## Rikhoff, Jeffrey

**From:** Eccleston, Charles
**Sent:** Wednesday, March 03, 2010 1:59 PM
**To:** Bacuta, George; Beissel, Dennis; Bulavinetz, Richard; Imboden, Andy; Klementowicz, Stephen; Logan, Dennis; Rikhoff, Jeffrey; Travers, Allison; Pham, Bo; Eccleston, Charles
**Attachments:** Draft Outline for Salem Alternatives Section (2).doc; 4 8 Human Health - KT (2).docx; 4 11 3 Cumulative Human Health Impacts.docx; Chapter 1 _ nspangler.docx; Chapter 2 - Section 2 1 1 6 - Power Transmission System Rev2.docx; Chapter 2 - Sections 2 1 1 1-2 1 1 6 - KTaylor.doc; Chapter 3 -NSpangler.doc; Chapters 6 and 7.docx

IDT,

Note: I hit some escape code which fired off the last email message before it was finished.

I have received these early drafts from AECOM. They have other Chapter 2 resource sections that are nearing completion, but haven't been approved by their document supervisors. I will send these sections on as soon as I receive them. Some of them are currently being reviewed at this time.

Let me know if you have any questions.

*Charles H. Eccleston*

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D80

Draft Outline
Salem/Hope Creek SEIS
Alternatives – Section 8

8.0 Intro materials (based on Duane Arnold)

8.1 Alternative Cooling System Technology (based on Indian Point Section 8.1.1)

- Description
- Air Quality
- Groundwater Use and Quality
- Surface Water Use and Quality
- Aquatic and Terrestrial Ecology
- Human Health
- Socioeconomics
- Aesthetics
- Historic and Archaeological Resources

8.2 Alternative Energy Sources

8.2.1 Super-Critical Coal-Fired Generation (based on DA Section 8.1) (need to decide onsite, offsite, or both)

- resource breakdowns

8.2.2 Natural Gas Combined Cycle (based on DA Section 8.2) (need to decide onsite, offsite, or both)

- resource breakdowns

8.2.3 Combination Alternative 1 (retire Salem, re-license Hope Creek, conservation component, renewable component, natural gas component) (based on Indian Point Section 8.3.5.1)

- resource breakdowns

8.2.4 Combination Alternative 2 (retire Salem and Hope Creek, conservation component, renewable component, natural gas component) (based on Indian Point Section 8.3.5.2)

- resource breakdowns

8.3 Alternatives Considered but Dismissed (based on DA Section 8.4)

8.3.1 Offsite Coal and Gas (if only onsite is considered above)
8.3.2 New Nuclear
8.3.3 Conservation/Efficiency
8.3.4 Purchase
8.3.5 Solar
8.3.6 Wood
8.3.7 Hydroelectric
8.3.8 Wave/Ocean

8.3.9 Geothermal
8.3.10 MSW
8.3.11 Biofuels
8.3.12 Oil
8.3.13 Fuel Cell
8.3.14 Delayed Retirement

8.4 No Action (based on DA Section 8.5)
- resource breakdown

## 1.8 Human Health

The human health issues applicable to Salem and HCGS are discussed below and listed in Table 4-8 for Category 1, Category 2, and uncategorized issues.

**Table 4-8. Human Health Issues.** *Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 contains more information on these issues.*

| Issues | GEIS Section | Category |
|---|---|---|
| Radiation exposures to the public during refurbishment | NA[a] | 1 |
| Occupational radiation exposures during refurbishment | NA[a] | 1 |
| Microbiological organisms (occupational health) | 4.3.6 | 1 |
| Microbiological organisms (public health, for plants using lakes or canals or discharging small rivers) | 4.3.6[b] | 2 |
| Noise | 4.3.7 | 1 |
| Radiation exposures to public (license renewal term) | 4.6.2 | 1 |
| Occupation radiation exposures (license renewal term) | 4.6.3 | 1 |
| Electromagnetic fields – acute effects (electric shock) | 4.5.4.1 | 2 |
| Electromagnetic fields – chronic effects | 4.5.4.2 | Uncategorized |

[a] - Issues apply to refurbishment, an activity that neither Salem nor HCGS plan to undertake.

[b] - Issue applies to plant features such as cooling lakes or cooling towers that discharge to small rivers. Neither Salem nor HCGS have applicable features.

In response to comments on the draft GEIS and the proposed rule, the standard defining a small radiological impact has changed from a comparison with background radiation to sustained compliance with the dose and release limits applicable to the activities being reviewed. . . For the purposes of assessing radiological impacts, the Commission has concluded that impacts are of small significance if doses and releases do not exceed permissible levels in the Commission's regulations. This definition of "small" applies to occupational doses as well as to doses to individual members of the public. Accidental releases or noncompliance with the standards could conceivably result in releases that would cause moderate or large radiological impacts. Such conditions are beyond the scope of regulations controlling normal operations and providing an adequate level of protection. Given current regulatory activities and past regulatory experience, the Commission has no reason to expect that such noncompliance will occur at a significant frequency. To the contrary, the Commission expects that future radiological impacts from the fuel cycle will represent releases and impacts within applicable regulatory limits. . . Radiation doses to members of the public from current operation of nuclear power plants have been examined from a variety of perspectives and the impacts were found to be well within design objectives and regulations in each instance. No effect of aging that would significantly affect the radioactive effluents has been identified. Both maximum individual and average doses are expected to remain well within design objectives and regulations. In about 5 percent of the plants, maximum individual doses are approximately 20 percent of the Appendix I design objective. All other plants are operating far below this level. . . Because no reason was identified to expect effluents to increase in the period after license renewal, continued operation well within regulatory limits is anticipated. The staff concludes that the significance of radiation exposures to the public attributable to operation after license renewal will be small at all sites. It should also be noted that the estimated cancer risk to the average individual due to plant operations is much less than $1 \times 10^{-6}$. No mitigation measures beyond those implemented during the current term license would be warranted because current mitigation practices have resulted in declining public radiation doses and are expected to continue to do so. This is a Category 1 issue.

Occupational doses attributable to normal operation during the license renewal term have been examined from several different perspectives. First, projected occupational doses during the period of maximum added dose, the 10-

year in-service inspection refueling, are within the range of doses experienced during the past 2 reporting years. Second, the average dose increase of 5 to 8 percent to the typical plant worker would still maintain doses well below regulatory limits. Therefore, occupational radiation exposure during the term of the renewed license meets the standard of small significance. No mitigation measures beyond those implemented during the current term license would be warranted because the ALARA process continues to be effective in reducing radiation doses. This is a Category 1 issue.

