8.0 Environmental Impacts of Alternatives

This chapter examines the potential environmental impacts associated with denying the renewal of the operating license (OL) (i.e., the no-action alternative); the potential environmental impacts from electric generating sources other than the R.E. Ginna Nuclear Power Plant (Ginna); the possibility of purchasing electric power from other sources to replace power generated by Ginna and the associated environmental impacts; the potential environmental impacts from a combination of generating and conservation measures; and other generation alternatives that were deemed unsuitable for replacement of power generated by Ginna. The environmental impacts are evaluated using the U.S. Nuclear Regulatory Commission's (NRC) three-level standard of significance – SMALL, MODERATE, or LARGE – developed using Council on Environmental Quality (CEQ) guidelines and set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.

LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[a] with the additional impact category of environmental justice.

8.1 No-Action Alternative

The NRC's regulations implementing National Environmental Policy Act (NEPA) of 1969 specify that the no-action alternative be discussed in an NRC EIS (10 CFR Part 51, Subpart A, Appendix A[4]). For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the Ginna OL and RG&E would then cease operations at the plant and initiate the decommissioning of the plant.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

RG&E will be required to comply with NRC decommissioning requirements whether or not the OL is renewed. If the Ginna OL is renewed, decommissioning activities will not be avoided but may be postponed for up to an additional 20 years. If the OL is not renewed, RG&E would conduct decommissioning activities according to the requirements in 10 CFR 50.82.

The environmental impacts associated with decommissioning following a license renewal period of up to 20 years or following the no-action alternative would be bounded by the discussion of impacts in Chapter 7 of the relicensing GEIS, (NRC 1999), Chapter 7 of this supplemental environmental impact statement (SEIS), and the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586 Supplement 1 (NRC 2002). The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.

The no-action alternative, that is, ceasing operations after the current license expires, would result in a net reduction in power production. The power not generated by Ginna during the license renewal term would likely be replaced by (1) demand-side management (DSM) and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than Ginna, or (4) some combination of these options. This replacement power would produce additional environmental impacts as discussed in Section 8.2.

The staff's assessments of the impacts of the no-action alternative on each impact category are provided in the following sections. The assessment of each impact category is supplemented with information about the potential impacts of decommissioning.

- **Land Use**

Cessation of plant operations would result in a reduced use of the Ginna site. Land use on and off the site will be reduced and eventually eliminated resulting from plant operations. During decommissioning, some temporary changes in onsite land use could occur. These changes may include additional or expanded staging and laydown areas or construction of temporary buildings and parking areas. No offsite land-use changes are expected as a result of decommissioning. After cessation of operations and following decommissioning, the Ginna site would likely be retained by RG&E for other corporate purposes. Eventual sale or transfer of the site, however, could result in changes to land use. Notwithstanding this possibility, the impacts of the no-action alternative and decommissioning on land use are considered SMALL.

- **Ecology**

Impacts on aquatic ecology should be reduced immediately following cessation of plant operations. Water withdrawal and discharge of heated water will end when the reactor is shut down. Decommissioning activities may have some short-term impacts to site ecology. Impacts on aquatic ecology could result from removal of in-water pipes and structures or the filling of the discharge canal. Impacts to aquatic ecology would likely be short-term and could be mitigated. The aquatic environment is expected to recover naturally. Impacts on terrestrial ecology, following cessation of operations, should be greatly reduced because there will be less use of the land on and off the site. Impacts on terrestrial ecology, related to decommissioning activities, could occur as a result of land disturbance for additional laydown yards, stockpiles, and support facilities. Land disturbance is expected to be minimal and would result in relatively short-term impacts that can be mitigated using best management practices. The land is expected to recover naturally. Overall, the impacts associated with the no-action alternative and decommissioning on terrestrial and aquatic ecology are considered SMALL.

- **Water Use and Quality**

Cessation of plant operations would result in a significant reduction in water use because reactor cooling will no longer be required. As plant staff size decreases, the demand for potable water is expected to also decrease. Water use during decommissioning is expected to be less than during operation. The water quality is unlikely to be adversely affected unless onsite disposal of demolition debris is utilized. Overall, water use and quality impacts of the no-action alternative and decommissioning are considered SMALL.

- **Air Quality**

Emission from diesel generators, boilers, and other activities associated with Ginna operations will cease or be greatly reduced. During normal operations, emissions from these Ginna sources are lower than the thresholds in New York state and Federal air-quality regulations. Decommissioning activities that can adversely affect air quality include dismantlement of systems and equipment, demolition of buildings and structures, and the operation of internal combustion engines. The most likely adverse impact would be the generation of fugitive dust. Best management practices, such as seeding and wetting, could be used to minimize the generation of fugitive dust. Air-quality impacts associated with the no-action alternative and decommissioning are considered SMALL.

- **Waste**

Liquid, gaseous, and solid radioactive wastes are by-products of reactor operations. Liquid wastes are generated primarily by plant maintenance and service operations. The primary source of gas is displaced from the chemical and volume control system tanks used to store liquids. Solid wastes include dry active waste, sludge, oil, bead resin, and filters. These wastes will be eliminated or greatly reduced by the cessation of operations. Decommissioning activities would result in the generation of radioactive and non-radioactive waste. The staff concluded in NRC (2002) that the volume of low-level waste generated during decommissioning could vary greatly depending on the type and size of the plant, the length of time it operated, the decommissioning option chosen, and the waste treatment and volume reduction procedures used. Low-level radioactive waste must be disposed of in a facility licensed by NRC or a state with authority delegated by NRC. Recent advances in volume reduction and waste processing have significantly reduced waste volumes. A permanent repository for high-level waste is not currently available. The NRC has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations (10 CFR 51.23(a)). Onsite and offsite licensed disposal facilities would be used for disposal of non-radioactive waste. Overall, waste impacts associated with the no-action alternative and decommissioning are considered SMALL.

- **Human Health**

During operation of Ginna, releases and the resultant dose revealed that the doses to maximally exposed individuals in the vicinity of Ginna have been a small fraction of the limits specified to meet U.S. Environmental Protection Agency (EPA) standards. The assessment of radiation dose to the general public from effluents indicates the dose is only a fraction of the regulatory limit. These potential exposures will be reduced following cessation of plant operations. Radiological doses to occupational workers during decommissioning activities are estimated to average approximately 5 percent of the dose limits in 10 CFR Part 20, and to be similar to, or lower than, the doses experienced by workers in operating nuclear power plants. Effluent releases from decommissioning activities are estimated to be well below the limits in 10 CFR Part 20, and to be similar to, or lower than, effluent releases from operating nuclear power plants. These effluent releases will result in doses to the public well below 10 CFR Part 20 requirements. Occupational injuries to workers engaged in decommissioning activities are possible. However, historical injury and fatality rates at nuclear power plants have been lower than the average U.S. industrial rates. For years, America’s commercial nuclear energy industry has ranked among the safest places to work in the United States. In 2000, its industrial safety accident rate, which tracks the number of accidents that result in lost work time, restricted work, or fatalities, was 0.26 per 200,000 worker-hours. This is lower than the accident rate for the U.S. manufacturing industry, at 3.95, and even lower than the accident rate for the workplaces of the U.S. finance, insurance, and real estate industries, at 0.62 (NEI 2003). Overall, the human health impacts associated with the no-action alternative and decommissioning are considered SMALL.

- **Socioeconomics**

If Ginna ceased operation, there would be a decrease in employment and tax revenues associated with the closure. Employment (primary and secondary) impacts and impacts on population would occur over a wide area. Employees working at Ginna reside in a number of New York counties including Wayne, Monroe, Ontario, and Livingston (RG&E 2002). Tax-related impacts would occur in Wayne County. In 2001, RG&E paid property taxes for Ginna to Wayne County, the town of Ontario, and the Wayne Central School District in the amount of $5,376,263 (RG&E 2002). This payment represented approximately 1.6 percent of total revenues in Wayne County and approximately 11 percent of total revenues for the town of Ontario. Payments to the Wayne Central School District accounted for 12.4 percent of the total district revenue between 1995 and 1999.

The no-action alternative would result in the loss of the taxes attributable to Ginna as well as the loss of plant payrolls 20 years earlier than if the OL was renewed. There would also be an adverse impact on housing values and the local nearby economy if Ginna ceased operations.

RG&E employees working at Ginna currently contribute time and money toward community involvement, including schools, churches, charities, and other civic activities. It is likely that with a reduced presence in the community following decommissioning, community involvement efforts by RG&E and its employees in the region would be less.

Both Chapter 7 of the GEIS and Supplement 1 to NUREG-0586 (NRC 2002) note that socioeconomic impacts would be expected as a result of the decision to close a nuclear power plant, and that the direction and magnitude of the overall impacts would depend on the state of the economy, the net change in workforce at the plant, and the changes in local government tax receipts. The socioeconomic impacts of decommissioning activities are expected to be SMALL. Appendix J of Supplement 1 to NUREG-0586 shows that the overall socioeconomic impact of plant closure plus decommissioning could be greater than SMALL.

The staff has concluded that when the property tax revenue from a nuclear power plant comprises less than 10 percent of the tax revenue of a local jurisdiction, the socioeconomic impacts associated with the loss of the plant's tax revenue as a result of plant closure is considered SMALL. The property taxes that RG&E pays for Ginna comprise less than 10 percent of total revenue of Wayne County; however, it comprises slightly more than 10 percent of the total revenue for both the town of Ontario and the Wayne Central School District; consequently, the socioeconomic impacts resulting from loss of this revenue are considered SMALL to MODERATE.

Employees at Ginna constitute approximately 1 percent of total employment in Wayne County. Loss of these jobs is considered to have a SMALL socioeconomic impact.

Overall, the staff concludes that the socioeconomic impacts associated with the no-action alternative are considered SMALL to MODERATE and the impacts of decommissioning are considered SMALL.

- **Aesthetics**

Cessation of plant operations would probably result in the dismantlement of buildings and structures at the site resulting in a positive aesthetic impact. Operational noise would be reduced or eliminated. Decommissioning would result in the eventual dismantlement of buildings and structures at the site resulting in a positive aesthetic impact. Noise would be generated during decommissioning operations that may be detectable offsite; however, the impact is unlikely to be of large significance and can normally be mitigated. Thus, the aesthetic impacts associated with the no-action alternative and decommissioning are considered SMALL.

- **Historic and Archaeological Resources**

Use of land resources at Ginna would be reduced following plant closure. The site would likely be retained by RG&E for other corporate purposes. Sale or transfer of the site could follow closure. Reduced use of the property will reduce the likelihood of adversely impacting historic and archaeological resources. The amount of undisturbed land needed to support the decommissioning process will be relatively small. The staff concluded in NRC (2002) that decommissioning activities conducted within the operational areas of a nuclear power plant are not expected to have a detectable effect on important cultural resources because these areas have been impacted during the operating life of the plant. Minimal disturbance of land outside the licensee's operational area for decommissioning activities is expected. Historic and archaeological resources on undisturbed portions of the site should not be adversely affected. Following decommissioning, the site would likely be retained by RG&E for other corporate purposes. Eventual sale or transfer of the site, however, could result in adverse impacts to cultural resources if the land-use pattern changes dramatically. Notwithstanding this possibility, the impacts of the no-action alternative and decommissioning on historic and archaeological resources are considered SMALL.

- **Environmental Justice**

Current operations at Ginna have no disproportionate impacts on the minority and low-income populations of Wayne and surrounding counties. No environmental pathways have been identified that would cause disproportionate impacts if the no-action alternative is implemented. Closure of Ginna would result in decreased employment opportunities and tax revenues in Wayne and surrounding counties, with possible negative and disproportionate impacts on minority or low-income populations. Ginna is located near a relatively urban area with many employment opportunities. Decommissioning activities are not expected to adversely impact the minority and low-income populations of Wayne and surrounding counties. Thus, the environmental justice impacts under the no-action alternative and decommissioning are considered SMALL.

- **Summary of the No-Action Alternative**

The environmental impacts associated with the no-action alternative are summarized in Table 8-1. Implementation of the no-action alternative would also have certain positive impacts in that adverse environmental impacts associated with current operation of Ginna (for example, solid waste generation and impingement or entrainment of aquatic life) would be eliminated.

