for mixed wastes and implement a waste management program in compliance with applicable EPA and NRC requirements.<br>Identify a primary and an alternative offsite facilities for transportation, treatment and disposal of mixed wastes. | N |
| Section 5.5.2 | Potential exposure of onsite workers and emergency response personnel during accidental releases and cleanup activities | Implement, or comply with existing, spill prevention and response plans and procedures that address hazards associated with managing/handling mixed wastes.<br>Include measures for response personnel training and protective equipment. | N |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Transmission System Impacts/ Terrestrial Ecosystems/ Section 5.6.1 | Air emissions and noise from use of helicopter to maintain transmission corridors | No new measures are required as current maintenance activities are sufficient. | N |
| Aquatic Ecosystems/ Section 5.6.2 | Potential impacts to mussel species from maintenance of transmission corridors | No new measures are required as current maintenance practices would continue. | N |
| Impacts to Members of the Public/ Section 5.6.3 | Dependent on design of transmission corridors and a determination whether any changes are required. | Based on an initial evaluation, the current ESP site transmission lines and corridors have sufficient capacity for the total output of the existing and new units. | N/A |
| Uranium Fuel Cycle Impacts (relative to reference LWR)/ Section 5.7 | Energy required, emissions generated, and water usage during mining, yellowcake production and uranium conversion; and production of $UO_2$ during fuel fabrication. | Select mining techniques, where feasible and practical, that minimize impacts such as in situ leaching rather than open pit mining.<br>Consider use of new technology that requires less $UF_6$.<br>Consider use of new technologies with less fuel loading to reduce energy, emissions, and water usage | Y |
| Section 5.7 | Emissions from fossil fuel plants supplying the gaseous diffusion plant | Consider use of new technology that requires less $UF_6$.<br>Consider use of centrifuge process rather than gaseous diffusion process which significantly reduces energy requirements and environmental impacts.<br>Fossil fuel plants must comply with air quality regulations. | N |
| Section 5.7 | Radioactive waste to be managed from operations, and decontamination and decommissioning | Consider use of new gas-cooled reactor technologies that can result in generation of far less low-level wastes. | Y |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Physical Impacts of Station Operations/ Section 5.8.1 | Potential noise impact from operating plant activities | Noise from cooling towers is expected to be below NRC-defined significance levels at the NAPS site EAB and nearest residence.<br>Perform noise study as part of the design of the cooling system to confirm compliance with NRC-defined levels, and apply controls if necessary.<br>Control noise levels in accordance with local noise regulations. | N |
| Section 5.8.1 | Potential air quality impacts from emissions associated with diesel generators and auxiliary power systems | Comply with applicable VDEQ permit limits and regulations to install and operate such sources. | N |
| Section 5.8.1 | Potential visual impacts to surrounding areas due to new structures, including wet and dry towers | Perform visual impact study during final plant design, and incorporate mitigation measures, as appropriate. | N |
| Section 5.8.1 | Potential traffic impacts on local roads | Existing roads are expected to have sufficient capacity to handle increased traffic due to operation of new units. | N |
| Socioeconomic/ Section 5.8.2 | Noise impacts at residences from operation of the new units and ancillary facilities, e.g., cooling tower | Due to distance to nearest residences, no noticeable increase in noise levels.<br>A noise study would be performed for the area once the reactor and ancillary facilities are selected.<br>If indicated, noise mitigation measures would be designed into facility. | N |
| Section 5.8.2 | Visual impact of new units | Selection of cooling tower, reactor.<br>Perform visual impact assessment prior to construction to assist in facility layout. | N |
| Section 5.8.2 | Impact of increased operations traffic on local road network | Operations traffic management study plus any permanent upgrades for the construction phase should eliminate any adverse impact on the local road network. | N |
| Environmental Justice/ Section 5.8.3 | None expected | None required. | N |

## Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

| Category/ESP ER Section | Adverse Impact | Mitigation Measure | Unavoidable Adverse Environmental Impacts |
|---|---|---|---|
| Decommissioning/ Section 5.9 | Potential radiation exposure related to decommissioning, including transportation of materials to authorized disposal sites | No mitigation measures are proposed at this time as this would be part of the required decommissioning plan. | N/A |

## 10.2 Irreversible and Irretrievable Commitments of Resources

This section describes the predicted irreversible and irretrievable environmental resource commitments used in the construction and operation of the new units. These environmental resource commitments are developed from information in Chapter 4 and Chapter 5, and are summarized in Section 10.1. Those areas that were assessed and determined to have unavoidable adverse environmental impacts, even after application of all practical means to mitigate or avoid the impacts, have been used to identify resources to be evaluated in this section.

### 10.2.1 **Irreversible Environmental Commitments**

The following categories have been assessed for their irreversible environmental commitments and are described in this section:

- Land Use
- Hydrology and Water Use
- Ecology (Terrestrial and Aquatic)
- Socioeconomics
- Radiological Releases
- Atmospheric Releases and Meteorological Changes

#### 10.2.1.1 **Land Use**

The ESP site is within the NAPS site. The NAPS site is zoned industrial by Louisa County. The original permitting of the NAPS site was for the installation of four units. Lake Anna was created by damming up the North Anna River for the purpose of providing cooling water to the power station. Virginia Power and ODEC own all of the land under the lake as well as the NAPS site. Structures at the NAPS site that would be used by the new units include the partial construction of an intake structure originally intended to service the abandoned Units 3 and 4.

Based on an initial evaluation, the existing transmission lines have sufficient capacity to carry the total output of the existing units and the new units.

In summary, no new property is needed for the new units and an existing partially completed intake structure for the cooling water is available to support the new units.

Currently undeveloped portions of the NAPS site would be cleared to construct the new units. A large portion of the cleared area would contain the new units and ancillary equipment. That area would not be restored after completion of the new units until the new units are decommissioned. Much of the wildlife that currently utilizes the area where the new units would be constructed would move out into the areas surrounding the ESP site. There are no known special or protected species on the site. When the units are decommissioned, both the vegetation and the wildlife are eventually

expected to return naturally to current conditions. Therefore, there are no irreversible environmental commitments associated with the land that is to house the new units and ancillary equipment.

#### 10.2.1.2 **Hydrology and Water Use**

Unit 3 would use a combination wet and dry cooling tower system for plant cooling, whereas Unit 4 would use a dry tower system. Make-up water for the wet cooling towers of Unit 3 would be taken from the North Anna Reservoir, consistent with the original permitting of the NAPS site. The amount of make-up water that is not returned as blowdown to the WHTF would be that evaporated in the wet towers, which is a small fraction of the amount of water in the lake. The evaporated water would be replaced by in-flowing water upstream of the dam. Once the site is decommissioned, the balance of water in the lake would be governed by the in-flowing water, evaporation from the surface of the lake, and the amount of water flowing over the dam.

Groundwater from existing wells would be sufficient for the potable water demands during operation of the new units.

#### 10.2.1.3 **Ecology (Terrestrial and Aquatic)**

As presented in Section 10.2.1.1, there would be some anticipated loss of vegetation and relocation of terrestrial wildlife, respectively, due to construction of the new units. However, some of this would return once construction is completed and unused areas are restored. The decommissioning of the new units would eventually result in complete restoration, if left undisturbed. There would be no irreversible loss of terrestrial ecology.

Similarly, aquatic ecology in streams and wetlands on site would be affected by the construction of the new units, but there are no protected or special aquatic ecosystems on the ESP site. The discharge from the new units would not adversely affect the aquatic ecology in Lake Anna. There are no unique, special, or protected aquatic ecosystems on the ESP site or in Lake Anna. Once the new units are decommissioned, the aquatic ecology is eventually expected to return to its current levels. Therefore, there is no irreversible loss of aquatic ecology associated with installation of the new units at the ESP site.