### 1.8.1 Geeric Human Health Issues

The staff did not identify any new and significant information related to human health issues or radiation exposures during its review of the PSEG environmental reports, the site audit, or the scoping process. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the GEIS concluded that the impacts are SMALL, and additional site-specific mitigation measures are not likely to be sufficiently beneficial to be warranted (Category 1 issues). These impacts will remain SMALL through the license renewal term.

### 1.8.2 Radiation Exposure

PSEG conducts an operational Radiological Environmental Monitoring Program (REMP) in which radiological impacts from all three Salem and HCGS units to the employees, the public, and the environment around Artificial Island are monitored, documented, and compared to the appropriate standards set by the EPA and the NRC in 40 CFR 190 and 10 CFR 20 respectively. The REMP measures radiation impacts by measuring external gamma radiation exposures and sampling air particulates, air iodine, milk, surface water, groundwater, drinking water, vegetables, game, fodder crops, fish, crabs, and sediments. Therefore, the program measures the cumulative impacts of exposures. The REMP is conducted in accordance with Sections 6.91.17 and 6.9.1.6 of the Salem and HCGS Technical Specification/Offsite Dose Calculation Manuals (ODCM) respectively.

The year-by-year radiological information about the Salem and HCGS site is published in the annual REMP report. The data is compared to pre-operational conditions measured from 1968 to December 1976 when Salem 1 reached criticality. The NRC staff reviewed the Salem and HCGS radioactive environmental operating reports for _____ through 2009 to look for any significant impacts to the environment or any unusual trends in the data (PSEG _____). No unusual trends were noted and all reported data on the radionuclides detected in environmental samples were below applicable NRC reporting levels and showed no significant or measurable impact to site workers or the public (PSEG _____).

The only radionuclide attributable to plant operation detected in recent REMP reports was tritium, which was measured in samples from groundwater monitoring wells screened in the shallow water-bearing zone of riverbed sediments (PSEG _(2009?)_, PSEG 2007, Appendix F). In response to an identified release from the Salem Unit 1 spent fuel pool in 2002, PSEG implemented a Remedial Action Work Plan (RAWP) and developed a voluntary Radiological Groundwater Protection Program in 2006 (PSEG 2007, Appendix F). The RAWP, which was reviewed by the NRC and approved by the NJDEP Bureau of Nuclear Engineering, directed PSEG to install a groundwater recovery system to remove the tritiated water and control the contaminated plume from reaching the site boundary (PSEG 2007, Appendix F). There are currently no known active releases to the groundwater that the site (PSEG _(2009?)_).

The Quarterly Remedial Action Progress Report for Salem for the _____ Quarter of ____ indicates that tritium concentrations in the shallow groundwater have continued to decrease since the initiation of the groundwater recovery system. Tritium concentrations in samples collected during the ____ quarter of _____ were all below _____ picoCuries per liter (pCi/L) from an initial maximum of approximately 15,000,000 pCi/L. Most of the sample concentrations were below _____ pCi/L (PSEG _____).

*Historical data on releases from Salem and HCGS and the resultant dose calculations demonstrate that the amount of radiation received to a hypothetical maximally exposed individual in the vicinity of the site is a small fraction of the limits specified in 10 CFR Part 20, the as low as is reasonably achievable (ALARA) dose design objectives in Appendix I to 10 CFR Part 50, and EPA's radiation standards in 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations." For ____, dose estimates were calculated based on actual liquid and gaseous effluent release data and conservative models to simulate the transport mechanisms* (PSEG _____). *The following summarizes the calculated hypothetical maximum dose to an individual located at the site boundary from liquid and gaseous effluents released during* _____ (PSEG _____):

- *The maximum whole-body dose to an offsite member of the general public from liquid effluents was _____ mrem (_____ mSv), which is well below the 3-mrem dose criteria in Appendix I to 10 CFR 50.*
- *The maximum whole-body dose to the likely most-exposed member of the general public from gaseous effluents was _____ mrem (_____ mSv), which is below the 5-mrem dose criteria in Appendix I to 10 CFR 50.*
- *The maximum whole-body dose to the likely most-exposed member of the general public from all radioactive emissions (radioactive gaseous and liquid effluents and direct radiation shine) was _____ mrem (_____ mSv), which is below the 25-mrem limit in 40 CFR Part 190.*

*Based on the review and assessment of the Salem and HCGS performance in controlling radioactive effluents and the resultant doses to members of the public in conformance with the ALARA criteria, the NRC staff found that the 2009 radiological data for Salem and HCGS are consistent, with reasonable variation attributable to operating conditions and outages, with the 5-year historical radiological effluent releases and resultant doses. These results demonstrate that Salem and HCGS are operating in compliance with Federal radiation protection standards contained in Appendix I to 10 CFR Part 50, 10 CFR Part 20, and 40 CFR Part 190. Continued compliance with regulatory requirements is expected during the license renewal term; therefore, the impacts from radioactive effluents are not expected to change.*

Based on the applicant's assertion that no refurbishment activities are planned at Salem or HCGS, no additional doses to members of the public, and the resultant environmental impacts, are expected due to refurbishment during the renewal period.

### 1.8.3 Microbiological Organisms – Public Health

Both Salem and HCGS have thermal discharges to the Delaware Estuary, a large brackish, tidally-influenced water body that allows their thermal plumes to disperse quickly. There are no other facilities that release thermal discharges to the Estuary in the vicinity of Salem and HCGS.

Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 and Table 4-8 above list the effects of thermophilic microbiological organisms on human health as a Category 2 issue and requires the conduct of a plant-specific evaluation before license renewal for those plants Issue applies to plant features such as cooling lakes or cooling towers that discharge to small rivers. NRC has determined that Salem and HCGS discharge to an estuary (NRC 1996 (GEIS – NUREG 1437); Table 5.13). Neither Salem nor HCGS use cooling ponds, cooling lakes, cooling canals, or discharge to a small river. Therefore, this issue does not apply and the effects of plant discharges on microbiological organisms do not need to be addressed for license renewal.

### 1.8.4 Electromagnetic Fields – Acute Shock

Based on the GEIS, the NRC found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been a problem at most

operating plants and generally is not expected to be a problem during the period of extended operation. However, a site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines within the scope of the supplemental EIS.

