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Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 37

Regarding Three Mile Island Nuclear Station, Unit 1

Final Report

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metropolitan area. Environmental justice impacts from the construction and operation of a gas-fired alternative could range from SMALL to MODERATE and would depend on whether effects from the plant on minority and low-income populations are adverse and disproportionate.

8.2.7 Waste Management

Minor quantities of waste are generated during burning of natural gas compared to other alternatives, however use of SCR to control NOx will generate spent SCR catalysts and small amounts of solid waste products.

It is concluded in the GEIS by the NRC staff that gas-fired technology waste generation would be minimal (NRC 1996) and the waste impacts would be SMALL for a natural gas-fired combined-cycle plant sited at TMI-1 or at alternate site.

8.3 Energy Conservation/Energy Efficiency

In this section, the NRC staff evaluates the environmental impacts of a demand-side energy conservation or energy efficiency alternative. On the following page Table 8-3 summarizes the environmental impacts of energy conservation and energy efficiency compared to continued operation of TMI-1.

Though often used interchangeably, energy conservation and energy efficiency are different concepts. Energy efficiency typically means deriving a similar level of services by using less energy, while energy conservation simply indicates a reduction in energy consumption. Both fall into a larger category known as demand-side management (DSM). DSM measures—unlike the energy supply alternatives discussed in previous sections—address energy end uses. DSM can include measures that shift energy consumption to different times of day to reduce peak loads, measures that interrupt certain large customers during periods of high demand or measures that interrupt certain appliances during high demand periods, and measures like replacing older, less efficient appliances, lighting, or control systems. DSM also includes measures that utilities use to boost sales, such as encouraging customers to switch from gas to electricity for water heating.

Unlike other alternatives to license renewal, the GEIS notes that conservation is not a discrete power generating source; it represents an option that states and utilities may use to reduce their need for power generation capability (NRC 1996). In addition, conservation represents a possible option in case of the no-action alternative. The GEIS "assumes that conservation technologies produce enough energy savings to permit the closing of a nuclear plant."

Prior to the implementation of Pennsylvania's Alternative Energy Portfolio Standard (AEPS), several Pennsylvania foundations sponsored a study by engineering firm Black and Veatch to document the potential effects renewable energy, conservation/efficiency, and unconventional power sources like waste coal (Pletka 2004). The study distinguished between energy efficiency and conservation, and defined conservation as demand-side measures, and efficiency as supply-side measure like repowering or other power plant, transmission, or distribution improvements. Because Black and Veatch's defined energy efficiency as only supply-side options, and because Black and Veatch defined conservation as including all demand-side measures to reduce electricity consumption, we will only use Black and Veatch's conservation

estimates in the following section. Black and Veatch's analysis indicated 18,206 gigawatt-hours (GWh) of conservation could be achieved within 10-15 years of the study's 2004 publication date (Pletka 2004), or roughly three times the amount of electricity produced by TMI-1 in a given year. The total magnitude of these savings could be as large as 6872 MW, or more than eight times TMI-1's power output. Overall, Black and Veatch indicated that Pennsylvania had "good" conservation resources.

Since the study, PJM[9] has instituted new measures to capture energy efficiency potential, and energy efficiency measures which now count for inclusion in the AEPS. The NRC had difficulty determining how much of the potential identified in the 2004 report remains available in Pennsylvania, though it appears unlikely that all or even most of this potential would already have been exploited. Beyond near-term potential, Black and Veatch's analysis identified an additional 70,000 GWh or 28,824 MW of conservation potential, some of which may be available at higher costs or on longer time horizons. Also, because TMI-1 sells power into the PJM interconnection, conservation in other nearby states may also help to offset power produced by TMI-1, even though sufficient capacity appears to exist in Pennsylvania alone. Therefore, the NRC staff chose to evaluate conservation as an alternative to license renewal.

A conservation alternative will produce different impacts than the other alternatives addressed. Unlike the discrete generation options, there is no major construction and few ongoing operational impacts. The most significant effects occur during installation or implementation or conservation measures, when old appliances may be disposed of, buildings may be retrofitted, or control devices may be installed. In some cases, increases in efficiency may come from better management of existing control systems. Many of these items may be recycled, though volumes of landfilled trash may still increase.

The GEIS generally indicates that impacts from a conservation alternative are small and that some postulated effects (like increases in mercury, polychlorinated biphenyls (PCBs), or chlorofluorocarbon (CFC) releases as fluorescent bulbs, old transformers or old refrigerators are replaced) may prove not to be significant as effective disposal methods can prevent health effects, and as more environmentally-benign alternatives have emerged (NRC 1996).

Table 8-3. Summary of Environmental Impacts of Energy Conservation/Energy Efficiency Compared to Continued Operation of TMI-1.