Table 8-1. Summary of Environmental Impacts of the No-Action Alternative and Decommissioning Related to Renewal of the R.E. Ginna Nuclear Power Plant Operating License

Impact Category	Impact	Comment
Land Use	SMALL	Closure will result in decreased land use. Decommissioning onsite impacts expected to be temporary. No offsite impacts expected or plant closure or decommissioning.
Ecology	SMALL	Plant closure will immediately reduce impacts to terrestrial and aquatic ecology. Decommissioning impacts to ecology are expected to be temporary and will be mitigated using best management practices.
Water Use and Quality	SMALL	Water use will decrease. Water quality unlikely to be adversely affected unless onsite disposal of demolition debris is utilized.
Air Quality	SMALL	All emissions will decrease following closure. During decommissioning, the greatest impact is likely to be from fugitive dust; impact can be mitigated by good management practices.
Waste	SMALL	Low-level radioactive waste will be disposed of in licensed facilities. A permanent disposal facility for high-level waste is not currently available.
Human Health	SMALL	Radiological doses to workers and members of the public are expected to be within regulatory limits and comparable to, or lower than, doses from operating plants. Occupational injuries, during decommissioning, are possible, but injury rates at nuclear power plants are below the U.S. average industrial rate.
Socioeconomics	SMALL to MODERATE	Following plant closure there will be a decrease in employment in Wayne and surrounding counties and tax revenues in Wayne County. There will be some employment created during decommissioning.
Aesthetics	SMALL	Positive impact from eventual removal of buildings and structures. Some noise impact during decommissioning operations.

Table 8-1. (contd)

Impact Category	Impact	Comment
Historic and Archaeological Resources	SMALL	Use of the properties will decrease following plant closure and will be controlled during decommissioning.
Environmental Justice	SMALL	Some loss of employment opportunities and social programs is expected.

8.2 Alternative Energy Sources

This section describes the environmental impacts associated with alternative sources of electric power to replace the power generated by Ginna, assuming that the OL is not renewed. The order of presentation of alternative energy sources in Section 8.2 does not imply which alternative would be most likely to occur or to have the least environmental impacts. The following generation alternatives are considered in detail:

- coal-fired generation at the Ginna site or at an alternate site (Section 8.2.1)

- natural-gas-fired generation at the Ginna site or at an alternate site (Section 8.2.2)

- nuclear generation at the Ginna site or at an alternate site (Section 8.2.3).

The alternative of purchasing power from other sources to replace power generated by Ginna is discussed in Section 8.2.4. Other power generation alternatives and conservation alternatives considered by the staff and found not to be reasonable replacements for Ginna are discussed in Section 8.2.5. The environmental impacts of a combination of generation and conservation alternatives are discussed in Section 8.2.6.

The Ginna site is approximately 197 ha (488 ac) and was originally planned to accommodate an additional nuclear power unit west of the existing plant. A replacement power plant, regardless of fuel type, could be placed at this site and could therefore use existing infrastructure (e.g., cooling water system, transmission, roads, and technical and administrative support facilities). However, for other reasons, such as fuel-delivery infrastructure limitations, there may be advantages to locating any replacement power plants elsewhere in western New York state.

Each year the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an annual energy outlook. In its *Annual Energy Outlook 2003*, EIA projects that natural-gas-fired combined-cycle or combustion turbine technology (including distributed generation capacity), will make up 80 percent of new electric-generating capacity through the year 2025 (DOE/EIA 2003). Both technologies are designed primarily to supply peak and intermediate capacity, but combined-cycle technology can also be used to meet base-load[a] requirements. Coal-fired plants are projected by EIA to account for approximately 17 percent of new capacity during this period. Coal-fired plants are generally used to meet base-load requirements. Renewable energy sources, primarily wind, geothermal, and municipal solid waste units, are projected by EIA to account for the remaining 3 percent of capacity additions. EIA's projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. Combined-cycle plants are projected by EIA to have the lowest generation cost in 2005 and 2025, followed by coal-fired plants and then wind generation (DOE/EIA 2003).

EIA projects that oil-fired plants will account for very little new generation capacity in the United States through the year 2025 because of higher fuel costs and lower efficiencies (DOE/EIA 2003).

EIA also projects that new nuclear power plants will not account for any new generation capacity in the United States through the year 2025 because natural-gas and coal-fired plants are projected to be more economical (DOE/EIA 2003). In spite of this projection, a new nuclear plant alternative for replacing power generated by Ginna is considered for reasons stated in Section 8.2.3. NRC established a New Reactor Licensing Project Office in 2001 to prepare for and manage future reactor and site licensing applications (NRC 2001).

If an alternative generating technology were selected to replace power generated by Ginna, Ginna would be decommissioned. Environmental impacts associated with decommissioning are discussed in Section 8.1 and are not otherwise addressed in Section 8.2.

8.2.1 Coal-Fired Generation

Environmental impact information for a replacement coal-fired power plant using closed-cycle cooling with cooling towers is presented in Section 8.2.1.1 and using once-through cooling in Section 8.2.1.2.

The staff assumed construction of two coal-generating companion units, each producing 265-megawatt electric [MW(e)] units,[b] which is consistent with RG&E's Environmental Report (ER) for Ginna (RG&E 2002). This assumption will slightly overstate the impacts of replacing

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(a) A base-load plant normally operates to supply all or part of the minimum continuous load of a system and consequently produces electricity at an essentially constant rate. Nuclear power plants are commonly used for base-load generation (i.e., these units generally run near full load).

(b) The units would have a rating of 297.5 gross MW(t) and 265 net MW(e). The difference between "gross" and "net" is electricity consumed on the plant site.

the 490 MW(e) from Ginna; however, an additional assumption is made that these power plants would operate at 80 percent capacity to correspond with the annual net production of 422 MW(e) from Ginna.

Unless otherwise indicated, the assumptions and numerical values used in Section 8.2.1 are from the Ginna ER (RG&E 2002). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the coal-fired alternative for 40 years is considered (as a reasonable projection of the operating life of a coal-fired plant).

The coal-fired alternative is analyzed for the Ginna site and an unspecified greenfield alternate site in western upstate New York. RG&E assumes in its ER that the plant would burn medium-sulfur bituminous coal of the type currently used at its Russell Station. This coal originates in Pennsylvania and West Virginia. Average characteristics of this fuel include a heat content of 30,775 kJ/kg (13,233 Btu/lb), a sulfur content of 2.22 percent by weight (7.2×10^{-4} g/kJ [1.68 lb/MMBtu]), and an ash content of 7.35 percent by weight. Scaling from DOE estimates for comparable units, taking into account differences in fuel heat content and capacity factor, RG&E estimates that the plant would consume approximately 1.3 million MT (1.4 million tons) of coal per year. Construction of a new electric power transmission line to connect to existing lines and a rail spur to the plant site may be needed.

8.2.1.1 Closed-Cycle Cooling System

The overall impacts at either the Ginna or alternate sites of the coal-fired generating system using a closed-cycle cooling system with cooling towers are discussed in the following sections. The magnitude of impacts for the alternate site will depend on the location of the particular site selected. The Ginna plant currently uses a once-through cooling system. For the purposes of comparison with an alternative site, however, it is assumed that the replacement coal-fired plant sited on the Ginna site would use a closed-cycle cooling system, which would most likely require the acquisition of additional land adjacent to the site.

- **Land Use**

The coal-fired generation alternative at the Ginna site would necessitate converting approximately 130 ha (320 ac) to industrial use for the power block, infrastructure and support facilities, coal storage and handling, and landfill disposal of ash, spent selective catalytic reduction (SCR) catalyst (used for control of nitrogen oxide [NO_x] emissions), and scrubber sludge (RG&E 2002). Of this amount, disposal of ash and sludge over a 40-year plant life would require approximately 105 ha (260 ac) (RG&E 2002). Additional land could be needed for an electric power transmission line, and a rail spur or barge slip and supporting facilities. Although the Ginna site has an existing once-through cooling system, it is likely that the system would need to be significantly modified to accommodate a coal plant with a closed-cycle cooling system. The alternate site would require construction of pipelines for cooling-water intake and discharge. During construction of the coal plant on the Ginna site, it is likely that the land requirements would exceed the size of the existing Ginna site, which would necessitate the acquisition of additional land adjacent to the site.

Locating the plant at an alternate site may require more site acreage than for the Ginna station siting alternative to provide for additional onsite support infrastructure and buffer areas. For example, scaling for plant size from the NRC's estimate for a 1000 MW plant (NRC 1996), a 900-ac site could be required.

Land-use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. In the GEIS, the staff estimated that approximately 8900 ha (22,000 ac) would be affected for mining the coal and disposing of the waste to support a 1000 MW(e) coal plant during its operational life (NRC 1996). A replacement coal-fired plant for Ginna would generate 425 MW(e), so proportionately less land would be affected. Partially offsetting this offsite land use would be the elimination of the need for uranium mining and processing to supply fuel for Ginna. In the GEIS, the staff estimated that approximately 400 ha (1000 ac) would be affected for mining and processing the uranium during the operating life of a 1000 MW(e) nuclear power plant (NRC 1996).

The impact of a coal-fired generating unit with a closed-cycle cooling system on land use located at either the Ginna site or at an alternate New York site is considered as MODERATE to LARGE. The impact would be greater than the alternative of renewing the OLs.

- **Ecology**

The coal-fired generation alternative at the Ginna site would use undeveloped areas of the site, which is primarily made up of wooded areas and orchards. In addition, there are two streams that flow through the site that would most likely be impacted. If the rail delivery option is chosen, it would require the construction of a 4.8-km (3.0-mi)-long rail spur to an existing rail line and the use of a 29-km (18-mi) corridor that is not currently used. If the barge delivery option is chosen, a navigable channel would need to be dredged and a dockage area would need to be constructed. Barge delivery would require maintenance dredging during operation of the plant. Cooling tower drift could result in some minor impacts.

Because construction would result in the loss of hundreds of acres of habitat for the plant, infrastructure and waste disposal, the staff considers the ecological impacts of a new coal-fired plant with a closed-cycle cooling system at the Ginna site to be MODERATE.

Coal-fired generation at an alternative site would introduce construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Use of cooling makeup water from a nearby surface-water body could have adverse impacts on aquatic resources. If needed, construction and maintenance of an electric power transmission line and a rail spur would have ecological impacts. There would be some impact on terrestrial ecology from water drift from the cooling towers. Overall, the ecological impacts of constructing a coal-fired plant with a closed-cycle cooling system at an alternate site are considered to be MODERATE to LARGE and would be greater than renewal of the Ginna OL.

- **Water Use and Quality**

Coal-fired generation at the Ginna site would likely use water from Lake Ontario for cooling. It is possible that some of the existing intake and discharge structures could be used, but the construction of additional cooling infrastructure would be needed to accommodate a closed-cycle cooling system. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams and sanitary wastewater may also be discharged. All discharges would be regulated by the New York State Department of Environmental Conservation (NYSDEC) through a State Pollution Discharge Elimination System (SPDES) permit. There would be a consumptive use of water due to evaporation from the cooling towers. Some erosion and sedimentation would likely occur during construction (NRC 1996). The staff considers the impacts to surface-water use and quality of a new coal-fired plant with a closed-cycle cooling system located at the Ginna site to be SMALL.

Cooling water at an alternate site would likely be withdrawn from a surface-water body and would be regulated by permit. Depending on the source water body, the impacts of water use for cooling system makeup water and the effects on water quality due to cooling tower blowdown could have noticeable impacts. Therefore, the staff considers the impacts of a new coal-fired plant utilizing a closed-cycle cooling system at an alternate site to be SMALL to MODERATE.

Use of groundwater at the Ginna site is unlikely, but is possible for a coal-fired plant at an alternate site. Groundwater withdrawal could require a permit. Overall, impacts to groundwater use and quality of a new coal-fired plant with a closed-cycle cooling system at the Ginna site are considered SMALL and the impacts to groundwater use and quality of such a plant at an alternate site are considered SMALL to MODERATE, depending on the volume of groundwater withdrawn.

- **Air Quality**

The air-quality impacts of coal-fired generation differ considerably from those of nuclear generation due to emissions of sulfur oxides (SO_x), NO_x, particulates, carbon monoxide, hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

A new coal-fired generating plant would likely need a prevention of significant deterioration (PSD) permit and an operating permit under the Clean Air Act. The plant would need to comply with the new source performance standards for such plants set forth in 40 CFR Part 60, Subpart Da. The standards establish emission limits for particulate matter and opacity (40 CFR 60.42a), sulfur dioxide (SO_2) (40 CFR 60.43a), and NO_x (40 CFR 60.44a). The facility would be designed to meet Best Available Control Technology (BACT) or Lowest Achievable Emissions Rate (LAER) standards, as applicable, for control of criteria air emissions.

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified for criteria pollutants[a] under the Clean Air Act. All of the RG&E potential power plant sites are most likely in areas that are designated as attainment or unclassified for criteria pollutants.

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future, and remedying existing, impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. In addition, EPA regulations provide that for each mandatory Class I Federal area located within a state, the state must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. The Ginna site and the surrounding region are not located within a Class I Federal area.