#### 10.2.1.4 **Socioeconomics**

The effect of the construction and operation of the new units would be to increase long-term employment and to provide positive input to the local community in the form of taxes and personal commitments to the community by the new employees and their families. The fact that the workforce during construction would be supplied primarily from the region means that there would not be major disruptions in the transition from construction to operation of the new units. Because the various DRI subsidiaries intend to maintain the NAPS site for power generation purposes for the foreseeable future, there would be no irreversible commitment of resources from a socioeconomic standpoint, once the decommissioning of the new units occurs.

#### 10.2.1.5 **Radiological Releases**

The new units would operate under the limitations imposed by the NRC with respect to radioactive releases. Decommissioning would also be performed according to the requirements of the NRC, which would ultimately be expected to result in the unrestricted use of the site. The loss of radioactive material in the form of nuclear fuel due to operation of the new units, is addressed in Section 10.2.2 under Irretrievable Resources.

#### 10.2.1.6 **Atmospheric Releases and Meteorological Changes**

There would be no major releases of pollutants to the atmosphere from operation of the new units, because only the testing of emergency generators and occasional use of large pieces of equipment that run on diesel fuel would generate such pollutants. The operation of a combination wet and dry tower system has the potential for making micro-level changes to the meteorology, but only in the immediate vicinity of the tower. Upon decommissioning of the new units, these changes would cease to be a factor. Therefore, the operation of ancillary equipment associated with the new units would not result in irreversible atmospheric or long-term meteorological changes to the area.

### 10.2.2 **Irretrievable Commitments of Resources**

Irretrievable commitments of resources during construction of the new units generally would be similar to that of any major, multi-year, construction project. Unlike the earlier generation of nuclear plants, asbestos and other materials considered hazardous would not be used, if possible, or would be used sparingly and in accordance with safety regulations and practices. Available information on materials used to construct earlier nuclear power plants has been reviewed and adjusted to a nominal 1000 MWe unit on the assumption that the usage is linear with energy output. That is, the usage of materials for each of the units is simply multiplied by the ratio of the actual energy output for each unit reviewed, divided by 1000. The conclusion is that each new 1000 MWe unit could require up to 200,000 cubic yards of concrete (not including cooling tower requirements) and up to 15,000 tons of structural steel.

The U.S. Defense National Stockpile centers, shut down since 1991, have been slowly selling off reserves since that time. A review by the federal government of the sources of available materials in the world, and their locations, has resulted in the determination of no material supply threat to the U. S., nor any real benefit to continuing to stockpile such materials. That is, the use of certain metals and materials on the list of strategic materials has been determined to no longer represent a significant impact on the country's defense (Reference 1). Therefore, use of such materials in the quantities associated with those expected for a 1000 MWe nuclear power plant, while irretrievable, would not be a large or moderate impact, with respect to the availability of such resources.

The main resource that would be irretrievably lost during operation of a new 1000 MWe nuclear unit would be uranium. This is best represented by the annual consumption of yellowcake, which is not expected to exceed the normalized value for the reference plant of 293 metric tons (MT) per year

for a 1000 MWe generating unit using current reactor technology as identified in Section 5.7.2.3.4, Uranium Milling. Depending on the actual reactor technology selected, this yellowcake consumption could be much lower. Studies performed by U.S. Government agencies, such as the National Defense Stockpile Impact Committee of the Bureau of Industry and Security (Reference 2), and entities such as the World Nuclear Association (Reference 3) (Reference 4), have concluded that there are easily accessible, rich deposits of uranium throughout the world and that existing stocks of highly enriched uranium (HEU) in the U.S. and Russia--formerly for military usage--could be converted to fuel for nuclear power plants. Also, the reduction in use of uranium by the newer reactors when compared to the existing reactors would serve to extend the current 50-year supply of uranium available to the nuclear power industry. Therefore, the uranium that would be used to generate power by the new units at the ESP site, while irretrievable, would not be a large or moderate impact with respect to the long-term availability of uranium worldwide.