According to the GEIS, secondary shock currents are produced when humans make contact with (1) capacitively charged bodies such as a vehicle parked near a transmission line or (2) magnetically linked metallic structures such as fences near transmission lines. Design criteria that limit the potential for secondary shock are based on the National Electrical Safety Code (NESC) (*IEEE 2006*) which requires that transmission lines be designed so that the short-circuit current to ground, produced from the largest anticipated vehicle or object in a position under the transmission line, is limited to less than 5 milliamperes (mA).

The GEIS states that, without a review of the conformance of each nuclear plant transmission line with NESC rules (NESC 2007), it is not possible to determine the significance of the electric shock potential. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For other plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with the requirements of 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents.

As described in Section 2.1.1.6, four 500-kilovolt (kV) transmission lines were specifically constructed to distribute power to the electrical grid from the Salem and HCGS power plants. One 500-kV line, the HCGS-New Freedom line, was originally constructed to connect HCGS to the transmission system. Two additional lines, Salem-New Freedom North and Salem-Keeney (via Red Lion substation), were originally built for Salem but have since been connected to HCGS. The fourth line, Salem-New Freedom South, originates at Salem (HC ER).

PSEG conducted an analysis of the Salem HCGS transmission lines using a computer model of induced current under the line and the results were field verified. PSEG calculated electric field strength and induced current using a computer code called ACDCLINE, produced by the Electric Power Research Institute (HC ER). As provided in Table 4-X, the maximum induced current was modeled at 4.2 milliamperes on Salem-New Freedom South line (HC ER).

PSEG also conducts regular aerial and ground surveillance and maintenance to ensure that design ground clearances do not change. The aerial patrols of all corridors include checks for encroachments, broken conductors, broken or leaning structures, and signs of burnt trees, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, examination for integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission line. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

**Table 4-X. Results of Induced Current Analysis.**

| Transmission Line | Voltage (kilovolts) | Maximum Induced Current (milliamperes) |
|---|---|---|
| Salem-New Freedom South | 500 | 4.2 |
| Salem-New Freedom North | 500 | 4.1 |

| | | |
|---|---|---|
| Salem to Red Lion | 500 | 2.2 |
| Red Lion to Keeney | 500 | 2.7 |
| HCGS-New Freedom (via Orchard) | 500 | 4.0 |

The staff has reviewed the available information, including the applicant's evaluation and computational results, the site visit, the scoping process, and other public sources of information. Based on this information, the staff evaluated the potential impacts of electric shock resulting from operation of Salem and HCGS and their associated transmission lines. The staff concludes that the potential impacts of electric shock during the renewal term would be SMALL.

*The staff identified a variety of measures that could mitigate potential acute electromagnetic field impacts resulting from continued operation of the TMI-1 transmission lines. These mitigation measures include limiting public access to transmission line structures, installing signs at road crossings, and increasing transmission line clearances.*

*These mitigation measures could reduce human health impacts by minimizing public exposures to electric shock hazards. NESC rules, as specified in Part 2, Rules 232C1c and 232D3c, contain provisions that are considered necessary for the protection of employees and the public from acute electromagnetic field hazards associated with transmission lines, which currently apply to TMI-1 and would apply during the license renewal period. AmerGen currently meets these rules. The staff did not identify any cost benefit studies applicable to the mitigation measures mentioned above.*

### 1.8.5 Electromagnetic Fields – Chronic Effects

The GEIS did not designate the chronic effects of 60-hertz electromagnetic fields from power lines as either Category 1 or 2; such a designation will not occur until a scientific consensus is reached on the health implications of these fields.

The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy (DOE). An NIEHS (1999) report contains the following conclusion which is supported by the recently published Environmental Health Criteria Monograph No. 238 (2007):

> The NIEHS concludes that ELF-EMF [extremely low frequency-electromagnetic field] exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the NRC staff to change its position with respect to the chronic effects of electromagnetic fields. This position is expressed in Footnote 5 to Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 as follows:

> If in the future, the Commission finds that, contrary to current indications, a consensus has been reached by appropriate Federal health agencies that there

are adverse health effects from electromagnetic fields, the Commission will require applicants to submit plant-specific reviews of these health effects as part of their license renewal applications. Until such time, applicants for license renewal are not required to submit information on this issue.

The NRC staff considers the GEIS finding of "Uncertain" still appropriate and will continue to follow developments on this issue.

### 1.1.1 Cumulative Human Health Impacts

The radiological dose limits for protection of the public and workers have been developed by the EPA and NRC to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 40 CFR Part 190 and 10 CFR Part 20. For the purpose of this analysis, the area within a 50-mi radius of the Salem and HCGS site was included. The REMP conducted by PSEG in the vicinity of the site measures radiation and radioactive materials from all sources, including all three Salem and HCGS units; therefore, the monitoring program measures cumulative radiological impacts. However, there are no other nuclear power plants, nuclear fuel cycle facilities, or U.S. Department of Energy nuclear weapons facilities within a 50-mi radius of Salem or HCGS that would potential contribute to the cumulative dose impact.

On February 11, 2010 PSEG submitted an Early Site Permit (ESP) application letter of intent to the NRC for the site [Salem or HCGS???] (PSEG February 11, 2010). A specific reactor design has not yet been selected; therefore, the application will utilize the Plant Parameter Envelope (PPE) approach. This approach uses surrogate values as upper and lower bounds of the potential reactor design characteristics. Analysis of environmental impacts based on this approach allows final design decisions to be deferred until the construction permit (CP) or combined construction permit and operating license (combined license or COL) stage.

Monitoring results for the __-year period from 2002 to 20__ were reviewed as part of the cumulative impacts assessment (PSEG xxxx). Additionally, in Sections 2.2.7 and 4.3, the Staff concluded that impacts of radiation exposure to the public and workers (occupational) from operation of Salem and HCGS during the renewal term are SMALL. The NRC and the State of New Jersey would regulate any future actions in the vicinity of the Salem and HCGS site that could contribute to cumulative radiological impacts, including new power reactors licensed and operated at the site. Should future reactors operate with similar monitoring results, the public and workers (occupational) would continue to be SMALL.

The NRC staff has determined that the electric-field-induced currents from the Salem and HCGS transmission lines are well below the NESC recommendations for preventing electric shock from induced currents. Therefore, the Salem and HCGS transmission lines do not significantly affect the overall potential for electric shock from induced currents within the analysis area. The NRC staff did identify a variety of mitigation measures that could reduce human health impacts by minimizing public exposures to electric shock hazards. However, no cost benefit studies applicable to these mitigation measures were identified. The potential for chronic effects from these fields continues to be studied and is not known at this time. The NRC staff considers the GEIS finding of "Uncertain" still appropriate and will continue to follow developments on this issue.