Impacts for specific pollutants are as follows:

- Sulfur oxides. A new coal-fired power plant would be subject to the requirements in Title IV of the Clean Air Act. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive

(a) Criteria pollutants under the Clean Air Act are ozone, carbon monoxide, particulates, SO_2, lead, and NO_x. Emission standards for criteria pollutants are set forth in 40 CFR Part 51.

allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore either acquire allowances from owners of other power plants by purchase or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new coal-fired power plant would not add to net regional SO_2 emissions, although it might do so locally. Regardless, SO_2 emissions would be greater for the coal alternative than the OL renewal alternative since a nuclear power plant releases almost no SO_2 during normal operations.

RG&E estimates that by using the best technology to minimize SO_2 emissions, the total annual stack emissions would be approximately 2661 MT (2933 tons) of SO_2 (RG&E 2002). RG&E states in its ER that an alternative coal-fired plant would use wet limestone flue-gas desulfurization technology (RG&E 2002).

- Nitrogen oxides. Section 407 of the Clean Air Act establishes technology-based emission limitations for NO_x emissions. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standard for such plants at 40 CFR 60.44a(d)(1), which limits the discharge of any gases that contain NO_x (expressed as NO_2) to 200 ng/J of gross energy output (1.6 lb/MWh), based on a 30-day rolling average.

  RG&E estimates that by using low-NO_x burners with overfire air and SCR, the total annual NO_x emissions for a new coal-fired power plant would be approximately 1597 MT (1760 tons) (RG&E 2002). Regardless of the control technology, this level of NO_x emissions would be greater than the OL renewal alternative, because a nuclear power plant releases almost no NO_x during normal operations.

- Particulates. RG&E estimates that the total annual stack emissions of particulates would include approximately 195 MT (215 tons) of PM_{10} (particulate matter having an aerodynamic diameter less than or equal to 10 μm). Fabric filters or electrostatic precipitators would be used for control (RG&E 2002). In addition, coal-handling equipment would introduce fugitive particulate emissions. Particulate emissions would be greater under the coal alternative than the OL renewal alternative since a nuclear plant releases few particles during normal operations.

  During the construction of a coal-fired plant, fugitive dust would be generated. In addition, exhaust emissions would come from vehicles and motorized equipment used during construction.

- Carbon monoxide. RG&E estimates that total carbon monoxide emissions would be approximately 2781 MT (3066 tons) per year (RG&E 2002). This level of emissions is greater than the OL renewal alternative.

- Hazardous air pollutants including mercury. In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). The EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA 2000a). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. The EPA found that (1) there is a link between coal consumption and mercury emissions; (2) electric utility steam-generating units are the largest domestic source of mercury emissions; and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000a). Accordingly, EPA added coal- and oil-fired electric utility steam-generating units to the list of source categories under Section 112(c) of the Clean Air Act for which emission standards for hazardous air pollutants will be issued (EPA 2000a).

- Uranium and thorium. Coal contains uranium and thorium. Uranium concentrations are generally in the range of 1 to 10 parts per million. Thorium concentrations are generally about 2.5 times greater than uranium concentrations (Gabbard 1993). One estimate is that a typical coal-fired plant had an annual release of approximately 4.7 MT (5.2 tons) of uranium and 11.6 MT (12.8 tons) of thorium in 1982 (Gabbard 1993). The population dose equivalent from the uranium and thorium releases and daughter products produced by the decay of these isotopes has been calculated to be significantly higher than that from nuclear power plants (Gabbard 1993).

- Carbon dioxide. A coal-fired plant would have unregulated carbon dioxide emissions that could contribute to global warming.

The GEIS analysis did not quantify emissions from coal-fired power plants but implied that air impacts would be substantial. The GEIS also mentioned global warming from unregulated carbon dioxide emissions and acid rain from SO_x and NO_x emissions as potential impacts (NRC 1996). Adverse human health effects from coal combustion such as cancer and emphysema have been associated with the products of coal combustion. Although local air quality would noticeably be reduced from the presence of a coal plant, equivalent regional allowances for SO_2 emissions would have to be obtained and credits to more than offset NO_x emissions by a ratio of 1.15:1.00 would also have to be obtained. The appropriate characterization of air impacts from coal-fired generation at either the Ginna site or an alternate site are considered to be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent SCR catalyst, and scrubber sludge. One 422-MW(e) coal-fired plant would annually generate approximately 148,000 MT (163,000 tons) of ash and 138,000 MT (152,000 tons) of scrubber sludge. Spent SCR catalyst would be regenerated or disposed of offsite. Construction-related debris would be generated during construction activities. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality but, with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for some other uses.

In May 2000, the EPA issued a “Notice of Regulatory Determination on Wastes From the Combustion of Fossil Fuels” (EPA 2000). The EPA concluded that some form of national regulation is warranted to address coal combustion waste products because (1) the composition of these wastes could present danger to human health and the environment under certain conditions; (2) EPA has identified 11 documented cases of proven damage to human health and the environment by improper management of these wastes in landfills and surface impoundments; (3) present disposal practices are such that, in 1995, these wastes were being managed in 40 percent to 70 percent of landfills and surface impoundments without reasonable controls in place, particularly in the area of groundwater monitoring; and (4) EPA identified gaps in state oversight of coal combustion wastes. Accordingly, EPA announced its intention to issue regulations for disposal of coal combustion waste under subtitle D of the Resource Conservation and Recovery Act.

For all of the preceding reasons, the impacts from waste generated by a coal-fired plant using once-through cooling at either the Ginna site or at an alternate site are considered to be MODERATE; the impacts would be clearly noticeable but would not destabilize any important resource.

- **Human Health**

Coal-fired power generation introduces worker risk from coal and limestone mining, worker and public risk from coal and lime/limestone transportation, worker and public risk from disposal of coal combustion wastes, and public risk from inhalation of stack emissions.

Emission impacts can be widespread and health risk is difficult to quantify. The coal alternative also introduces the risk of coal pile fires and attendant inhalation risk.

The staff stated in the GEIS that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates from a coal-fired plant, but the GEIS does not identify the significance of these impacts (NRC 1996). In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and state agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. As discussed previously, the EPA has recently concluded that certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures from sources such as coal-fired power plants. However, in the absence of more quantitative data, human health impacts from radiological doses and inhaling toxins and particulates generated by a coal-fired plant at either the Ginna or alternate site are considered to be SMALL.

- **Socioeconomics**

If a coal-fired power plant were built on the Ginna site, the community would not lose the tax base; however, they would experience a net loss of operational jobs, down from 500 to 100-150 plant employees. If a coal-fired power plant were built at an alternate site to replace power produced by Ginna, the communities around the Ginna site would experience the impact of Ginna operational job loss and the town of Ontario, the Wayne Central School District, and Wayne County would lose the Ginna tax base. These losses would have SMALL to MODERATE socioeconomic impacts, given the fact that Ginna provides less than 10 percent of the total revenue in Wayne County and slightly over 10 percent of the total revenue in the town of Ontario and the Wayne Central School District (Section 8.1.7).

During construction of the new coal-fired plant, communities near the construction site would experience demands on housing and public services that could have a MODERATE impact around the Ginna site and possibly a MODERATE to LARGE impact at an alternative site. After construction, the nearby communities would be impacted by the loss of the construction jobs. The construction of the representative coal-fired plant would require a peak onsite workforce of approximately 820 workers and would take approximately three years to complete. It is estimated that the completed coal plant would employ approximately 100-150 workers. The coal-fired plant would provide a new tax base for the local jurisdiction at an alternative site. The staff stated in the GEIS that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction workforce would need to move to the area to work (NRC 1996). Socioeconomic impacts at a rural site could be MODERATE. Transportation-related impacts associated with commuting construction and plant operating personnel at the Ginna site would likely be SMALL. Transportation-related impacts associated with commuting construction workers at an alternate site are site-dependent, but could be SMALL to MODERATE. Transportation impacts related to commuting of plant operating personnel would also be site-dependent, but can be characterized as SMALL.

Coal and lime/limestone would likely be delivered to both the Ginna and alternative site by rail or barge. Socioeconomic impacts associated with rail transportation would likely be SMALL to MODERATE. For example, there would be delays to highway traffic as trains pass and there could be negative impacts on the value of property close to the train tracks. Barge delivery of coal and lime/limestone would likely have SMALL socioeconomic impacts.

Overall, the socioeconomic impacts of constructing and operating a coal-fired generating plant at the Ginna site are considered to be SMALL to MODERATE. The socioeconomic impacts of a coal-fired plant at an alternate site are considered to be MODERATE to LARGE depending on the alternate site location.

- **Aesthetics**

The two coal-fired power block units could be as much as 61 m (200 ft) tall and be visible from offsite during daylight hours. The exhaust stacks could be as much as 152 m (500 ft) high. The stacks would likely be highly visible in daylight hours for distances greater than 16 km (10 mi). Cooling towers and associated plumes would also have an aesthetic impact. Natural draft towers could be up to 160 m (520 ft) high. Mechanical draft towers could be up to 30 m (100 ft) high. The stacks would be visible from parks, other recreational areas, and wildlife refuges in the vicinity of the plant. The power block units and associated stacks and cooling towers would also be visible at night because of outside lighting. The U.S. Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 61 m (200 ft) above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000). Visual impacts of a new coal-fired plant could be mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting, provided the lighting meets FAA requirements, and appropriate use of shielding. Overall, the coal-fired units and the associated exhaust stacks and cooling towers would likely have a MODERATE to LARGE aesthetic impact. There would also be an aesthetic impact that could be LARGE if construction of a new electric power transmission line is needed.

Coal-fired generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to the noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations and mechanical draft cooling towers. Intermittent sources include the equipment related to coal handling, solid waste disposal, transportation related to coal and lime/limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise impacts associated with rail delivery of coal and lime/limestone would be most significant for residents living in the vicinity of the facility and along the rail route. Although noise from passing trains significantly raises noise levels near the rail corridor, the short duration of the noise reduces the impact. Nevertheless, given the frequency of train transport and the fact that many people are likely to be within hearing distance of the rail route, the impacts of noise on residents in the vicinity of the facility and the rail line is considered MODERATE. Noise associated with barge transportation of coal and lime/limestone would be SMALL. Noise and light from the plant would be detectable offsite. Aesthetic impacts at the plant site would be mitigated if the plant were located in an industrial area or adjacent to other power plants.

Overall, the aesthetic impacts associated with locating a coal-fired plant with a closed-cycle cooling system at either the Ginna or an alternate New York site are considered to be MODERATE to LARGE.

- **Historic and Archaeological Resources**

An historic and archaeological resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on historic and archaeological resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be managed or mitigated to some extent. Therefore, the impacts of a new coal-fired plant at either the Ginna or an alternate site could be SMALL to MODERATE.

- **Environmental Justice**

If a coal-fired plant were located on the Ginna site, the environmental impacts on minority and low-income populations around the site would most likely be SMALL. There may be some impacts on housing that occur during construction; however, the impacts on minority and low-income populations should be similar to those experienced by the population as a whole. The loss of Ginna operating jobs would be SMALL due to the proximity of the plant to a diverse urban job market.

Environmental impacts on minority and low-income populations associated with a replacement coal-fired plant built at an alternate site in New York state would depend upon the site chosen and the nearby population distribution. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of Ginna would result in the loss of approximately 500 operating jobs. Resulting economic conditions could reduce employment prospects for minority or low-income populations. However, Ginna is located in a relatively urban area with many employment possibilities. Wayne County would also experience a loss of property tax revenue, which could affect its ability to provide services and programs. However, these losses would likely have SMALL environmental justice impacts given the moderate proportion of the tax base in Wayne County attributable to Ginna (Section 8.1.7). Overall, impacts of a new coal-fired plant at either the Ginna or an alternate site are considered to be SMALL.

- **Summary**

The potential impacts of replacing the power produced by Ginna with a coal-fired generating plant with a closed-cycle cooling system are summarized in Table 8-2.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation Using Closed-Cycle Cooling at the R.E. Ginna Nuclear Power Plant Site and an Alternate Site in New York State

	Ginna Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comment**
Land Use	MODERATE to LARGE	Uses up to approximately 130 ha (320 ac) for power block; coal handling, storage, and transportation facilities; infrastructure facilities; and waste disposal. Additional land impacts for coal and limestone mining. Additional impacts would occur for rail spur and closed-cycle cooling-water intake and discharge piping.	MODERATE to LARGE	May use up to approximately 360 ha (320 ac) for power block; coal handling, storage, and transportation facilities; infrastructure facilities; and waste disposal. Additional land impacts for coal and limestone mining. Additional impacts would occur for electric power transmission line, rail spur, and cooling-water intake and discharge piping.

