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United States Nuclear Regulatory Commission

Protecting People and the Environment

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Main Report

Draft Report for Comment

Office of Nuclear Reactor Regulation

Cover Sheet

Responsible Agency: U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation

Title: *Draft Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437) Volumes 1 and 2, Revision 1

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Abstract

U.S. Nuclear Regulatory Commission (NRC) regulations allow for the renewal of commercial nuclear power plant operating licenses, depending on the outcome of an assessment to determine whether the nuclear plant can continue to operate safely and protect the environment during the 20-year period of extended operation. Renewal of a nuclear power plant operating license requires the preparation of an environmental impact statement (EIS). To support the preparation of these EISs, the NRC published the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) in 1996. The proposed action considered in the GEIS is the renewal of nuclear power plant operating licenses.

The NRC committed to review and revise the GEIS on a 10-year cycle, if necessary. Since publication of the GEIS, approximately 30 plant sites (50 reactor units) have applied for license renewal and undergone environmental reviews, the results of which were published as supplements to the 1996 GEIS. This GEIS revision reviews and reevaluates the issues and findings of the 1996 GEIS. Lessons learned and knowledge gained during previous license renewal reviews provides a significant source of new information for this assessment. In addition, new research, findings, and other information were considered in evaluating the significance of impacts associated with license renewal.

The intent of the GEIS is to determine which issues would result in the same impact at all nuclear power plants, and which issues could result in different levels of impact at different plants and thus require a plant-specific analysis for impact determinations. The GEIS is intended to improve the efficiency of the license renewal process by (1) providing an evaluation of the types of environmental impacts that may occur as a result of renewing the license of a nuclear power plant, (2) identifying and assessing the impacts that are expected to be generic (the same or similar), and (3) defining the number and scope of impacts that need to be addressed in plant-specific EISs. The GEIS revision identifies 78 environmental impact issues for consideration in plant-specific supplements to the GEIS.

In addition to the impacts of continued operations and refurbishment, the GEIS evaluates other consequences of license renewal, including the environmental effects of postulated accidents and the effects of an additional 20 years of operation on the impacts of shutdown and decommissioning and on the uranium fuel cycle. The GEIS evaluates a full range of alternatives to the proposed action, including a no-action alternative (denial of license renewal), fossil energy alternatives, nuclear energy alternatives, renewable energy alternatives, conservation (demand-side management), and the purchase of power. For most impact areas, the proposed action would have impacts that would be similar to or less than impacts of the alternatives, in large part because most alternatives would require new power plant construction, whereas the proposed action would not.

- Groundwater use conflicts for plants that withdraw less than 100 gallons per minute (gpm) (378 L/min) (evaluated in the 1996 GEIS);

- Groundwater use conflicts for plants that withdraw more than 100 gpm (378 L/min) including those using Ranney wells (combination of two issues from the 1996 GEIS: (1) groundwater use conflicts for potable and service water and dewatering for plants that use more than 100 gpm (378 L/min) and (2) groundwater use conflicts for plants that use Ranney wells);

- Groundwater use conflicts for plants with closed-cycle cooling systems that withdraw makeup water from a river (issue modified from the 1996 GEIS to include all rivers);

- Groundwater quality degradation resulting from water withdrawals (combination of two issues from the 1996 GEIS: (1) groundwater quality degradation for plants that use Ranney wells and (2) groundwater quality degradation from saltwater intrusion);

- Groundwater quality degradation for plants using cooling ponds in salt marshes (evaluated in the 1996 GEIS);

- Groundwater quality degradation for plants using cooling ponds at inland sites (evaluated in the 1996 GEIS);

- Groundwater and soil contamination (new issue not considered in the 1996 GEIS); and

- Radionuclides released to groundwater (new issue not considered in the 1996 GEIS);

Impacts of Continued Operations and Refurbishment Activities on Groundwater Use and Quality

As mentioned in Section 3.5.2, the original construction of some plants required dewatering of a shallow aquifer, and operational dewatering takes place at some plants. This is accomplished by systems of pumping wells or drain tiles. Continued operations and refurbishment activities during the license renewal term are not expected to require any significant dewatering that would have an incremental effect over that which has already taken place. During continued operations and refurbishment, any wastes or spills (e.g., fuels and paints) affecting groundwater quality would be addressed in a manner consistent with best management practices, such as using secondary containment for fuels and implementing spill prevention and control plans. Soils contaminated by spills may need to be excavated for remediation before the chemicals leach to the shallow groundwater.

use (NRC 2007b), and hydrocarbon spills and sulphuric acid leaks (NRC 2008b). These situations have required regulatory involvement by State agencies during both monitoring and remediation phases. Remediation has taken place in the form of excavation and recovery wells. The number of occurrences of such problems can be minimized by means of proper chemical storage, secondary containment, and leak detection equipment.

An additional source of groundwater contamination can be the use of wastewater lagoons. At the Cook plant in Michigan, permitted wastewater ponds are used for receiving treated sanitary wastewater and for process wastes from the turbine room sump. Groundwater monitoring has shown that concentrations of water quality parameters have increased to levels above background but below drinking water standards (NRC 2005a). As a result, in an arrangement with the county, the use of groundwater by other users in a designated area has been restricted.