Therefore, the NRC staff concludes that cumulative radiological impacts of continued operations of Salem and HCGS are SMALL and that no further mitigation measures are warranted.

# 1.0 PURPOSE AND NEED FOR ACTION

Pursuant to the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10, Part 51, of the U.S. *Code of Federal Regulations* (10 CFR 51), which implement the U.S. National Environmental Policy Act of 1969 (NEPA), an environmental impact statement (EIS) is required to be prepared for issuance of a new nuclear power plant operating license.

The Atomic Energy Act of 1954 (AEA) originally specified that licenses for commercial power reactors be granted for up to 40 years with an option to renew for up to another 20 years. The 40-year licensing period is based on economic and antitrust considerations rather than on technical limitations of the nuclear facility.

The decision to seek a license renewal rests entirely with nuclear power facility owners and typically is based on the facility's economic viability and the investment necessary to continue to meet NRC safety and environmental requirements. The NRC staff (Staff) makes the decision to grant or deny a license renewal, based on whether or not the applicant has demonstrated that the environmental and safety requirements in the NRC's regulations can be met during the period of extended operation.

## 1.1 Proposed Federal Action

PSEG Nuclear, LLC (PSEG) initialized the proposed Federal action by submitting an application for license renewal of Salem Nuclear Generating Station, Units 1 and 2 (Salem) for which the existing licenses DPR-70 (Unit 1) and DPR-75 (Unit 2) expire August 13, 2016, and April 18, 2020, respectively and Hope Creek Generating Station (HCGS), for which the existing license NPF-57 expires April 11, 2026. NRC's Federal action is the decision whether or not to renew the licenses for an additional 20 years.

## 1.2 Purpose and Need for the Proposed Federal Action

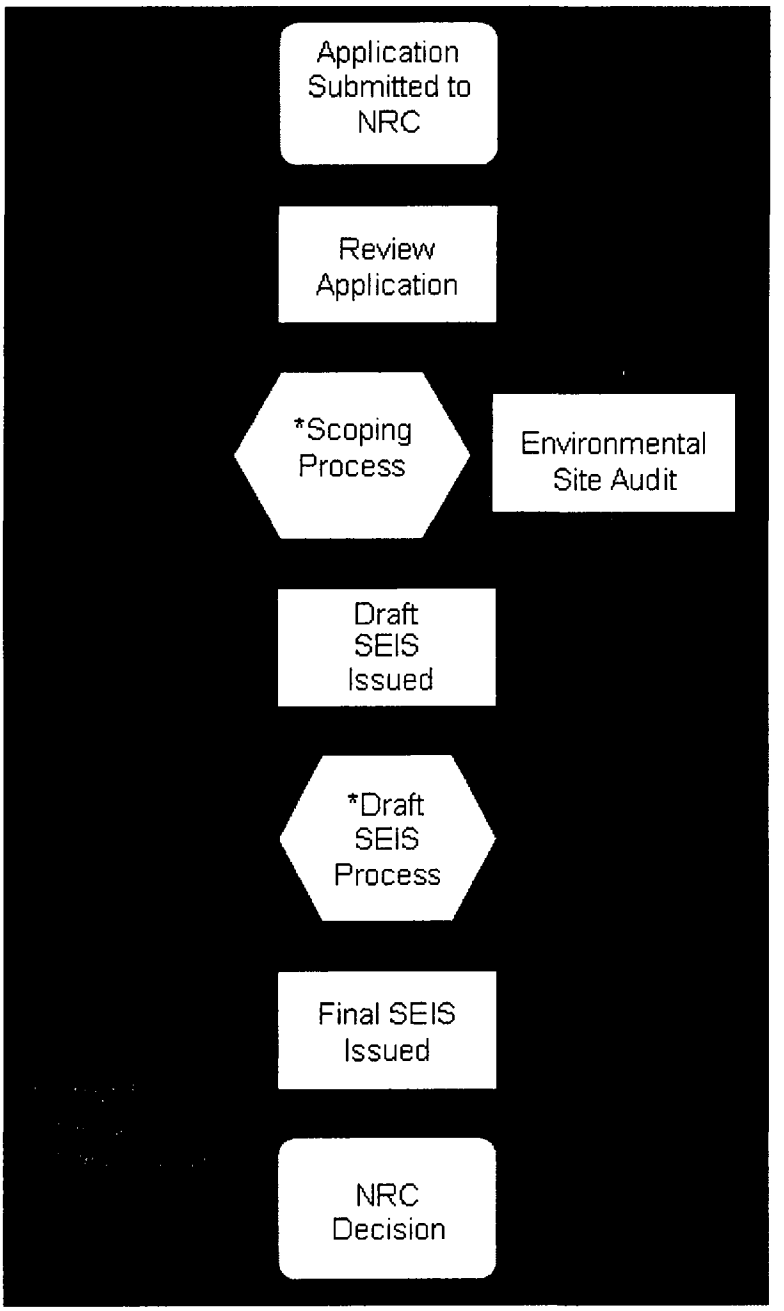
The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, which may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers. This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the AEA or findings in the NEPA environmental analysis that would lead the NRC to not grant a license renewal, the NRC does not have a role in the energy-planning decisions of State regulators and utility officials as to whether or not a particular nuclear power plant should continue to operate.

If the renewed license is issued, State regulatory agencies and PSEG will ultimately decide whether the plant will continue to operate or not based on factors such as the need for power, or other matters within the State's jurisdiction, or the purview of the owners. If the operating license is not renewed, the facility must be shut down on or before the expiration date of the current operating licenses, August 13, 2016 for Unit 1 at Salem, April 18, 2020 for Unit 2 at Salem, and April 11, 2026 at HCGS.

## 1.3 Major Environmental Review Milestones

As part of the license renewal application, PSEG submitted an environmental report (ER) for each Salem (PSEG 2009a) and HCGS (PSEG 2009b) dated August 18, 2009. After reviewing the application and the ERs for sufficiency, the Staff published a notice of acceptance for docketing of the application on October 23, 2009, in the *Federal Register* (FR)(Volume 74, p. 54854, (74 FR 54854) for Salem; and Volume 74, p. 54856, (74 FR 54856) for HCGS). Also, on October 23, 2009, the NRC published another notice in the FR (74 FR 54859) on its intent to conduct scoping, thereby beginning the 60-day scoping period for the supplemental environmental impact statement (SEIS).