Table 8-2. (contd)

	Ginna Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comment**
Ecology	MODERATE	Uses undeveloped areas in current site and possibly other nearby land and existing transmission corridor. Construction of barge slip and dredged channel or 4.8-km (3.0-mi) rail spur needed; impacts to terrestrial ecology from cooling tower drift.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface-water body used for intake and discharge, and electric power transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity; impacts to terrestrial ecology from cooling tower drift.
Surface-Water Use and Quality	SMALL	Partial use of existing intake and discharge structures. Operational impacts similar to or less than Ginna.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged, the constituents in the discharge water, and the characteristics of the surface-water body. Discharges would be regulated by NYSDEC.
Groundwater Use and Quality	SMALL	Use of groundwater is unlikely.	SMALL TO MODERATE	Impact will depend on the volume of groundwater withdrawn.
Air Quality	MODERATE	Sulfur oxides • 2661 MT/yr (2933 tons/yr) 0.25 g/GJ (0.15 lb/MMBtu) Nitrogen oxides • 1597 MT/yr (1760 tons/yr) 0.15 g/GJ (0.09 lb/MMBtu) Particulates • 195 MT/yr (215 tons/yr) of PM_{10} Carbon monoxide • 2781 MT/yr (3066 tons/yr) Small amounts of mercury and other hazardous air pollutants and naturally occurring radioactive materials – mainly uranium and thorium	MODERATE	Same as Ginna site.

Table 8-2. (contd)

Impact Category	Ginna Site Impact	Ginna Site Comments	Alternate Site Impact	Alternate Site Comment
Waste	MODERATE	Total waste volume would be approximately 148,000 MT/yr (163,000 tons/yr) of ash, spent catalyst, and 138,000 MT/yr (152,000 tons/yr) of scrubber sludge requiring approximately 105 ha (260 ac) for disposal during the 40-year life of the plant.	MODERATE	Same as Ginna site.
Human Health	SMALL	Impacts are uncertain, but considered SMALL in the absence of more quantitative data.	SMALL	Same as Ginna site.
Socioeconomics	SMALL to MODERATE	Increased demand for public services during construction (up to 820 workers needed during 3-year construction period). Net loss of jobs during operation (from 500 to approximately 150 employees); tax base preserved. Transportation of coal and limestone could have MODERATE impact if rail line is used. For barge transportation, the impact is considered SMALL.	MODERATE to LARGE	Construction impacts depend on location, but could be LARGE if plant is located in a rural area. Wayne County would experience loss of the Ginna site tax base and employment, but impacts are likely to be SMALL to MODERATE. Impacts during operation would be SMALL. Transportation impacts associated with construction workers could be MODERATE to LARGE. For rail transportation of coal and lime/limestone, the impact is considered MODERATE to LARGE. For barge transportation, the impact is considered SMALL.

Table 8-2. (contd)

Impact Category	Ginna Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comment**
Aesthetics	MODERATE to LARGE	Visual impact of large industrial facility with stacks and cooling towers on lake shore could be significant. Construction and operation of new barge facilities or railway line to Rochester could also impact aesthetics. Noise impacts from plant operations and intermittent sources such as rail transportation of coal could be MODERATE.	MODERATE to LARGE	Impact would depend on the site selected and the surrounding land features. Power block, exhaust stacks, cooling towers, and cooling tower plumes will be visible from nearby areas. If needed, a new electric power transmission line could have a LARGE aesthetic impact. Noise impact from plant operations and intermittent sources such as rail transportation of coal could be MODERATE.
Historic and Archaeological Resources	SMALL to MODERATE	Impacts can generally be managed or mitigated.	SMALL to MODERATE	Same as Ginna site.
Environmental Justice	SMALL	Impacts on minority and low-income populations should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction. Loss of Ginna operating jobs would be SMALL due to the proximity of the plant to a diverse urban job market.	SMALL	Impacts at alternate site vary depending on population distribution and makeup at site. Wayne County would lose tax revenue and jobs, however, the impacts on minority and low-income populations would likely be SMALL.

8.2.1.2 Once-Through Cooling System

The environmental impacts of constructing a coal-fired generation system at the Ginna site and an alternate site in New York state using once-through cooling are similar to the impacts for a coal-fired plant using a closed-cycle cooling system. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-3 summarizes the incremental differences.

Table 8-3. Summary of Environmental Impacts of Coal-Fired Generation with Once-Through Cooling at the R.E. Ginna Nuclear Power Plant Site or an Alternate Site in New York State

	Ginna Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Land Use	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.
Ecology	MODERATE	Slightly less loss of terrestrial habitat and elimination of potential cooling tower impacts. Increased water withdrawal, but aquatic impacts would be similar to current Ginna operations.	MODERATE to LARGE	Slightly reduced habitat loss, and no impacts to terrestrial resources from cooling towers, but increased water withdrawal may impact aquatic resources.
Surface-Water Use and Quality	SMALL to MODERATE	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.	SMALL to MODERATE	Impact will depend on the characteristics of the surface-water body, volume of water withdrawn, and characteristics of the discharge.
Groundwater Use and Quality	SMALL	No change	SMALL	It is unlikely that groundwater would be used for once-through cooling, but could be used for sanitary water.
Air Quality	MODERATE	No change	MODERATE	No change
Waste	MODERATE	No change	MODERATE	No change
Human Health	SMALL	No change	SMALL	No change
Socioeconomics	SMALL to MODERATE	No change	MODERATE to LARGE	No change
Aesthetics	SMALL to MODERATE	Reduced aesthetic impact because cooling towers would not be used.	SMALL to MODERATE	Reduced aesthetic impact because cooling towers would not be used.

Table 8-3. (contd)

Impact Category	Ginna Site Impact	Ginna Site Comparison with Closed-Cycle Cooling System	Alternate Site Impact	Alternate Site Comparison with Closed-Cycle Cooling System
Historic and Archaeological Resources	SMALL to MODERATE	Less land impacted	SMALL to MODERATE	Less land impacted
Environmental Justice	SMALL	No change	SMALL	No change

8.2.2 Natural-Gas-Fired Generation

The environmental impacts of a natural-gas-fired plant using combined-cycle combustion turbines are examined in this section for both the Ginna site and an alternate site in New York state. For the Ginna site, the staff assumed that the plant would use at least part of the existing once-through cooling canal system.

RG&E concluded in its ER that the Ginna site would be a reasonable site for location of a natural-gas-fired generating unit. In its ER, RG&E chose to evaluate gas-fired generation using combined-cycle turbines. The environmental impact analysis in the ER is based on the Wawayanda Energy Center plant, near Middletown, New York. The Wawayanda Energy Center plant operates at a nominal 540 MW(e), which is slightly more than the 490 MW(e) net capacity of Ginna; therefore, a net capacity factor of 80 percent for the representative gas-fired plant is assumed.

For construction at an alternate site, a new pipeline would need to be constructed from the plant site to a supply point where a reliable supply of natural gas would be available.

The staff assumed that a replacement natural-gas-fired plant would use combined-cycle combustion turbines as described by RG&E (RG&E 2002). RG&E estimates that the plant would consume approximately 765 million m^3 (27 billion ft^3) of natural gas annually (RG&E 2002).

Unless otherwise indicated, the assumptions and numerical values used throughout this section are from the Ginna ER (RG&E 2002). The staff reviewed this information and compared it to environmental impact information in the GEIS. Although the OL renewal period is only 20 years, the impact of operating the natural-gas-fired alternative for 40 years is considered a reasonable projection of the operating life of a natural-gas-fired plant.

The impacts of a plant with a closed-cycle cooling system with cooling towers are discussed in Section 8.2.2.1 and the impacts of a plant with once-through cooling are discussed in Section 8.2.2.2.

8.2.2.1 Closed-Cycle Cooling System

The overall impacts of the natural-gas-generating system with a closed-cycle cooling system located either at the Ginna site or an alternate New York site are discussed in the following sections. The magnitude of impacts at an alternate site will depend on the location of the particular site selected.

- **Land Use**

The natural-gas-fired alternative would require converting approximately 12 ha (30 ac) to industrial use for the power block, cooling towers, and infrastructure and support facilities (RG&E 2002). Additional land would likely be impacted for construction of an electric power transmission line, natural gas pipeline, and water intake/discharge pipelines to serve the plant. The Ginna ER assumes that these activities could impact up to 59 ha (145 ac) (RG&E 2002). Locating the facility at an alternate site may require greater land area devoted to transmission rights-of-way, but potentially less for gas pipelines. At the Ginna site, there is sufficient land available within the existing plant boundaries for the power block, cooling tower, and support facilities. A natural gas pipeline to the Ginna site would likely follow the existing transmission lines right-of-way. For any new natural-gas-fired power plant, additional land would be required for natural gas wells and collection stations. In the GEIS, the staff estimated that approximately 1500 ha (3600 ac) would be needed for a 1000 MW(e) plant (NRC 1996). Proportionately less land would be needed for a natural-gas-fired plant replacing the 490 MW(e) from Ginna. Partially offsetting these offsite land requirements would be the elimination of the need for uranium mining and processing to supply fuel for Ginna. NRC staff stated in the GEIS (NRC 1996) that approximately 400 ha (1000 ac) would be affected for mining and processing the uranium during the operating life of a 1000 MW(e) nuclear power plant.

Overall, land-use impacts for a natural-gas-fired plant with a closed-cycle cooling system at the Ginna site are considered SMALL, and the impacts to land use of a new natural-gas-fired plant with a closed-cycle cooling system located at an alternate site are considered to be MODERATE.

- **Ecology**

There would be ecological impacts related to habitat loss and cooling tower drift associated with siting of the gas-fired plant. If needed, there would also be temporary ecological impacts associated with bringing a new underground gas pipeline and/or electric power transmission line to the site. Ecological impacts would depend on the nature of the land converted for the plant and the possible need for a new transmission line and/or gas pipeline. To accommodate a gas-fired plant at the Ginna site, a 26-km (16-mi) gas supply pipeline would need to be constructed, which, assuming a construction right-of-way of 75 feet, could disrupt 59 ha (145 ac) of terrestrial habitat. Ecological impacts to the plant site and utility easements could include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Cooling makeup water intake and discharge could impact aquatic resources. There would be some impact on terrestrial ecology from drift from the cooling towers. Because it would use existing site land areas and infrastructure, a new natural-gas-fired plant with closed-cycle cooling at the Ginna site is considered to have a SMALL impact on ecological resources. A new natural-gas-fired plant with closed-cycle cooling at an alternate site will have SMALL to MODERATE impacts on ecological resources.

- **Water Use and Quality**

Natural-gas-fired generation at the Ginna site would likely use water from Lake Ontario for cooling. It is possible that some of the existing intake and discharge structures could be used, but the construction of additional cooling infrastructure would be needed to accommodate a closed-cycle system. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams and sanitary wastewater may also be discharged. All discharges would be regulated by NYSDEC through an SPDES permit. There would be a consumptive use of water due to evaporation from the cooling towers. Some erosion and sedimentation would likely occur during construction (NRC 1996). The staff considers the impacts to surface-water use and quality of a new natural-gas-fired plant with a closed-cycle cooling system located at the Ginna site to be SMALL.

Cooling water at an alternate site would likely be withdrawn from a surface-water body and would be regulated by permit. Depending on the source water body, the impacts of water use for cooling system makeup water and the effects on water quality due to cooling tower blowdown could have noticeable impacts. Therefore, the staff considers the impacts of a new natural-gas-fired plant utilizing a closed-cycle cooling system at an alternate site to be SMALL to MODERATE.

Use of groundwater at the Ginna site is unlikely, but is possible for a natural-gas-fired plant at an alternate site. Groundwater withdrawal could require a permit. Overall, impacts to groundwater use and quality of a new gas-fired plant with a closed-cycle cooling system at the Ginna site are considered SMALL and the impacts to groundwater use and quality of such a plant at an alternate site are considered SMALL to MODERATE, depending on the volume of groundwater withdrawn.

- **Air Quality**

Natural gas is a relatively clean-burning fuel. The gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired alternative.

A new gas-fired generating plant would likely need a PSD permit and an operating permit under the Clean Air Act. A new combined-cycle, natural-gas-fired power plant would also be subject to the new source performance standards for such units specified in 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_x. The facility would be designed to meet BACT or LAER standards, as applicable, for control of criteria air emissions.

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in areas designated as attainment or unclassified under the Clean Air Act. All of the RG&E preferred and potential power plant sites (RG&E 2002) are in areas that are designated as attainment or unclassified for criteria pollutants.

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future impairment of visibility and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. In addition, EPA regulations provide that for each mandatory Class I Federal area located within a state, the state must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)].