## Section 10.2 References

1. *National Defense Stockpile Market Impact Committee*, Bureau of Industry and Security, website www.bis.doc.gov/DefenseIndustrialBasePrograms/OSIES/StockpikeCommittee.html accessed 8/15/03.

2. *Effects of Imports of Uranium on the National Security* Summary, Bureau of Industry and Security, Document Number 003-009-00698-8, September 1989, website. www.bis.doc.gov/defenseindustrialbaseprograms/OSIES/2-3-2-Reports/Uranium89.html.

3. *Introduction to Nuclear Energy/Factsheets, Uranium Resources*, World Nuclear Association, website www.world-nuclear.org/factsheets/uranium.htm, accessed 8/15/03.

4. *Supply of Uranium, Information and Issue Briefs,* World Nuclear Association August 2002, website www.world-nuclear.org/info/inf75.htm, accessed 8/15/03.

## 10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

This ER has focused on the analyses and resulting conclusions associated with the environmental and socioeconomic impacts arising from activities during the construction, operation, and decommissioning of new units at the ESP site. These activities are considered to be short-term uses for purposes of this section. For this section, the long-term is considered to start with the conclusion of decommissioning of the new units at the ESP site. This section includes an evaluation of the extent to which the short-term uses preclude any options for future use of the ESP site.

### 10.3.1 Construction of New Units at ESP Site and Long-Term Productivity

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of construction of the new units and the measures proposed to reduce these impacts. There are adverse environmental impacts that would remain after all practical measures to avoid or mitigate the impacts have been taken. However, none of these impacts represent a long-term effect that would preclude any options for future use of the ESP site.

The new units would be constructed on the property adjacent to the existing units. The NAPS site was originally selected and reviewed to accommodate four units. As a consequence, the size of the site, the characterization of the Lake, and the transmission capacity are generally already acceptable for the new units.

While some changes may be made to the WHTF or the existing intake area to accommodate the new units, any disturbances to these areas would be temporary and would not change the long-term productivity of the ESP site.

The acreage disturbed during construction of the new units would be much larger than that required for the actual structures and other ancillary facilities because of the need for construction laydown areas and a parking area for the construction workforce. The clearance of this acreage, plus the noise of the construction of the new units, would displace some wildlife and remove vegetation. Once the new units are completed, the disturbed areas would be restored. Wildlife is expected to return to the restored area.

Noise emitted during some construction activities would increase the ambient noise levels in the vicinity of the site. However, upon completion of these activities, the ambient levels would return to the levels associated with the operation of the existing units. Because of the nature of the vicinity about the ESP site, no long-term effects would occur. Generally, the requirements of the local ordinance would be complied with during construction of the new units so that the local residents or visitors to Lake Anna would not be unduly impacted. Also, the workforce would be protected by adherence to the OSHA requirements for noise levels that are acceptable during specified time periods or through the use of protective equipment when excessive noise levels for a given time

period are unavoidable. There would be no effects on the long-term productivity of the ESP site as a result of these impacts.

Construction traffic has the potential to cause congestion in the immediate area of the ESP site. A construction traffic management plan would be developed and implemented in cooperation with VDOT to reduce the possibility of major congestion problems. It is likely that permanent upgrades would be made at both the intersection of the construction access road with Route 700 and at the intersection of Route 700 and Route 652. These upgrades to relieve congestion problems that could arise during shift changes would remain in place after construction ends and would be a benefit to the local area throughout the life of the new units.

The construction of the new units would be beneficial to the local area through the generation of new construction-related jobs, local spending by the construction workforce, and payment of taxes to the area.

No long-term adverse environmental impacts would result from the construction of new units at the ESP site.

### 10.3.2 **Operation of the New Units and Long-Term Productivity**

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of operation of the new units and the measures proposed to reduce or eliminate these impacts. There are some adverse environmental impacts that could remain after all practical measures to avoid or mitigate the impacts have been taken. However, none of these impacts represent long-term effects that would preclude any options for future use of the ESP site.