**Figure 1-1. Environmental Review Process.**
*The environmental review provides opportunities for public involvement.*




NRC conducted two public scoping meetings on November 5, 2009 in Woodstown, New Jersey. The Staff prepared an SEIS scoping process summary report dated XXXXXXX, which presents the comments received during the scoping process (NRC xxxx). Appendix A to this SEIS presents comments considered to be within the scope of the environmental license renewal review and the associated NRC responses.

To independently verify information provided in the ER, the Staff conducted a site audit at the Salem and HCGS, site in March of 2010. During the site audit, the Staff met with plant personnel, reviewed specific documentation, toured the facility, and met with interested Federal, State, and local agencies. A summary of that site audit and the attendees is contained in the site audit summary report (NRC 2010x).

Upon completion of the scoping period and site audit, the Staff compiled its findings in this draft SEIS (Figure 1-1). This SEIS is being made publically available for period of 75 days during which the Staff will host public meetings and collect public comments. Based on the information

gathered, the Staff will amend the draft SEIS findings as necessary, and then publish the final SEIS.

The Staff has established a license renewal process that can be completed in a reasonable period of time with clear requirements to assure safe plant operation for up to an additional 20 years. The safety review, which documents its finding in a Safety Evaluation Report (SER), is conducted simultaneously as the environmental review process. Both the findings in the SEIS and the SER are factors considered in the Commission's decision to either grant or deny the issuance of a new license.

***Significance*** indicates the importance of likely environmental impacts and is determined by considering two variables: **context** and **intensity**.

***Context*** is the geographic, biophysical, and social context in which the effects will occur.

***Intensity*** refers to the severity of the impact, in whatever context it occurs.

## 1.4 Generic Environmental Impact Statement

To improve the efficiency of the license renewal process, the Staff prepared a generic assessment of the environmental impacts associated with license renewal. Specifically, the agency prepared NUREG-1437, *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants,* which evaluates the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years (NRC 1996, 1999).[1] The Staff analyzed those environmental issues that could be resolved generically in the GEIS.

The GEIS establishes 92 separate issues for the Staff to consider. Of these, the staff determined that 69 are generic to all plants (Category 1), while 21 issues do not lend themselves to generic consideration (Category 2). Two other issues remained uncategorized; environmental justice and the chronic effects of electromagnetic fields, which must be evaluated on a site-specific basis. Appendix B to this report lists all 92 issues.

For each environmental issue, the GEIS: (1) describes the activity that affects the environment; (2) identifies the population or resource that is affected; (3) assesses the nature and magnitude of the impact on the affected population or resource; (4) characterizes the significance of the effect for both beneficial and adverse effects; (5) determines whether the results of the analysis apply to all plants or not; and (6) considers whether additional mitigation measures are warranted or not for impacts that would have the same significance level for all plants.

The GEIS assesses the significance of these issues, using the Council on Environmental Quality (CEQ) terminology for "significant." The Staff established three levels of significance for potential impacts—SMALL, MODERATE, and LARGE. The three levels of significance are defined below:

**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.

[1] The NRC originally issued the GEIS in 1996 and issued Addendum 1 to the GEIS in 1999. Hereafter, all references to the "GEIS" include the GEIS and Addendum 1.

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

The GEIS includes a determination of whether or not the analysis of the environmental issue could be applied to all plants and whether or not additional mitigation measures are warranted (Figure 1-2). Issues are assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

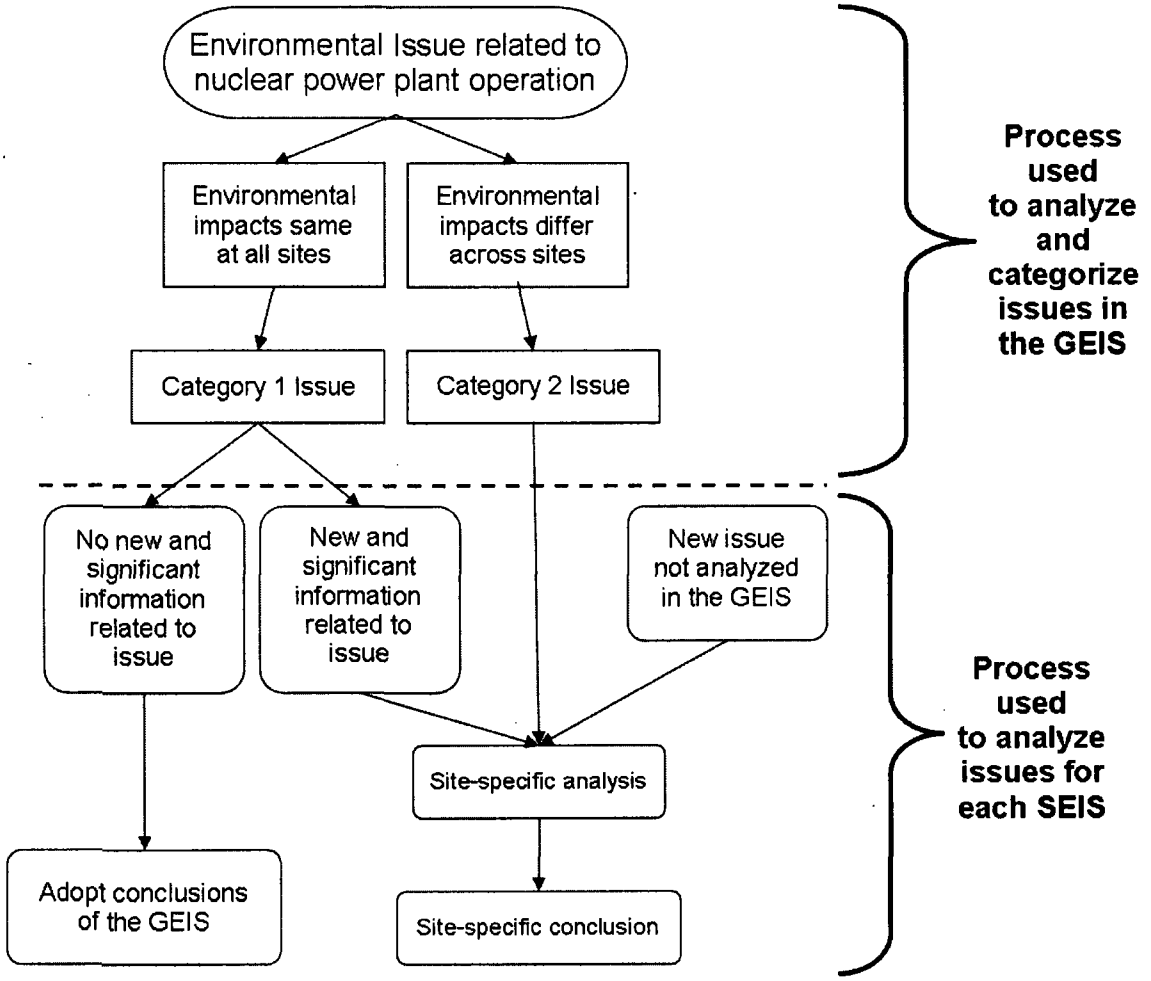
1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For generic issues (Category 1), no additional site-specific analysis is required in this SEIS unless new and significant information is identified. Chapter 4 of this report presents the process for identifying new and significant information. Site-specific issues (Category 2) are those that do not meet one or more of the criterion for Category 1 issues, and therefore, additional site-specific review for these issues is required. The SEIS documents the results of that site-specific review.