RG&E estimates that a natural-gas-fired plant equipped with appropriate pollution control technology would have the following emissions (RG&E 2002):

- sulfur oxides – 27 MT/yr (30 tons/yr)

- nitrogen oxides – 86 MT/yr (95 tons/yr)

- carbon monoxide – 53 MT/yr (58 tons/yr)

- PM_{10} particulates – 100 MT/yr (110 tons/yr).

A natural-gas-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). Natural-gas-fired power plants were found by EPA to emit arsenic, formaldehyde, and nickel (EPA 2000a). Unlike coal- and oil-fired plants, EPA did not determine that regulation of emissions of hazardous air pollutants from natural-gas-fired power plants should be regulated under Section 112 of the Clean Air Act.

Construction activities would result in temporary fugitive dust. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process.

Impacts of emissions from a gas-fired plant would be clearly noticeable, but would not be sufficient to destabilize air resources as a whole. The overall air-quality impact for a new natural-gas-generating plant sited at either the Ginna site or an alternate site in New York State is considered MODERATE.

- **Waste**

In the GEIS the staff concluded that waste generation from gas-fired technology would be minimal (NRC 1996). Gas firing results in few combustion by-products because of the clean nature of the fuel. Other than spent SCR catalyst, waste generation at an operating gas-fired plant would be largely limited to typical office wastes. Construction-related debris would be generated during construction activities. Overall, the waste impacts are considered to be SMALL for a natural-gas-fired plant located at either the Ginna site or an alternate site.

- **Human Health**

In the GEIS, the staff identified cancer and emphysema as potential health risks from natural-gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contributes to health risks. For a plant sited in New York, NO_x emissions would be regulated by NYSDEC. Human health effects are expected to be undetectable or sufficiently minor that they would neither destabilize nor noticeably alter any important attribute of the resource. Overall, the impacts on human health of a natural-gas-fired plant at either the Ginna site or an alternate site are considered SMALL.

- **Socioeconomics**

Construction of a natural-gas-fired plant would take approximately two years. Peak employment could be up to 420 workers (RG&E 2002). The staff assumed that construction would take place while Ginna continues operation and would be completed by the time Ginna permanently ceases operations. During construction, the communities immediately surrounding the plant site would experience demands on housing and public services that could have SMALL to MODERATE impacts. These impacts would be tempered by construction workers commuting to the site from more distant communities. After construction, the communities would be affected by the loss of jobs. The current Ginna workforce (500 workers) would decline through a decommissioning period to a minimal maintenance size. The new natural-gas-fired plant would provide a new tax base at an alternate site and provide approximately 25 permanent jobs (RG&E 2002). Siting at an alternate site in New York state would result in the loss of the nuclear plant tax base in Wayne County and associated employment. These losses would have SMALL to MODERATE socioeconomic impacts, given the fact that Ginna provides less than 10 percent of the total revenue in Wayne County and slightly over 10 percent of the total revenue in the town of Ontario and the Wayne Central School District (Section 8.1.7).

In the GEIS, the staff concluded that socioeconomic impacts from constructing a natural-gas-fired plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts of any nonrenewable technology (NRC 1996).

Compared to the coal-fired and nuclear alternatives, the smaller size of the construction workforce, the shorter construction time frame, and the smaller size of the operations workforce would mitigate socioeconomic impacts.

Transportation impacts associated with construction personnel commuting to the plant site would depend on the population density and transportation infrastructure in the vicinity of the site. The impacts can be classified as MODERATE. Impacts associated with operating personnel commuting to the plant site would be SMALL.

Overall, socioeconomic impacts resulting from construction of a natural-gas-fired plant either at the Ginna site or at an alternate site would be SMALL to MODERATE.

- **Aesthetics**

The turbine buildings, exhaust stacks (approximately 61 m [200 ft] tall), cooling towers, and the plume from the cooling towers would be visible from offsite during daylight hours. The gas pipeline compressors also would be visible. Noise and light from the plant would be detectable offsite. If a new electric power transmission line is needed, the aesthetic impact at an alternate site could be LARGE. Aesthetic impacts would be mitigated if the plant were located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with a replacement natural-gas-fired plant with a closed-cycle cooling system at either the Ginna site or an alternate site in New York state are categorized as MODERATE to LARGE, with site-specific factors determining the final categorization.

- **Historic and Archaeological Resources**

An historic and archaeological resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on historic and archaeological resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated rights-of-way where new construction would occur (e.g., roads, transmission and pipeline rights-of-way, or other rights-of-way). Impacts to historic and archaeological resources can be managed and mitigated to a certain extent under current laws and regulations. Therefore, impacts to historical and archaeological resources from a natural-gas-fired plant are considered to be SMALL to MODERATE.

- **Environmental Justice**

Environmental impacts on minority and low-income populations associated with a replacement natural-gas-fired plant built at an alternate site in New York state would depend upon the site chosen and the nearby population distribution. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of Ginna would result in the loss of approximately 500 operating jobs. Resulting economic conditions could reduce employment prospects for minority or low-income populations. However, Ginna is located in a relatively urban area with many employment possibilities. Wayne County would also experience a loss of property tax revenue, which could affect its ability to provide services and programs. However, these losses would likely have SMALL environmental justice impacts, given the moderate proportion of the tax base in Wayne County attributable to Ginna (Section 8.1.3) considered. Overall, impacts of a new natural-gas-fired plant at either the Ginna or an alternate site are considered to be SMALL.

- **Summary**

The environmental impacts of a new gas-fired electrical power generation facility with closed-cycle cooling are summarized in Table 8-4.

Table 8-4. Summary of Environmental Impacts of Natural-Gas-Fired Generation Using Closed-Cycle Cooling at an Alternate Site in New York State

	Ginna Site		Alternate Site	
Impact Category	**Impact**	**Comments**	**Impact**	**Comment**
Land Use	SMALL	12 ha (30 ac) of existing site land for power blocks, office, roads, and parking areas. Additional impact of up to approximately 59 ha (145 ac) for construction of underground gas piping.	MODERATE	12 ha (30 ac) for power block, switchyard, cooling towers, and infrastructure support facilities. Additional impact of up to 53 ha (130 acres) for electric power transmission line, natural gas pipeline, and cooling-water intake/discharge piping.
Ecology	SMALL	Uses previously-disturbed areas at current Ginna site. Some effects from gas pipeline construction. Impacts to terrestrial ecology from cooling tower drift.	SMALL to MODERATE	Impact depends on location and ecology of the site, surface-water body used for intake and discharge, and possible electric power transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity; impacts to terrestrial ecology from cooling tower drift.
Surface-Water Use and Quality	SMALL	Uses part of the existing once-through cooling system. Discharge of cooling tower blowdown will have impacts.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge, the constituents in the discharge water, and the characteristics of the surface water body. Discharge of cooling tower blowdown will have impacts.
Groundwater Use and Quality	SMALL	Use of groundwater very unlikely.	SMALL to MODERATE	Impacts will depend on the quality of water withdrawn.

Table 8-4. (contd)

Impact Category	Ginna Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comment**
Air Quality	MODERATE	Sulfur oxides • 27 MT/yr (30 tons/yr) Nitrogen oxides • 86 MT/yr (95 tons/yr) Carbon monoxide • 53 MT/yr (58 tons/yr) PM_{10} particulates • 100 MT/yr (110 tons/yr) Some hazardous air pollutants.	MODERATE	Same as Ginna site.
Waste	SMALL	Minimal waste product from fuel combustion.	SMALL	Same as Ginna site.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Same as Ginna site.
Socio-economics	SMALL to MODERATE	During construction impacts would be SMALL to MODERATE. Up to 420 additional workers during the peak of the two-year construction period, followed by reduction from current Ginna workforce from 500 to 25; tax base preserved. Impacts during operation would be SMALL.	SMALL to MODERATE	During construction impacts would be SMALL to MODERATE. Up to 420 additional workers during the peak of the two-year construction period. Wayne County would experience loss of the tax base and employment associated with Ginna with potentially SMALL impacts. Impacts during operation would be SMALL. Transportation impacts associated with construction workers would be MODERATE.
Aesthetics	MODERATE to LARGE	Aesthetic impact due to impact of plant unit, and cooling towers and associated plume stacks.	MODERATE to LARGE	MODERATE impact from plant, stacks, and cooling towers and associated plumes. Additional impact that could be LARGE if a new electric power transmission line is needed.
Historic and Archaeological Resources	SMALL to MODERATE	Impacts can generally be managed or mitigated.	SMALL to MODERATE	Same as Ginna site.

Table 8-4. (contd)

Impact Category	Ginna Site		Alternate Site	
	Impact	Comments	Impact	Comment
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of Ginna operating jobs on minority and low-income populations would most likely be SMALL due to the proximity of the plant to diverse urban job market.	SMALL	Impacts at alternate site vary depending on population distribution and makeup at site. Wayne County would lose tax revenue and jobs, however the impacts on minority and low-income populations would likely be SMALL.

8.2.2.2 Once-Through Cooling System

The environmental impacts of constructing a natural-gas-fired generation system at an alternate site in New York state using a once-through cooling system are similar to the impacts for a natural-gas-fired plant using closed-cycle cooling with cooling towers. However, there are some environmental differences between the closed-cycle and once-through cooling systems. Table 8-5 summarizes the incremental differences.

Table 8-5. Summary of Environmental Impacts of Natural-Gas-Fired Generation with Once-Through Cooling at the R.E. Ginna Nuclear Power Plant Site or at an Alternate Site in New York State

	Ginna Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Land Use	SMALL to MODERATE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.	SMALL to MODERATE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.
Ecology	SMALL	Less terrestrial habitat lost and cooling tower effects eliminated. Increased water withdrawal, but aquatic impact would be similar to current Ginna operations.	SMALL to MODERATE	Impact would depend on ecology at the site. No impact to terrestrial ecology from cooling tower drift. Increased water withdrawal and possible greater impact to aquatic ecology.
Surface-Water Use and Quality	SMALL	No discharge of cooling tower blowdown containing dissolved solids. Increased water withdrawal would be insignificant to Lake Ontario.	SMALL to MODERATE	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.
Groundwater Use and Quality	SMALL	No change	SMALL	It is unlikely that groundwater would be used for once-through cooling, but could be used for sanitary water.
Air Quality	MODERATE	No change	MODERATE	No change
Waste	SMALL	No change	SMALL	No change
Human Health	SMALL	No change	SMALL	No change
Socioeconomics	SMALL to MODERATE	No change	SMALL to MODERATE	No change

Table 8-5. (contd)

	Ginna Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Aesthetics	SMALL to MODERATE	Reduced aesthetic impact because cooling towers would not be used.	SMALL to MODERATE	Reduced aesthetic impact because cooling towers would not be used.
Historic and Archaeological Resources	SMALL to MODERATE	Less land affected.	SMALL to MODERATE	Less land affected.
Environmental Justice	SMALL	No change	SMALL	No change

8.2.3 Nuclear Power Generation

Since 1997, the NRC has certified three new standard designs for nuclear power plants under 10 CFR Part 52, Subpart B. These designs are the U.S. Advanced Boiling Water Reactor (10 CFR Part 52, Appendix A), the System 80+ Design (10 CFR Part 52, Appendix B), and the AP600 Design (10 CFR Part 52, Appendix C). All of these plants are light-water reactors. Although no applications for a construction permit or a combined license based on these certified designs have been submitted to the NRC, the submission of the design certification applications indicates continuing interest in the possibility of licensing new nuclear power plants. Recent volatility in prices of natural gas and electricity have made new nuclear power plant construction more attractive from a cost standpoint. Additionally, Entergy Nuclear, Exelon, and Dominion Power recently announced that they will submit applications for early site permits for new advanced nuclear power plants under the procedures in 10 CFR Part 52 Subpart A (NEI 2002). Therefore, construction of a new nuclear power plant, either at the Ginna site or at an alternate site in New York state using both closed- and open-cycle cooling is considered in this section. The staff assumed that the new nuclear plant would have a 40-year lifetime.

The NRC has summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The impacts shown in Table S-3 are representative of the impacts that would be associated with a replacement nuclear power plant built to one of the certified designs. The impacts shown in Table S-3 are for a 1000-MW(e) reactor and would need to be adjusted to reflect replacement of Ginna, which has a capacity of 490 MW(e). The environmental impacts associated with transporting fuel and waste to and from a light-water-cooled nuclear power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, is also relevant, although not directly applicable, for consideration of environmental impacts associated with the operation of a replacement nuclear power plant. Additional environmental impact information for a replacement nuclear power plant using closed-cycle cooling with cooling towers is presented in Section 8.2.3.1 and using once-through cooling in Section 8.2.3.2.

8.2.3.1 Closed-Cycle Cooling System

The overall impacts of a new nuclear electrical-generating plant utilizing a closed-cycle cooling system at the Ginna site or an alternate site are discussed in the following sections. The extent of impacts at an alternate site will depend on the location of the particular site selected.