Remediation of groundwater contamination can involve long-duration cleanup processes that depend on the types, properties, and concentrations of the contaminants; aquifer properties; groundwater flow field characteristics; and remedial objectives. Contaminants may be able to migrate to onsite potable wells or to the wells of offsite groundwater users. Groundwater monitoring programs would be expected to identify problems before contaminated groundwater reached receptors; however, monitoring wells need to be present and in proper locations in order to detect contaminants. On the basis of these considerations, the impact of groundwater and soil contamination during operations and refurbishment activities could be small or moderate, depending on the factors described above and is considered a Category 2 issue.

Radionuclides Released to Groundwater

There is growing concern about radionuclides detected in groundwater at nuclear power plants. These releases have occurred as leaks in at least 14 plants (NRC 2006a). Tritium, being the most mobile radionuclide in soil and groundwater, is of particular concern. Concentrations of tritium in sampled onsite groundwater at many of these plants ranged well above the EPA drinking water standard of 20,000 pCi/L. Examples include onsite monitoring well samples of up to 250,000 pCi/L at the Braidwood plant in Illinois, up to 211,000 pCi/L at the Indian Point plant in New York (NRC 2008c), up to 486,000 pCi/L at the Dresden plant in Illinois, more than 30,000 pCi/L at the Watts Bar plant in Tennessee, and 71,400 pCi/L at the Palo Verde plant in Arizona. Examples of samples taken either directly from the source of the leak or from nearby onsite monitoring wells include samples with up to 200,000 pCi/L of tritium at the Callaway plant in Missouri, up to 15,000,000 pCi/L at the Salem plant in New Jersey, and up to 750,000 pCi/L at the Seabrook plant in New Hampshire. At the Byron plant in Illinois, tritium in monitoring wells was above the background level but below drinking water standards (up to 3800 pCi/L). The location and construction of the monitoring wells relative to potential leak locations have not been evaluated. For each example, it is possible that a different well placement could detect higher or lower activity concentrations.

Other reported instances (NRC 2006a) of tritium above background levels have been a result of operator error, licensed discharge, or leaks or discharges to drain systems. At the Oyster Creek plant in New Jersey, a mistake involving a valve allowed tritium-contaminated water to flow to the discharge canal. Sampling of this water showed levels of 16,000 pCi/L. At the Wolf Creek plant in Kansas, an onsite lake receiving liquid effluent was found to have a tritium activity concentration of 13,000 pCi/L (NRC 2008a). The Perry plant in Ohio had water samples in its drainage system with an activity concentration of 60,000 pCi/L. In each of these cases, the tritium present at the surface could infiltrate or seep into the groundwater system.

The NRC does not consider these tritium releases to be a health risk to the public or onsite workers in any of these cases (NRC 2006a) because the tritiated groundwater is expected to remain onsite. However, an exception is the event at Braidwood, which resulted in detectable concentrations of tritium at an offsite location. Sampling of an offsite residential well at Braidwood showed 1600 pCi/L of tritium which is above the background level but well below EPA's drinking water standard. Risk to workers would arise if onsite wells were used for the potable water system and if the leak was in the capture zone of the well. However, the NRC requires that the onsite potable well water be monitored for radioactivity to protect the workers.

As discussed in Section 3.5.2, groundwater monitoring efforts are increasing in accordance with industry guidelines (Nuclear Energy Institute 2007). With these monitoring networks, the presence and extent of any tritium plumes (both onsite and offsite) will become clearer. These new monitoring well networks are expected to provide information about any existing tritium groundwater plumes and future system leaks by siting additional wells at key locations. Well design and depth would be determined through a site-specific assessment of the hydrogeology and the subsurface infrastructure. Because the leaks are typically underground, detection does not occur promptly. In addition to monitoring wells, leak detection equipment or surveillance of accessible piping and components containing radioactive materials would improve the chance of discovery of a tritium leak before significant activity reached an aquifer.

On the basis of occurrences at several nuclear plants, the impact of radionuclide releases to groundwater quality could be small or moderate, depending on the occurrence and frequency of leaks and the ability to respond to leaks in a timely fashion. The issue is considered a Category 2 issue.

4.5.2 Environmental Consequences of Alternatives to the Proposed Action

Construction – Construction-related impacts on hydrology (land clearing during and impervious pavements) would alter surface drainage patterns and groundwater recharge zones. Surface

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Appendices

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Table B-1. (cont.)

GEIS Revision Issue	Findings in the GEIS Revision	Related Issue(s) in Table B-1 of 10 CFR Part 51	Findings in Table B-1 of 10 CFR Part 51
Groundwater (cont.)			
Groundwater and soil contamination (cont.)	and subsoil. Contamination is subject to State- and U.S. Environmental Protection Agency-regulated cleanup and monitoring programs.		
Radionuclides released to groundwater	Small or moderate impact (Category 2). Underground system leaks of process water have been discovered in recent years at several plants. Groundwater protection programs have been established at all operating nuclear power plants.	Not addressed	Not applicable
Terrestrial Resources			
Impacts of continued plant operations on terrestrial ecosystems	Small, moderate, or large impact (Category 2). Continued operations, refurbishment, and maintenance activities are expected to keep terrestrial communities in their current condition. Application of best management practices would reduce the potential for impacts. The magnitude of impacts would depend on the nature of the activity, the status of the resources that could be affected, and the effectiveness of mitigation.	Refurbishment impacts	Small, moderate, or large (Category 2). Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application.
Exposure of terrestrial organisms to radionuclides	Small impact (Category 1). Doses to terrestrial organisms are expected to be well below exposure guidelines developed to protect these organisms.	Not addressed	Not applicable