The NAPS site has been developed by Virginia Power as a location for major energy generation facilities. The existing units have been operating for over twenty years. The various DRI subsidiaries intend to continue the use of the NAPS site for major energy generation facilities beyond the lifetime of the existing or new units. Therefore, the operation of the new units represents a continuation of the current and planned use of the land. For the foreseeable future, any options for future use of the ESP site, including operation of new energy generation facilities, are not precluded.

The type of reactor to be installed at the ESP site has not yet been selected, nor has the ancillary equipment related to the reactor. Unit 3 would use a combination wet and dry cooling tower system, whereas Unit 4 would use a dry tower system. Make-up water for Unit 3 would be taken from the North Anna Reservoir, consistent with the original permitting of the NAPS site. The amount of water that is not returned as blowdown to the WHTF would be that evaporated in the wet towers, which is a small fraction of the amount of water in the lake. The evaporated water would be replaced by in-flowing water upstream of the dam. Once the site is decommissioned, the balance of water in the lake would be governed by the in-flowing water, evaporation from the surface of the lake, and the

amount of water flowing over the dam. There would be no future long-term issues with regard to future uses of the ESP site.

The blowdown water discharge from Unit 3 would be to the existing WHTF. Although there would be a small increase in water temperature within the WHTF, there would be negligible to no increase in temperature within the North Anna Reservoir part of Lake Anna that is open to the public for recreational purposes. Additionally, the discharges to the existing WHTF are projected to remain within the limits of the wastewater discharge permit issued for the NAPS site (or, if needed, to the wastewater discharge permit as amended). Therefore, any long-term effects on the future usage of the lake, including the cessation of the heated discharge, would be small.

The daily volume of traffic on the section of Route 700 between Route 652 and the entrance to the NAPS site is expected to nearly double, once the new units become operational. However, any permanent upgrades that would be made for construction to eliminate or greatly reduce congestion, would remain in effect after construction is completed and the new units become operational. Normal maintenance of this half-mile section of road should allow the benefits of these upgrades to persist into the future.

The operation of the new units would slightly increase air emissions because of diesel engines that would be operated intermittently on site. However, these engines would be operated in accordance with applicable federal, state, and local regulations, and they would not create any noticeable impacts in the area. Additionally, no long-term impacts would result from salt deposition arising from salt drift from the cooling towers as the analysis has determined the amount deposited on a monthly basis would be minimal when compared to those levels at which ecological impacts might occur. Normal maintenance activities for the area within 300 feet of the cooling towers plus rain or snowfall would prevent the buildup of salt in the soil within this area. No future issues for the long-term uses of the site would result from the impacts of increased air emissions.

Impacts due to radiological emissions would be negligible to small, since the operation of the new units would be in accordance with the operating license and NRC regulations. Furthermore, radiological monitoring would be implemented to measure radiation levels from the operation of the new units and would initiate a timely response to reduce such emissions if elevated levels are detected. No future issues associated with the radiological emissions from operation of the new units would affect the long-term uses of the ESP site.

### 10.3.3 Summary of Relationship Between Short-Term Uses and Long-Term Productivity

The impacts from the local use of the human environment by the installation and operation of the proposed new units at the ESP site is presented in Section 10.1 and summarized in the preceding paragraphs in terms of the unavoidable adverse environmental impacts of construction and operation. Section 10.2 presents information on the irreversible and irretrievable commitments of resources. Except for consumption of non-renewable resources because of construction and operation of the new units, the uses may be classified as short-term. The principal short-term

benefit is the production of electrical energy, and the economic productivity of the ESP site is large compared with the productivity from agriculture or other probable uses for the site. Because the site would eventually be restored by decommissioning, there would be no significant impact on long-term productivity.

## Section 10.3 References

None

## 10.4 Benefit – Cost Balance

In accordance with the 10 CFR 52.17(a)(2), an assessment of the benefits (need for power) of new units is not included in this report.

## Section 10.4 References

None