- **Land Use**

According to the GEIS, land-use requirements for a new nuclear unit at an alternate site would be approximately 200 to 400 ha (500 to 1000 ac) (NRC 1996). Additional land could be needed for an electric power transmission line, a rail spur to bring construction materials to the plant site, and/or pipelines to supply cooling-water intake and discharge. Depending particularly on transmission line routing, siting a new nuclear plant with closed-cycle cooling at an alternate site would result in MODERATE to LARGE land-use impacts.

If a new nuclear plant were to be constructed at the Ginna site, the staff assumed that the existing facilities would be used to the extent practicable, reducing the amount of new construction that would be required. Specifically, the staff assumed that a replacement nuclear power plant would use the existing cooling system, switchyard, offices, and transmission right-of-way. A replacement nuclear unit constructed at the Ginna site would be expected to require less land area than a unit at a greenfield site, but would still require at least several hundred acres. It is not clear whether there is enough usable land for a replacement unit at the Ginna site, and additional land beyond the current Ginna boundary may be needed to construct a new nuclear power plant while the current Ginna plant continues to operate. Therefore, the siting of a new nuclear plant with closed-cycle cooling at the Ginna site would likely result in a MODERATE to LARGE impact. The impact would be greater than the OL renewal alternative.

There would be no net change in land needed for uranium mining because land needed to support the new nuclear plant would offset land needed to supply uranium for fuel for the existing Ginna reactor.

- **Ecology**

A new nuclear plant at an alternate site would introduce construction impacts and new incremental operational impacts. Even assuming siting at a previously disturbed area, the impacts likely would alter the ecology. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity. Intake and discharge of cooling water from a nearby surface-water body could have adverse aquatic resource impacts. If needed, construction and maintenance of an electric power transmission line would have ecological impacts. There would be some impact on terrestrial ecology from cooling tower drift. Overall, the ecological impacts of a new nuclear plant with closed-cycle cooling at an alternate site would be MODERATE to LARGE.

A new nuclear plant with a closed-cycle cooling system at the Ginna site would also result in impacts to the ecology of the site. Most of the land area that would be used for a new plant at the Ginna site is currently used for apple orchards, but the more natural wooded areas of the site also would be adversely impacted. There would be some impact on terrestrial ecology from cooling tower drift. Overall, the ecological impacts of a new nuclear plant with closed-cycle cooling at the Ginna site would be MODERATE and would be greater that renewal of the Ginna OL.

- **Water Use and Quality**

New nuclear generation at the Ginna site would likely use water from Lake Ontario for cooling. It is possible that some of the existing intake and discharge structures could be used, but the construction of additional cooling infrastructure would be needed to accommodate a closed-cycle system. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentrations of biocides (e.g., chlorine). Treated process waste streams and sanitary wastewater may also be discharged. All discharges would be regulated by NYSDEC through an SPDES permit. There would be a consumptive use of water due to evaporation from the cooling towers. Some erosion and sedimentation would likely occur during construction (NRC 1996). The staff considers the impacts to surface-water use and quality of a new nuclear plant with a closed-cycle cooling system located at the Ginna site to be SMALL.

Cooling water at an alternate site would likely be withdrawn from a surface-water body and would be regulated by permit. Depending on the source water body, the impacts of water use for cooling system makeup water and the effects on water quality due to cooling tower blowdown could have noticeable impacts. Therefore, the staff considers the impacts of a new nuclear plant utilizing a closed-cycle cooling system at an alternate site to be SMALL to MODERATE.

Use of groundwater at the Ginna site is unlikely, but is possible for a nuclear plant at an alternate site. Groundwater withdrawal could require a permit. Overall, impacts to groundwater use and quality of a new nuclear plant with a closed-cycle cooling system at the Ginna site are considered SMALL and the impacts to groundwater use and quality of such a plant at an alternate site are considered SMALL to MODERATE, depending on the volume of groundwater withdrawn.

- **Air Quality**

Construction of a new nuclear plant at either the Ginna site or at an alternate site would result in fugitive dust emissions during the construction process. Exhaust emissions would come from vehicles and motorized equipment during the construction process and after operation commences. An operating nuclear plant would have minor air emissions associated with diesel generators. These emissions would be regulated by NYSDEC. Overall, emissions and associated impacts to air quality of a nuclear plant at either the Ginna site or an alternate site are considered SMALL.

- **Waste**

The waste impacts associated with operation of a nuclear power plant either at the Ginna site or at an alternate site are set forth in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. In addition to the impacts shown in Table B-1, construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts of a new nuclear plant at either the Ginna or alternate sites are considered SMALL.

- **Human Health**

Human health impacts for an operating nuclear power plant at either the Ginna site or an alternate site are set forth in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. Overall, human health impacts of a new nuclear power plant at either the Ginna site or an alternate site are considered SMALL.

- **Socioeconomics**

The construction period and the peak workforce associated with construction of a new nuclear power plant are currently unquantified (NRC 1996). In the absence of quantified data, the staff assumed a construction period of 5 years and a peak workforce of 2500. The staff assumed that construction would take place while the existing Ginna plant continued operation and would be completed by the time Ginna permanently ceases operations. During construction, the communities surrounding the plant site would experience demands on housing, transportation, and public services that could have MODERATE to LARGE impacts. These impacts would be tempered by construction workers commuting to the site from more distant communities.
In the GEIS, the staff noted that socioeconomic impacts at a rural site would be larger than at an urban site because more of the peak construction workforce would need to move to the area to work (NRC 1996). Socioeconomic impacts at a rural site could be LARGE. After

construction, the communities would be impacted by the loss of the construction jobs. The replacement nuclear unit is assumed to have an operating workforce comparable to the approximately 500 workers currently working at Ginna. Transportation impacts related to commuting of plant operating personnel are considered SMALL to MODERATE. If a replacement nuclear unit was built at an alternate site, the communities around Ginna would experience the impact of Ginna operational job loss and Wayne County would experience the loss of a tax base. These losses would have SMALL to MODERATE socioeconomic impacts, given the fact that Ginna provides less than 10 percent of the total revenue in Wayne County and slightly over 10 percent of the total revenue in the town of Ontario and Wayne Central School District (Section 8.1.7). Overall, the staff considers the potential impacts of a new nuclear plant at either the Ginna or an alternate site to be MODERATE to LARGE.

- **Aesthetics**

The containment buildings for a replacement nuclear power plant, other associated buildings, the cooling towers, and the plume from the cooling towers would be visible during daylight hours. Natural draft towers could be up to 160 m (520 ft) high. Mechanical draft towers could be up to 30 m (100 ft) high and would also have an associated noise impact and condensate plumes. Visual impacts of buildings and structures could be mitigated by landscaping and selecting a color that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting and appropriate use of shielding. There would also be a significant aesthetic impact if a new electric power transmission line were needed. No exhaust stacks would be needed.

Noise from operation of a replacement nuclear power plant would potentially be audible offsite in calm wind conditions or when the wind is blowing in the direction of the listener. Mitigation measures, such as reduced or no use of outside loudspeakers, could be employed to reduce noise level and keep the impact SMALL to MODERATE. Overall, the staff considers the aesthetic impact of a new nuclear plant with closed-cycle cooling at the Ginna site to be MODERATE to LARGE.

The aesthetic impact of a new nuclear plant with closed-cycle cooling at an alternate site would depend on the site selected. If the alternate site is in an industrial area, visual and noise impacts would probably be SMALL; if the alternate site were a rural greenfield site, the impacts could be MODERATE to LARGE. Regardless of the alternate site location, the impact could be LARGE if a lengthy new electric power transmission line is needed to connect the plant to the power grid.

- **Historic and Archaeological Resources**

An historic and archeological resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions related to physical expansion of the plant site.

Before construction, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new plant construction on historic and archeological resources. The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other rights-of-way). Historic and archaeological resource impacts can generally be managed and mitigated to a certain extent. Therefore, the staff considers the impacts to historic and archeological resources of a new nuclear plant at either the Ginna or alternate sites to be SMALL to MODERATE.

- **Environmental Justice**

Environmental impacts on minority and low-income populations associated with a replacement nuclear plant built at an alternate site and would depend upon the site chosen and the nearby population distribution. The environmental justice impact of replacing Ginna with a new nuclear unit at the Ginna site would be SMALL. Some impacts on housing availability and prices during construction might occur, and this could disproportionately affect minority and low-income populations. Closure of Ginna would result in the loss of approximately 500 operating jobs. Resulting economic conditions could reduce employment prospects for minority or low-income populations. However, Ginna is located near a relatively urban area with many employment opportunities. Wayne County would experience a loss of property tax revenue that could affect its ability to provide services and programs. However, these losses would likely have SMALL environmental justice impacts, and would be similar to the no-action alternative (Section 8.1.10). Therefore, the staff considers the environmental justice impacts of a new nuclear plant at either the Ginna site or an alternate site to be SMALL.

- **Summary**

The staff's conclusions regarding the environmental impacts of a new nuclear plant with closed-cycle cooling are summarized in Table 8-6.

Table 8-6. Summary of Environmental Impacts of New Nuclear Generation Using Closed-Cycle Cooling at the R.E. Ginna Nuclear Power Plant Site and at an Alternate Site in New York State

Impact Category	Ginna Site		Alternate Site	
	Impact	**Comment**	**Impact**	**Comment**
Land Use	MODERATE to LARGE	Requires approximately 200 to 400 ha (500 to 1000 ac) for the plant and 400 ha (1000 ac) for uranium mining and processing. May require acquisition of adjacent lands.	MODERATE to LARGE	Same as Ginna site, plus land for new transmission line, rail spur, and cooling water intake/discharge pipelines. Up to 259 ha (640 ac) assuming a 25-km (15 mi) transmission line.
Ecology	SMALL to MODERATE	Uses undeveloped areas at the current Ginna site. Impacts to terrestrial ecology from cooling tower drift.	MODERATE to LARGE	Impact depends on location and ecology of the site, surface-water body used for intake and discharge, and electric power transmission line route; potential habitat loss and fragmentation; reduced productivity and biological diversity; impacts to terrestrial ecology from cooling tower drift.
Surface-Water Use and Quality	SMALL	Uses existing cooling water intake system. Closed-cycle system would use less water than current Ginna once-through system. Discharge of cooling tower blowdown will have impacts.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged, the constituents in the discharge water, and the characteristics of the surface-water body. Discharges would be regulated by NYSDEC. Discharge of cooling tower blowdown will have impacts.

Table 8-6. (contd)

Impact Category	Ginna Site		Alternate Site	
	Impact	Comment	Impact	Comment
Groundwater Use and Quality	SMALL	No groundwater used at the Ginna site.	SMALL to MODERATE	Groundwater may be used. Impacts SMALL if only used for potable water, impacts could be SMALL to MODERATE, depending on the site or aquifer if groundwater is used as makeup cooling water.
Air Quality	SMALL	Fugitive dust emissions and emissions from vehicles and equipment during construction. Small amounts of emissions from diesel generators, vehicles, and possibly other sources during operation.	SMALL	Same as at Ginna site.
Waste	SMALL	Waste impacts for an operating nuclear power plant are set forth in 10 CFR Part 51, Appendix B, Table B-1. Debris would be generated and removed during construction.	SMALL	Same as at Ginna site.
Human Health	SMALL	Human health impacts for an operating nuclear power plant are set forth in 10 CFR Part 51, Appendix B, Table B-1.	SMALL	Same as at Ginna site.

Table 8-6. (contd)

Impact Category	Ginna Site Impact	Ginna Site Comment	Alternate Site Impact	Alternate Site Comment
Socio-economics	MODERATE to LARGE	During construction, impacts would be SMALL to MODERATE. Up to 2500 workers during the peak of the 5-year construction period. Operating workforce assumed to be similar to Ginna. Tax base would be preserved. Impacts during operation would be SMALL. Transportation impacts associated with commuting construction workers could be MODERATE to LARGE. Transportation impacts during operation would be SMALL.	MODERATE to LARGE	Construction impacts depend on location. Impacts at a rural location could be LARGE. Wayne County would experience loss of tax base and employment with SMALL impacts. However, tax base and employment at alternate site would increase with SMALL to LARGE impacts, depending on the location. Transportation impacts would be similar to the Ginna site.
Aesthetics	MODERATE to LARGE	Containment buildings, cooling towers, and the plumes from cooling towers would be visible from offsite. No exhaust stacks would be needed. Daytime visual impact could be mitigated by landscaping and appropriate color selection for buildings. Visual impact at night could be mitigated by reduced use of lighting and appropriate shielding. Noise impacts would be relatively small and could be mitigated.	SMALL to LARGE	Impacts would depend on the characteristics of the alternate site. Visual and noise impacts could be mitigated as at the Ginna site. Impacts could be SMALL if the plant is located adjacent to an industrial area. Potential impacts will be greater if a new electric power transmission line is needed. Aesthetic impacts could be LARGE if a non-industrial, greenfield site is selected.