	Energy Conservation/Energy Efficiency	Continued TMI-1 Operation
Air Quality	SMALL	SMALL
Ground Water	SMALL	SMALL
Surface Water	SMALL	SMALL
Aquatic and Terrestrial Resources	SMALL	SMALL
Human Health	SMALL	SMALL
Socioeconomics	SMALL	SMALL
Waste Management	SMALL	N/A

[9] PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia, including Pennsylvania.

8.3.1 Air Quality

Implementation of the energy conservation alternative reduces direct fuel use and reduces environmental emissions resulting from plant fuel cycles, workers' commuting, and plant operation and maintenance. Improvements in efficiency may also reduce consumption of fuels used for space or water heating at the same time they reduce electrical consumption.

As noted above, no major construction would be required and few ongoing operational impacts would be experienced during implementation of the conservation alternative. The conservation alternative would likely cause only minor and short-duration air quality impacts—use of best management practices would minimize air quality impacts during installation of new appliances or systems. Implementation of energy conservation measures would improve efficiency of boilers and heating units and would help to reduce already low air emissions.

The overall impacts on air quality of the energy conservation and/or energy efficiency alternative would be SMALL.

8.3.2 Ground Water Use and Quality

The conservation alternative would not require any groundwater. It is possible that wastes produced during installation of improved equipment could have an effect on groundwater if leachate from landfills infiltrate groundwater, but this effect is not likely to be noticeably altered by a small increase in overall waste production, if any, associated with the conservation alternative. Overall impacts to groundwater are SMALL.

8.3.3 Surface Water Use and Quality

The impacts on surface water use and quality because of energy conservation efforts would be SMALL, but positive. The consumptive use of water from the Susquehanna River would certainly decrease as would the discharge of waste water streams.

8.3.4 Terrestrial and Aquatic Ecology

Terrestrial Ecology

Terrestrial ecology impacts would be SMALL. No additional land disturbances on or offsite would be required.

Aquatic Ecology

Impacts to aquatic resources would be SMALL, but positive, as withdrawals from and discharges to the Susquehanna River would cease, since the no-power generation alternative would take the place of TMI-1. If more energy is conserved than is produced by TMI-1, then positive impacts to aquatic resources could extend beyond the Susquehanna River to other water bodies. This net conservation of energy could result in less demand for power production at other plants and could lead to lower rates of water withdrawal and discharge at these power plants. The implementation of conservation measures, such as the increased use of mercury-containing compact fluorescent light bulbs and their impact to the environment after landfill

disposal, would result in SMALL impacts to the aquatic environment. While increased mercury levels in landfills could leach into adjacent waterways, State and local landfill regulations could reduce or eliminate such pollution.

8.3.5 Human Health

Energy demand reduction measures are specific procedures or technologies that are undertaken to reduce energy demands. Human health risks of the energy conservation alternative are minimal, although in Table 8-2 of the GEIS (NRC 1996) the NRC staff identified radon as the major potential health risk from the energy conservation alternative. Currently, there are no Federal or State regulatory frameworks pertaining to radon exposure standard, therefore, the NRC staff has chosen the EPA recommendation level of 4 picocuries per Liter (pCi/L) as a significant threshold for determining the human health risks associated with the energy conservation alternative.

Radon-222 is a naturally occurring radioactive noble gas that is formed from the decay of radium-226. Radiation exposure from radon-222 is indirect. Radon has a short half-life (4 days) and decays into other solid particulate radioactive nuclides that give off high energy alpha particles. These radioactive particles are inhaled and remain lodged in the lungs, causing continued exposure. People in affected localities can receive up to 10 mSv per year background radiation of radon-222. Radon-222 is thus the second leading cause of lung cancer after smoking, and accounts for 15,000 to 22,000 cancer deaths per year in the U.S. alone (Darby 1989). The general population is exposed to small amounts of polonium as a radon-daughter in indoor air; the isotopes polonium-214 and polonium-218 are thought to cause the majority of the estimated lung cancer deaths from radon (Darby 1989). A Bonneville Power Administration radon-222 exposure study found that radon-222 was a serious concern in new home construction if mitigation measures were not implemented. Cancer cases from radon-222 exposures were estimated to be 335 per 100,000 for baseline homes but as high as 767 cases per 100,000 for new homes with advanced infiltration control but no exhaust or mechanical ventilation (Pace 1991).

EPA recommends homes be fixed if the radon level is 4 pCi/L or more. Because there is no known safe level of exposure to radon, EPA also recommends that Americans consider fixing their homes for radon levels between 2 pCi/L and 4 pCi/L. The average radon concentration in the indoor air of America's homes is about 1.3 pCi/L. The average concentration of radon in outdoor air is 0.4 pCi/L, about 1/10th of EPA's 4 pCi/L action level (EPA 2008b). Given that a member of the public has taken appropriate mitigative actions—such as installing a more efficient ventilation system for radon removal, sealing cracks in basements, etc.—to achieve an indoor radon concentration below 2 pCi/L, the human health risks to members of the public from the energy conservation alternative would be within the range of the national average and would likely be SMALL.