**Figure 1-1. Environmental Issues Evaluated During License Renewal.** *92 issues were initially evaluated in the GEIS. A site-specific analysis is required for 23 of those 92 issues.*




## 1.5 Supplemental Environmental Impact Statement

The SEIS presents an analysis that considers the environmental effects of the continued operation of Salem and HCGS, potential alternatives to license renewal, and potential mitigation measures for minimizing adverse environmental impacts. Chapter 8 contains analysis and comparisons of the environmental impacts from alternatives. Chapter 9 presents the preliminary recommendation to the Commission as to whether or not the environmental impacts of license renewal are so great that preserving the option of license renewal would be unreasonable. The recommendation will be made after consideration of comments received during the public scoping period for the draft SEIS.

In the preparation of this SEIS, the Staff:

- reviewed the information provided in the PSEG ERs,
- consulted with other Federal, State, and local agencies,
- conducted an independent review of the issues during site audit, and

- considered the public comments received during the scoping process and on the draft SEIS.

New and significant information can be identified from a number of sources, including the Staff, the applicant, other agencies, and public comments. If a new issue is revealed, it is first analyzed to determine whether or not it is within the scope of the license renewal evaluation. If it is not addressed in the GEIS, then the NRC determines its significance and documents its analysis in the SEIS.

**New and significant information either:**
(1) identifies a significant environmental issue not covered in the GEIS, or
(2) was not considered in the analysis in the GEIS and leads to an impact finding that is different from the finding presented in the GEIS.

## 1.6 Cooperating Agencies

During the scoping process, no Federal, State or local agencies were identified as cooperating agencies in the preparation of this SEIS.

## 1.7 Consultations

The Endangered Species Act of 1973, as amended; the Magnuson-Stevens Fisheries Conservation and Management Act of 1996, as amended; and the National Historic Preservation Act of 1966, require that Federal agencies consult with applicable State and Federal agencies and groups before taking action that may affect endangered species, fisheries, or historic and archaeological resources, respectively.

Listed below are the agencies and groups with whom the NRC consulted; Appendix D of thos report includes copies of consultation documents.

- Delaware Department of Natural Resources and Environmental Control, Dover, Delaware
- New Jersey Department of Environmental Protection, Trenton, New Jersey
- U.S. Fish and Wildlife Service, Pleasantville, New Jersey

## 1.8 Correspondence

Table 1-1 lists persons and organizations to which a copy of this draft SEIS is sent. Appendix E to this report contains a chronological list of all documents sent and received during the environmental review. During the course of the environmental review, the Staff corresponded or consulted with the following Federal, State, regional, local or tribal agencies:

Accohannock Indian Tribe, Salsbury, Maryland

Delaware Department of Natural Resources and Environmental Control, Dover, Delaware

Delaware Nation, Andarko, Oklahoma

Delaware River Basin Comission, West Trenton, New Jersey

Delaware Tribe of Indians, Bartlesville, Oklahoma

Eastern Lenape Nation of PA, Mountville, Pennslyvania

Echota Chickamauga Cherokee Tribe of New Jersey, Irvington, New Jersey

Lenape Tribe of Delaware, Cheshold, Delaware
Nanticoke Indians Association, Inc., Millsboro, Delaware
Nanticoke Lenni-Lenape Indians of New Jersey, Brigeton, New Jersey
National Marine Fisheries Service, Gloucester, Massachusetts
Nause-Waiwash Tribe, Cambridge, Maryland
New Jersey Department of Environmental Protection, Trenton, New Jersey
Osprey Band of Free Cherokees, Mays Landing, New Jersey
Piscataway-Conoy Confederacy and Sub-Tribes, Inc., LaPlata, Maryland
Piscataway Indian Nation, Accokeek, Maryland
Pocomoke Indian Nation, Mount Airy, Maryland
Powhatan Renape Nation, Rancocas, New Jersey
Ramapough Mountain Lenape, Mahway, New Jersey
State Historic Preservation Office, Crownsville, Maryland
State Historic Preservation Office, Dover, Delaware
State Historic Preservation Office, Harrisburg, Pennslyvania
State Historic Preservation Office, Trenton, New Jersey
U.S. Army Corps of Engineers, Philadelphia, PA
U.S. Environmental Protection Agency, Region 2, New York, New York
U.S. Environmental Protection Agency, Region 3, Philadelphia, Pennslyvania
U.S. Fish and Wildlife Service, Pleasantville, New Jersey
Unalachtigo Band of the Nanticoke-Lenni Lenape Nation, Bridgeton, New Jersey