Table 8-6. (contd)

Impact Category	Ginna Site		Alternate Site	
	Impact	**Comment**	**Impact**	**Comment**
Historic and Archaeological Resources	SMALL	Impacts can generally be managed or mitigated.	SMALL to MODERATE	Same as Ginna site.
Environmental Justice	SMALL	Impacts on minority and low-income populations should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction.	SMALL	Impacts will vary depending on population distribution and makeup at the site. Wayne County would lose tax revenue and jobs, however the impacts on minority and low-income population would likely be SMALL.

8.2.3.2 Once-Through Cooling System

The environmental impacts of constructing a nuclear power plant, either at the Ginna site or at an alternate site in New York state using once-through cooling, are similar to the impacts for a nuclear power plant using closed-cycle cooling with cooling towers. However, there are some differences in the environmental impacts between the closed-cycle and once-through cooling systems. In those impact categories that are related to land area requirements such as land use, terrestrial ecology, and cultural resources, the impacts are likely to be smaller if the site uses a once-through cooling system rather than a closed-cycle cooling system. However, the impacts of a plant with a once-through cooling system are likely to be greater than a plant with a closed-cycle cooling system in the areas of water use and aquatic ecology due to the need for greater quantities of cooling water. Table 8-7 summarizes the incremental differences.

Table 8-7. Summary of Environmental Impacts of New Nuclear Generation Using Once-Through Cooling at the R.E. Ginna Nuclear Power Plant Site or at an Alternate Site in New York State

	Ginna Site		Alternate Site	
Impact Category	**Impact**	**Comparison with Closed-Cycle Cooling System**	**Impact**	**Comparison with Closed-Cycle Cooling System**
Land Use	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.	MODERATE to LARGE	10 to 12 ha (25 to 30 ac) less land required because cooling towers and associated infrastructure are not needed.
Ecology	MODERATE	Slightly less terrestrial habitat loss, no cooling tower drift, but increase water usage with increased aquatic ecology impacts.	MODERATE to LARGE	Impact would depend on ecology at the site. No impact to terrestrial ecology from cooling tower drift. Increased water withdrawal with possible greater impact to aquatic ecology.
Surface-Water Use and Quality	SMALL	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water, but similar to current Ginna plant.	SMALL to MODERATE	No discharge of cooling tower blowdown. Increased water withdrawal and more thermal load on receiving body of water.
Groundwater Use and Quality	SMALL	No change	SMALL	No change
Air Quality	SMALL	No change	SMALL	No change
Waste	SMALL	No change	SMALL	No change
Human Health	SMALL	No change	SMALL	No change
Socioeconomics	MODERATE to LARGE	No change	MODERATE to LARGE	No change
Aesthetics	SMALL	Reduced aesthetic impact because cooling towers would not be used.	SMALL to LARGE	Reduced aesthetic impact because cooling towers would not be used, but impacts could still be large if lengthy transmission line is required.

Table 8-7. (contd)

Impact Category	Ginna Site Impact	Ginna Site Comparison with Closed-Cycle Cooling System	Alternate Site Impact	Alternate Site Comparison with Closed-Cycle Cooling System
Historic and Archaeological Resources	SMALL to MODERATE	Less land impacted	SMALL to MODERATE	Less land impacted.
Environmental Justice	SMALL	No change	SMALL	No change

8.2.4 Purchased Electrical Power

If available, purchased power from other sources could potentially obviate the need to renew the Ginna OL. The New York State Energy Plan is designed to promote competition in energy supply markets by facilitating participation by non-utility suppliers. A regulatory structure is in place to appropriately anticipate and meet electricity demands, and RG&E has restructured to enable participation in the resulting wholesale electricity market. As an additional facet of this restructuring effort, retail customers in RG&E's service territory may choose among RG&E and other sources (i.e., qualified energy service companies) to supply their power, resulting in uncertainty with regard to future RG&E load obligations. In view of these conditions, RG&E assumed in the ER that adequate supplies of electricity would be available, and that purchased power would be a reasonable alternative to meet its load requirements in the event the OL for Ginna is not renewed.

During 2001, RG&E supplied 9803 GWh of electricity to its customers, 25 percent of which was purchased from other generators. The source of the purchased power that would potentially replace Ginna's power is speculative, but may reasonably include new generating facilities developed within RG&E's service territory, elsewhere in the state, or neighboring power pool jurisdictions. The technologies that would be used to generate this purchased power are similarly conjectural. However, considering the current and projected development of additional generating capabilities in New York state noted above, natural-gas-fired, combined-cycle units, such as those described in Section 8.2, would be the most likely candidate.

RG&E does not anticipate that any additional transmission infrastructure would be needed in the event RG&E purchased power to replace the Ginna generating capacity. From a local perspective, loss of Ginna would not result in a load pocket that would require construction of new transmission lines, although RG&E expects that planned reinforcement of its 110-kilovolt distribution system would be implemented sooner to ensure local system stability. From a regional perspective, New York state's interconnected transmission system is highly reliable, and the market-driven process for generation addition in the state is expected to have a positive impact on overall system reliability. The traditional strain on the New York state transmission system is west-to-east as a result of relatively low-cost generation in western upstate New York and higher demand in the east and downstate. As noted by a recent study sponsored by the New York Independent System Operator (Sanford et al. 2001), power imports from New England in the next few years are expected to relieve this strain in the near term, and the addition of new generation within the state is expected to reduce the frequency of encountering transmission constraints in the future.

Imported power from Canada or Mexico is unlikely to be available for replacement of the Ginna generating capacity. In Canada, 62 percent of the country's electricity capacity is derived from renewable energy sources, principally hydropower (DOE/EIA 2002). Canada has plans to continue developing hydroelectric power, but the plans generally do not include large-scale projects (DOE/EIA 2002). Canada's nuclear generation capacity is projected to increase by 2020, but its share of electric power generation in Canada is projected to decrease from 14 percent currently to 13 percent by 2020 (DOE/EIA 2002). EIA projects that total gross U.S. imports of electricity from Canada and Mexico will gradually increase from 38.5 billion kWh in year 2001 to 48.3 billion kWh in year 2005 and then gradually decrease to 24.4 billion kWh in year 2020 (DOE/EIA 2003). On balance, it appears unlikely that electricity imported from Canada or Mexico would be able to replace the Ginna generating capacity.

If power to replace Ginna generating capacity were to be purchased from sources within the United States or a foreign country, the generating technology likely would be one of those described in this SEIS and in the GEIS (probably coal, natural gas, or nuclear). The description of the environmental impacts of other technologies in Chapter 8 of the GEIS is representative of the impacts associated with the purchased electrical power alternative to renewal of the Ginna OL. Under the purchased power alternative, the environmental impacts of imported power would still occur, but would be located elsewhere within the region, nation, or another country.

The staff has assumed that any environmental impacts associated with the production of purchased power would be evaluated under separate NEPA or comparable environmental analyses, and therefore do not need to be reconsidered in relation to the Ginna OL renewal.

8.2.5 Other Alternatives

Other generation technologies are discussed in the following sections. As described in the following sections, none of these alternatives is considered feasible as a replacement for the 490 MW(e) base-load capacity of Ginna.

8.2.5.1 Oil-Fired Generation

The EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States through the year 2025 because of higher fuel costs and lower efficiencies compared to other available technologies (DOE/EIA 2003). Oil-fired operation is more expensive than coal, natural gas, or nuclear generation alternatives. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than other generation alternatives. The high cost of oil has prompted a steady decline in its use for electricity generation. In Section 8.3.11 of the GEIS, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 49 ha (120 ac) (NRC 1996). Operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant (Section 8.2.1).

8.2.5.2 Wind Power

Most of western New York is in wind power Class 2 or 3 regions (average wind speeds at 9-m [30-ft] elevation of 4.4 to 5.6 m/s [9.8 to 12.5 mph]) (DOE 2002a). In general, Class 3 or higher can be used for commercial power production, but wind turbines are considered economical in wind power Classes 4 through 7 (average wind speeds of 5.6 to 9.4 m/s [12.5 to 21.1 mph]) (DOE 2002a). Wind turbines typically operate at a 25 to 35 percent capacity factor compared to 80 to 95 percent for a base-load plant (NWPPC 2000). The largest commercially available wind turbines are in the range of 1 MW to 1.5 MW, therefore at least 327 to 490 units would be required to replace the Ginna generating capacity. Given the intermittent nature of the wind resource (perhaps 30 to 35 percent availability), approximately three times this number would be required to replace the KWh generated by Ginna.

As of January 2003, there were approximately 48 MW of grid-connected wind power facilities in New York state, with an additional 410 MW of additional capacity in various stages of planning (AWEA 2003). Statewide, the New York State Energy Research and Development Authority (NYSERDA) estimates that there is a potential for approximately 17,000 MW of installed capacity, of which approximately 3200 MW would be available for the peak summer load (NYSERDA 2002). Access to many of the best wind power sites would require extensive road building, as well as clearing (for towers and blades) and leveling (for the tower bases and associated facilities) in steep terrain. Also, many of the best quality wind sites are on ridges and hilltops that could have greater archaeological sensitivity than surrounding areas. For these reasons development of large-scale, land-based wind-power facilities are likely to not only be costly, but could have MODERATE to LARGE impacts on aesthetics, archaeological resources, land use, and terrestrial ecology.

The offshore wind speeds in Lake Ontario are higher than those onshore, and could thus support greater energy production than onshore facilities. Ten offshore wind power projects are currently operating in Europe, but none have been developed in the United States. The European plants together provide approximately 250 MW, which is significantly less than the electrical output of Ginna (BWEA 2003). For the preceding reasons, the staff concludes that locating a wind-energy facility on or near the Ginna site or offshore as a replacement for Ginna generating capacity would not be economically feasible at this time given the current state of wind energy generation technology. Development of an offshore wind-power facility could impact shipping lanes, may disrupt the aquatic ecology, and would be visible for many miles, resulting in considerable aesthetic impacts. These impacts could be MODERATE to LARGE.

8.2.5.3 Solar Power

Solar technologies use the sun’s energy and light to provide heat and cooling, light, hot water, and electricity for homes, businesses, and industry. Neither photovoltaic nor thermal solar power technologies currently can compete with conventional fossil-fueled electrical generation technologies in grid-connected applications due to higher capital costs per kilowatt of capacity. The average capacity factor of photovoltaic cells is about 25 percent (NRC 1996), and the capacity factor for solar thermal systems is about 25 to 40 percent (NRC 1996). Energy storage requirements limit the use of solar-energy systems as base-load electricity supply.

There are substantial impacts to natural resources (wildlife habitat, land-use, and aesthetic impacts) from construction of solar-generating facilities. As stated in the GEIS, land requirements are high. Approximately 7000 ha (27 mi^2) for photovoltaic technology (NRC 1996) and approximately 2850 ha (11 mi^2) for solar thermal systems (NRC 1996) would be required to replace the 490 MW(e) produced by Ginna. Neither type of solar electric system would fit at the Ginna site, and both would have large environmental impacts at an alternate site.

The Ginna site receives less than 2.8 kWh of direct normal solar radiation per square meter per day compared to greater than 7 kWh of solar radiation per square meter per day in areas of the western United States such as California or Arizona, which are most promising for solar technologies (DOE/EIA 2000). Because of the natural resource impacts (land and ecological), the area’s relatively low rate of solar radiation, the intermittent nature of the resource in the area, and the high cost, solar power is not deemed a feasible base-load alternative to renewal of the Ginna OL. Some onsite-generated solar power (e.g., from rooftop photovoltaic applications) may substitute for a portion of the electric power from the grid. Implementation of solar generation on a scale large enough to replace the Ginna generating capacity would likely result in LARGE environmental impacts.

8.2.5.4 Hydropower

New York state has an estimated 1308 MW of undeveloped hydroelectric resource (INEEL 1998). This amount is greater than needed to replace the 490 MW(e) generating capacity of Ginna. However, as stated in Section 8.3.4 of the GEIS, hydropower's percentage of U.S. generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern about land requirements, destruction of natural habitat, and alteration of natural river courses. DOE/EIA states that potential sites for hydroelectric dams have already been largely established in the United States, and environmental concerns are expected to prevent the development of any new sites in the future (DOE/EIA 2002). In the GEIS, the staff estimated that approximately 200,000 ha (500,000 ac) of land would be required to replace the 490 MW(e) produced by Ginna using hydroelectric power (NRC 1996). Due to the relatively low amount of undeveloped hydropower resource in New York state and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to replace Ginna, the staff concludes that local hydropower is not a feasible alternative to renewal of the Ginna OL. Any development of hydroelectric facilities large enough to replace Ginna would result in LARGE environmental impacts.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for base-load power where available. However, geothermal technology is not widely used as baseload generation due to the limited geographical availability of the resource and immature status of the technology (NRC 1996). As illustrated by Figure 8.4 in the GEIS, geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii where hydrothermal reservoirs are prevalent. There is no feasible eastern location for geothermal capacity to serve as an alternative to Ginna. The staff concludes that geothermal energy is not a feasible alternative to renewal of the Ginna OL.