8.3.6 Socioeconomics

Land Use

Since Exelon Generation would continue to use the existing transmission lines land use impacts of an energy efficiency alternative would be SMALL. Quickly replacing and disposing of old inefficient appliances could generate waste material and potentially increase the size of landfills. However, given the 10 to 15-year timeline for program development and implementation, the cost of replacements, and the average life of an appliance; the replacement process would probably be more gradual. Older appliances would simply be replaced by more efficient appliances as they fail (especially in the case of frequently replaced items, like lightbulbs). In addition, many items (like home appliances or industrial equipment) have substantial recycling value and would likely not be disposed of in landfills.

Socioeconomics

Socioeconomic effects of an energy efficiency program would be SMALL. As noted in the GEIS, the program would likely employ additional workers. Lower-income families could benefit from weatherization and insulation programs. This effect would be greater than the effect for the general population because low-income households experience home energy burdens more than four times larger than the average household (OMB 2007).

Transportation

Transportation impacts would be SMALL, because fewer employees would commute to TMI-1. Any transportation effects from the energy efficiency alternative would be widely distributed across the State, and would not be noticeable.

Aesthetics

Impacts from energy efficiency programs would be SMALL because TMI-1 would be decommissioned with no alternative power plant to replace it. The transmission lines would remain after plant decommissioning. Traffic to the plant would decrease, however, as would noise and emissions. Some noise impacts could occur in instances of energy efficiency upgrades to major building systems, though this impact would be intermittent and short-lived.

Historic and Archaeological Resources

Impacts from the energy conservation/energy efficiency alternative would be SMALL, since TMI-1 would be decommissioned with no alternative power plant to replace it. A separate environmental review would be conducted for decommissioning. That assessment will address the protection of historic and archaeological resources.

Environmental Justice

Weatherization programs could target low-income residents as a cost-effective energy efficiency option since low-income populations tend to spend a larger proportion of their incomes paying utility bills (according to the Office of Management and Budget, low income populations experience energy burdens more than four times as large as those of average households [OMB 2007]). Impacts to minority and low-income populations from energy efficiency programs would be SMALL, depending on program design and enrollment. The impacts from these programs may be disproportionate, but are not likely to be adverse.

8.3.7 Waste Management

The most significant effects occur during installation or implementation or conservation measures, when old appliances may be disposed of, buildings may be retrofitted, or control devices may be installed. Implementation of the recycling programs would help to decrease volumes of the generated waste, though volumes of the trash sent to the landfills may still increase.

According to the GEIS, impacts from a conservation alternative are minimal, and some postulated effects (like increases in mercury, PCBs, or CFC releases as fluorescent bulbs, old transformers or old refrigerators are replaced) may prove to be insignificant as more environmentally-benign alternatives have emerged, and if proper disposal methods are employed (NRC 1996).

Overall, the waste impacts would be SMALL for the energy conservation and/or energy efficiency alternative.

8.4 Combination Alternative

In this section, we evaluate the environmental impacts of a combination of alternatives. This combination will include a portion of the energy efficiency/conservation potential identified in Section 8.3, a portion of the combined-cycle gas-fired capacity identified in Section 8.2, and a series of uprates to existing hydroelectric dams. This alternative requires little new construction (only for the single gas-fired unit installed at the TMI-1 site and minor renovation at uprated dams). We acknowledge that we could also include some amount of wind power in this alternative as a companion to the hydropower uprates, though the NRC elected not to do so since constructing wind power facilities would likely increase the environmental impact of the combination alternative without a commensurate decrease in operating impacts from other portions of the combination alternative. Table 8-4 on the following page contains a summary of the environmental impacts of the combination alternative compared to continued operation of TMI-1.

In this alternative, slightly more than half of TMI-1's output (approximately 420 MW) would be replaced by conservation. Power uprates at existing hydroelectric dams will account for roughly 100 MWe of capacity (as identified in INEEL 1997) and 280 MWe will come from one GE S107FB combined cycle power plant. The only major construction we anticipate will happen at the current TMI-1 site where the combined-cycle gas-fired power plant would be constructed. No major construction should be necessary for the conservation portion, and relatively minor construction would occur at existing dams for purposes of power uprates.

The appearance of the single-unit gas-fired facility would be similar to that of the two-unit gas-fired alternative considered in Section 8.2, except smaller. We estimate that the single-unit gas-fired facility would require approximately 35 percent of the space necessary for the two-unit gas-fired facility considered in Section 8.2, and that all construction effects—as well as operational aesthetic, fuel-cycle, air quality, socioeconomic, land use, environmental justice, and water