Table 1-1. List of persons who are sent a copy of this draft SEIS

| | | |
|---|---|---|
| Peter M. Glass, Xcel Energy Services, Inc. | Manager, Regulatory Affairs, Northern States Power Co. | Manager, Minnesota Attorney General's Office |
| Resident Inspector's Office, NRC | Philip R. Mahowald, Prairie Island Indian Community | Gene Eckholt, Northern States Power Co. |
| Heather Westra, Prairie Island Indian Community | Administrator, Goodhue County Courthouse | Jim Holthaus, Northern States Power Co. |
| Katie Himanga, City of Lake City | Commissioner, Minnesota Department of Commerce | Tribal Council, Prairie Island Indian Community |
| Nuclear Asset Manager, Xcel Energy, Inc. | Dennis L. Koehl, Northern States Power Co. | Joel P. Sorenson, Northern States Power Co. |
| Kay Kuhlmann, Red Wing City Council | Joan Marshman | Deanna Sheely, Red Wing City Council |
| John Wurst | Joe Ellingson | Michael McKay, Wacouta Township |
| Elaine and Arlen Diercks, Hay Creek Township | Doub Lansing, Maiden Rock Village | Matrix Energy Solutions |
| Mr. Ronald Johnson, Prairie Island Indian Community | Mr. Kevin Jensvold, Upper Sioux Community of Minnesota | Jean Stacy, Lower Sioux Indian Community of Minnesota |
| Joseph Brings Plenty, Cheyenne River Sioux Tribe | Lester Thompson, Crow Creek Sioux Tribal Council | Joshua Weston, Flandreau Santee Sioux Executive Committee |
| Michael Jandreau, Lower Brule Sioux Tribal Council | John Yellow Bird Steele, Oglala Sioux Tribal Council | Rodney Bordeaux, Rosebud Sioux Tribal Council |
| Roger Trudell, Santee Sioux Nation | Michael Selvage, Sr., Sisseton-Wahpeton Oyate of the Lake | Myra Pearson, Spirit Lake Tribal Council |

## 1.9 Status of Compliance

PSEG is responsible for complying with all NRC regulations and other applicable Federal, State, and local requirements; Appendix C describes some of the principal Federal statutes for which PSEG must comply. Table 1-2 lists the numerous permits and licenses issued by Federal, State, and local authorities for activities at Salem and HCGS, respectively.

**Table 1-2. Licenses and Permits.** *Existing environmental authorizations for Salem and HCGS*

**SALEM:**

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Operating Licenses | DPR-70 and DPR-75 | Issued: 8/13/1976 and 4/18/1980<br>Expires: 8/13/2016 and 4/18/2020 | U.S. Nuclear Regulatory Commission |
| Certification of the Environmental Lab | 027-049-218 | Expires: 12/23/2009 | Minnesota Department of Health |
| Construction of intake canal system | Docket 050-282 and 050-306 | N/A | Minnesota Department of Natural Resources |
| Construction of discharge canal system | Docket 050-282 and 050-306 | N/A | Minnesota Department of Natural Resources |
| National Pollutant Discharge Elimination System Permit | MN0004006 | Issued: 06/30/2006<br>Expires: 08/31/2010 | Minnesota Pollution Control Agency |
| Fish, mussels, and icthyoplankton collection Permit | MN State rules 14658, 14567, and 159 | Expires: 12/31/2008 and 12/31/2009 for permit 159 | Minnesota Department of Natural Resources |
| Surface Water Appropriation Permit | 690172 | N/A | Minnesota Department of Natural Resources |
| Groundwater Appropriation Permit | Permit Nos. 690171, 785153, 865114, and 965042 | N/A | Minnesota Department of Natural Resources |
| Hazardous materials shipments | UPR-211635-MN | Expires: 10/27/2008 | Minnesota Department of Transportation |
| Industrial wastewater discharge to Mississippi River Permit | MN0004006 | Expires: 08/31/2010 | Minnesota Pollution Control Agency, Industrial Division |
| Operation of air emissions system for an electric utility power generation system Permit | 00000001-003 | Expires: 12/17/2004 (renewal application submitted) | Minnesota Pollution Control Agency |
| Operation of oil-fired boiler and diesel-fired engines for emergency power, pump cooling water, and fire fighting system Permit | 04900030-003 | Expires: 01/03/2012 | Minnesota Pollution Control Agency |

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Above ground storage tank registration | MPCA 51557 | No Expiration | Minnesota Pollution Control Agency |
| Hazardous Waste Generator License, Small Quantity | MND049537780 | Expires: 06/30/2008 | Minnesota Pollution Control Agency |
| Transportation of radioactive waste into the State of South Carolina Permit | 0051-22-08-X | Expires: 12/31/2008 | South Carolina Department of Health and Environmental Control – Division of Waste Management |
| Transportation of radioactive waste into the State of Tennessee Permit | T-MN003-L08 | Expires: 12/31/2008 | State of Tennessee Department of Environmental and Conservation Division of Radiological Health |
| Transportation of radioactive waste into the State of Utah Permit | 0402 002 748 | Expires: 02/23/2008 (renewal application submitted) | State of Utah Department of Environmental Quality Division of Radiation Control |
| Collect fish and ichthyoplankton for radiological and biological monitoring | SCP-WCR-20-C-08 | Expires: 12/31/2008 | Wisconsin Department of Natural Resources |
| Maintenance dredging and erosion control discharge canal General Permit | GP/LOP-98-MN | Expires: 02/18/2008 | U.S. Army Corps of Engineers |
| Air quality monitoring station at Lock and Dam Number 3 License | DACW37-3-06-0071 | Issued: 4/17/2007<br>Expires: 09/30/2011 | U.S. Army Corps of Engineers |
| Maintenance dredging in front of the River Intake Structure Dredging Permit | GP-01-MN | Expires: 05/15/2006 | U.S. Army Corps of Engineers |
| Hazardous materials shipments Registration | 062706 552 0090 | Expires: 06/30/2008 | U.S. Department of Transportation |
| Retreive, transport, and temporarily possess carcasses of migratory birds as well as collect, stabilize, and transport sick/injured migratory birds | MB074020-0 | Expires: 03/31/2009 | U.S. Fish and Wildlife Service |