8.2.5.6 Wood Waste

A wood-burning facility can provide base-load power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent energy conversion efficiency (NRC 1996). The energy conversion efficiency of a conventional fossil-fired plant is on the order of 35 percent. The fuels required are variable and site-specific. A significant barrier to the use of wood waste to generate electricity is the high delivered fuel cost and high construction cost per MW of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impact per MW of installed capacity should be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Due to uncertainties associated with obtaining sufficient wood and wood waste to fuel a base-load generating facility, ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and relatively low energy conversion efficiency, the staff has determined that wood waste is not a feasible alternative to renewing the Ginna OL.

8.2.5.7 Municipal Solid Waste

Municipal waste combustors incinerate waste and use the resultant heat to generate steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2001). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001b). Mass burning technologies are most commonly used in the United States. This group of technologies process raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion. The initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at wood-waste facilities. This is due to the need for specialized waste-separation and -handling equipment for municipal solid waste (NRC 1996).

Growth in the municipal waste combustion industry slowed dramatically during the 1990s after rapid growth during the 1980s. The slower growth was due to three primary factors: (1) the Tax Reform Act of 1986, which made capital-intensive projects such as municipal waste combustion facilities more expensive relative to less capital-intensive waste disposal alternative such as landfills; (2) the 1994 Supreme Court decision (*C&A Carbone, Inc. v. Town of Clarkstown*), which struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills with lower fees; and (3) increasingly stringent environmental regulations that increased the capital cost necessary to construct and maintain municipal waste combustion facilities (DOE/EIA 2001b).

Similar to the combustion of coal, municipal solid-waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue-gases using fabric filters and/or scrubbers (DOE/EIA 2001b).

Currently, there are approximately 102 waste-to-energy plants operating in the United States. These plants generate approximately 2800 MW(e), or an average of approximately 28 MW(e) per plant (IWSA 2001). Therefore, approximately 18 typical waste-to-energy plants would be required to replace the 490 MW(e) base-load capacity of Ginna. Therefore, the staff concludes that generating electricity from municipal solid waste would not be a feasible alternative to renewal of the Ginna OL.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are several other concepts for fueling electric generators, including crops, crops converted to a liquid fuel such as ethanol, and crops (including wood waste) that have been converted to a gas. In the GEIS, the staff stated that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as Ginna (NRC 1996). For these reasons, such fuels do not offer a feasible alternative to renewal of the Ginna OL.

8.2.5.9 Fuel Cells

Fuel cells work without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air over a cathode and separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. These are commercially available today at a cost of approximately $4500 per kW of installed capacity (DOE 2002b). Higher-temperature second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

DOE has a performance target that by 2003, two second-generation fuel cell technologies using molten carbonate and solid oxide technology, respectively, will be commercially available in sizes up to approximately 3 MW at a cost of $1000 to $1500 per kW of installed capacity (DOE 2002b). For comparison, the installed capacity cost for a natural-gas-fired, combined-cycle plant is approximately $456 per kW (DOE/EIA 2001a). As market acceptance and manufacturing capacity increase, natural-gas-fueled fuel cell plants in the 50- to 100-MW range are projected to become available. At the present time, however, fuel cells are not economically or technologically competitive with other alternatives for base-load electricity generation. Fuel cells are, consequently, not a feasible alternative to renewal of the Ginna OL.

8.2.5.10 Delayed Retirement

RG&E has only one other electrical generating plant designed for base-load service – the 257 MW coal-burning Russell Station. RG&E has no current plans to retire that plant, and stated in the Ginna ER (RG&E 2002) that it is not aware of opportunities for delayed retirement available to other energy suppliers in the state. For this reason, delayed retirement of existing units would not be a feasible alternative to renewal of the Ginna OL.

8.2.5.11 Utility-Sponsored Conservation

Since the 1980s, RG&E has participated in state-wide residential, commercial, and industrial programs to reduce both peak demands and daily energy consumption. These programs are commonly referred to as demand-side management (DSM). State-wide, these DSM programs through 2001 have resulted in a cumulative summer peak reduction of approximately 1600 MW between 1999 and 2000, and additional peak demand reductions on the order of 900 to 1300 MW are projected in the 2004 to 2006 time frame (RG&E 2002). These DSM-induced load reductions are acknowledged in load forecasts, therefore they cannot be used as credits to offset the power generated by Ginna. An additional 490 MW(e) of savings, or a 38- to 54-percent increase in the state-wide reduction in peak demand by 2006, would be required to offset the power generated by Ginna. Therefore, the conservation option by itself is not considered a reasonable replacement for the Ginna OL renewal alternative.

8.2.6 Combination of Alternatives

Even though individual alternatives might not be sufficient on their own to replace the Ginna generating capacity due to the small size of the resource or lack of cost-effective opportunities, it is conceivable that a combination of alternatives might be cost effective.

Ginna has an average net capacity of 490 MW(e). For the natural-gas-fired, combined-cycle alternative, RG&E assumed one 540-MW unit in its ER as a potential replacement for Ginna. The staff used this same assumption in Section 8.2.2.

There are many possible combinations of alternatives. Table 8-8 contains a summary of the environmental impacts of an assumed combination of alternatives consisting of 245 MW(e) of combined-cycle, natural-gas-fired generation (one 245-MW unit) at either the Ginna site or an alternate site in New York State using closed-cycle cooling, 175 MW(e) purchased from other generators, 40 MW(e) produced by new wind power facilities in western New York state, and 30 MW(e) gained from additional DSM measures. The impacts associated with the combined-cycle, natural-gas-fired units are based on the gas-fired generation impact assumptions discussed in Section 8.2.2, adjusted for the reduced generating capacity. For the combination of alternatives, the staff assumed that a replacement gas-fired plant would use the existing once-through cooling system, while a gas-fired plant located at an alternative site would utilize a closed-cycle cooling system. While the DSM measures would have few environmental impacts, operation of the new natural-gas-fired plant would result in increased emissions (compared to the OL renewal alternative) and other environmental impacts. Installation of new wind power facilities would have land-use, ecology, and aesthetic impacts. The environmental impacts of power generation associated with power purchased from other generators would still occur, but would be located elsewhere within the region, nation, or another country as discussed in Section 8.2.4. The environmental impacts associated with purchased power are not shown in

Table 8-8. The staff concludes that it is very unlikely that the environmental impacts of any reasonable combination of generating and conservation options could be reduced to the level of impacts associated with renewal of the Ginna OL.

Table 8-8. Summary of Environmental Impacts for an Assumed Combination of Generating (Combined-Cycle-Natural-Gas-Fired Generation, Wind Power, and DSM) and Acquisition Alternatives

	Ginna Site		**Alternate Site**	
Impact Category	**Impact**	**Comment**	**Impact**	**Comment**
Land Use	SMALL to MODERATE	8 ha (20 ac) for gas-fired plant power block, offices, roads, and parking areas. Additional impact at wind power sites (at least 20 ha [50 acres]). Additional impact for construction of an underground natural gas pipeline, electric power transmission line, and cooling-water intake/discharge piping.	SMALL to MODERATE	Same as Ginna site.
Ecology	SMALL to MODERATE	Uses previously disturbed areas of Ginna site, plus gas pipeline. Habitat loss due to development of wind power sites could have a MODERATE impact. Some increase in bird mortality at wind towers. Impacts to terrestrial ecology from cooling tower drift.	SMALL to MODERATE	Impact depends on location and ecology of the sites, surface-water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity; impacts to terrestrial ecology from cooling tower drift. Some increase in bird mortality associated with wind towers.

Table 8-8. (contd)

Impact Category	Ginna Site Impact	Ginna Site Comment	Alternate Site Impact	Alternate Site Comment
Surface-water Use and Quality	SMALL	Uses part of the existing cooling system. Discharge of cooling tower blowdown will have impacts.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge, the constituents in the discharge water, and the characteristics of the surface-water body. Discharge of cooling tower blowdown will have impacts.
Groundwater Use and Quality	SMALL	Use of groundwater very unlikely.	SMALL to MODERATE	Impact depends on the quantity of water withdrawn.
Air Quality	MODERATE	Sulfur oxides: 13 MT/yr (14 tons/yr) Nitrogen oxides: 43 MT/yr (47 tons/yr) Carbon monoxide: 26 MT/yr (29 tons/yr) PM_{10} particulates: 50 MT/yr (55 tons/yr) Some hazardous air pollutants. Additional emissions from producers of purchased power.	MODERATE	Same as Ginna site.
Waste	SMALL	Minimal waste generated.	SMALL	Same as Ginna site.
Human Health	SMALL	Impacts considered to be minor.	SMALL	Same as Ginna site.
Socio-economics	SMALL to MODERATE	During construction impacts would be SMALL to MODERATE. Possibly over 200 additional workers needed during the peak construction period followed by reduction from current Ginna workforce. Impacts during operation would be SMALL.	MODERATE	Construction impacts depend on location, but could be significant if location is in a rural area. Wayne County would experience loss of tax base and employment with potentially SMALL to MODERATE impacts. Impacts during operation would be SMALL. Transportation impacts associated with construction workers would be MODERATE.

Table 8-8. (contd)

Impact Category	Ginna Site		Alternate Site	
	Impact	**Comment**	**Impact**	**Comment**
Aesthetics	MODERATE	SMALL aesthetic impact due to the impact of plant unit and stack for gas plant (similar to Ginna plant). Additional impact from wind turbine towers.	MODERATE to LARGE	MODERATE to LARGE impact from wind turbine towers as well as the gas-fired plant, stacks, and cooling towers and associated plumes. Additional impact that could be LARGE if a lengthy new electric power transmission line is needed.
Historic and Archaeological Resources	SMALL to MODERATE	Impacts can generally be managed or mitigated. Wind turbines often placed along ridge lines that may have higher likelihood of historic or archaeological significance.	SMALL to MODERATE	Same as Ginna site.
Environmental Justice	SMALL	Impacts on minority and low-income communities should be similar to those experienced by the population as a whole. Some impacts on housing may occur during construction; loss of Ginna jobs on minority and low-income populations most likely SMALL due to the proximity of the plant to a diverse urban job market.	SMALL	Impacts vary dependent on population distribution and makeup at site. Wayne County would lose tax revenue and jobs; however, the impacts on minority and low-income populations would likely be SMALL.

8.3 Summary of Alternatives

The environmental impacts of the proposed action, renewal of the Ginna OL, are SMALL for all impact categories (except collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal, for which a single significance level was not assigned). Alternative actions (i.e., no-action alternative [Section 8.1], new generation alternatives [from coal, natural gas, and nuclear discussed in Sections 8.2.1 through 8.2.3, respectively], purchased electrical power [Section 8.2.4], alternative technologies [discussed in Section 8.2.5], and the combination of alternatives [Section 8.2.6]) were considered.

The no-action alternative would result in decommissioning Ginna and would have SMALL environmental impacts for all impact categories except socioeconomics, which may have SMALL to MODERATE impacts. The no-action alternative would result in a net reduction in power production. The power not generated by Ginna during the license renewal term would likely be replaced by (1) DSM and energy conservation, (2) power purchased from other electricity providers, (3) generating alternatives other than Ginna, or (4) some combination of these options. This replacement power would produce additional environmental impacts as discussed in Section 8.2.

For each of the new generation alternatives (coal, natural gas, and nuclear), the environmental impacts would be greater than the impacts of license renewal. For example, the land-disturbance impacts resulting from construction of any new facility would be greater than the impacts of continued operation of Ginna. The impacts of purchased electrical power would still occur, but would occur elsewhere. Alternative technologies are not considered feasible at this time for replacement of the Ginna base-load power and it is very unlikely that the environmental impacts of any reasonable combination of generation and conservation options could be reduced to the level of impacts associated with renewal of the Ginna OL.

8.4 References

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10 CFR Part 50. Code of Federal Regulations, Title 10*, Energy,* Part 50, “Domestic Licensing of Production and Utilization Facilities.”

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Functions.”

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy,* Part 52, “Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants.”

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, “Requirements for Preparation, Adoption, and Submittal of Implementation Plans.”

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, “Standards of Performance for New Stationary Sources.”

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