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Wildlife Permit | | | |

**HCGS:**

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Operating Licenses | NPF-57 | Issued: 4/11/1986<br>Expires: 4/11/2026 | U.S. NRC |
| Certification of the Environmental Lab | 027-049-218 | Expires: 12/23/2009 | Minnesota Department of Health |
| Construction of intake canal system | Docket 050-282 and 050-306 | N/A | Minnesota Department of Natural Resources |
| Construction of discharge canal system | Docket 050-282 and 050-306 | N/A | Minnesota Department of Natural Resources |
| National Pollutant Discharge Elimination System Permit | MN0004006 | Issued: 06/30/2006<br>Expires: 08/31/2010 | Minnesota Pollution Control Agency |
| Fish, mussels, and icthyoplankton collection Permit | MN State rules 14658, 14567, and 159 | Expires: 12/31/2008 and 12/31/2009 for permit 159 | Minnesota Department of Natural Resources |
| Surface Water Appropriation Permit | 690172 | N/A | Minnesota Department of Natural Resources |
| Groundwater Appropriation Permit | Permit Nos. 690171, 785153, 865114, and 965042 | N/A | Minnesota Department of Natural Resources |
| Hazardous materials shipments | UPR-211635-MN | Expires: 10/27/2008 | Minnesota Department of Transportation |
| Industrial wastewater discharge to Mississippi River Permit | MN0004006 | Expires: 08/31/2010 | Minnesota Pollution Control Agency, Industrial Division |
| Operation of air emissions system for an electric utility power generation system Permit | 00000001-003 | Expires: 12/17/2004 (renewal application submitted) | Minnesota Pollution Control Agency |
| Operation of oil-fired boiler and diesel-fired engines for emergency power, pump cooling water, and fire fighting | 04900030-003 | Expires: 01/03/2012 | Minnesota Pollution Control Agency |

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| system Permit | | | |
| Above ground storage tank registration | MPCA 51557 | No Expiration | Minnesota Pollution Control Agency |
| Hazardous Waste Generator License, Small Quantity | MND049537780 | Expires: 06/30/2008 | Minnesota Pollution Control Agency |
| Transportation of radioactive waste into the State of South Carolina Permit | 0051-22-08-X | Expires: 12/31/2008 | South Carolina Department of Health and Environmental Control – Division of Waste Management |
| Transportation of radioactive waste into the State of Tennessee Permit | T-MN003-L08 | Expires: 12/31/2008 | State of Tennessee Department of Environmental and Conservation Division of Radiological Health |
| Transportation of radioactive waste into the State of Utah Permit | 0402 002 748 | Expires: 02/23/2008 (renewal application submitted) | State of Utah Department of Environmental Quality Division of Radiation Control |
| Collect fish and ichthyoplankton for radiological and biological monitoring | SCP-WCR-20-C-08 | Expires: 12/31/2008 | Wisconsin Department of Natural Resources |
| Maintenance dredging and erosion control discharge canal General Permit | GP/LOP-98-MN | Expires: 02/18/2008 | U.S. Army Corps of Engineers |
| Air quality monitoring station at Lock and Dam Number 3 License | DACW37-3-06-0071 | Issued: 4/17/2007<br>Expires: 09/30/2011 | U.S. Army Corps of Engineers |
| Maintenance dredging in front of the River Intake Structure Dredging Permit | GP-01-MN | Expires: 05/15/2006 | U.S. Army Corps of Engineers |
| Hazardous materials shipments Registration | 062706 552 0090 | Expires: 06/30/2008 | U.S. Department of Transportation |
| Retreive, transport, and temporarily possess carcasses of migratory birds as well as collect, stabilize, and transport sick/injured migratory birds | MB074020-0 | Expires: 03/31/2009 | U.S. Fish and Wildlife Service |

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Wildlife Permit | | | |

## 1.10 References


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

73 FR 34335. U.S. Nuclear Regulatory Commission. Washington D.C. "Nuclear Management Company, LLC, Prairie Island Nuclear Generating Plant, Units 1 and 2; Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License Nos. DPR– 42 and DPR–60 for an Additional 20- Year Period." Federal Register. Vol. 73, No. 117, pp34335-34337. June 17, 2008.

73 FR 42628. U.S. Nuclear Regulatory Commission. Washington D.C. "Nuclear Management Company, LLC.; Prairie Island Nuclear Generating Plant, Units 1 and 2; Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." Federal Register: Vol. 73, No. 141, pp42628-42630. July 22, 2008.

*Atomic Energy Act of 1954.* 42 U.S.C. 2011, et seq.

*Endangered Species Act of 1973.* 16 U.S.C. 1531, et seq.

*Magnuson-Stevens Fishery Conservation and Management Act*, as amended by the *Sustainable Fisheries Act of 1996.* 16 U.S.C. 1855, et seq.

*National Environmental Policy Act of 1969.* 42 U.S.C. 4321, et seq.

*National Historic Preservation Act.* 16 U.S.C. 470, et seq.

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Volumes 1 and 2, Washington, D.C. ADAMS Nos. ML040690705 and ML040690738.

NRC (U.S. Nuclear Regulatory Commission). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

PSEG Nuclear, LLC (PSEG). 2009a. Salem Nuclear Generating Station, Units 1 and 2, License Renewal Application, Appendix E - Applicant's Environmental Report – Operating License Renewal Stage. Lower Alloways Creek Township, New Jersey. August, 2009. ADAMS Nos. ML092400532, ML092400531, ML092430231

PSEG Nuclear, LLC (PSEG). 2009b. Hope Creek Generating Station, License Renewal Application, Appendix E - Applicant's Environmental Report – Operating License Renewal Stage. Lower Alloways Creek Township, New Jersey. August, 2009. ADAMs No. ML092430389

### 2.1.1 Power Transmission System

Three Right of Way (ROW) corridors and five 500-kilovolt (kV) transmission lines connect Salem and HCGS to the regional electric grid, all of which are owned and maintained by PSE&G and Pepco Holdings Inc. (PHI). Each corridor is 350 feet wide, with the exception of two-thirds of both the HCGS-Red Lion and Red Lion-Kenney lines, which narrows to 200 feet. Unless otherwise noted, the discussion of the power transmission system is adapted from the environmental report (ER) (PSEG 2009a, PSEG 2009b) or information gathered at NRC's environmental site audit.

For the operation of Salem a transmission line was constructed to extend north, across the Delaware River, and to terminate at Keeney substation in Delaware. This line was previously identified as the "Salem-Keeney". After construction of HCGS, several changes were made to the Salem transmission line connections. A new substation (known as Red Lion) was built along the Salem-Keeney transmission line. The Salem-Keeney transmission line is now comprised of two segments: one from HCGS to Red Lion and the other from Red Lion to Keeney. Consequently this line is now referred by two different names per segment of the transmission lines "HCGS-Red Lion" and "Red Lion-Keeney". The transmission line located within Delaware, "Red Lion-Keeney", is owned and maintained by Pepco (a regulated electric utility that is a subsidiary of PHI). Because the "Salem-New Freedom North" line was re-routed for operation of HCGS; it was necessary to construct a transmission line connecting Salem and New Freedom substation. This line is known as the "HCGS-New Freedom" line. Pre-existing the construction of HCGS, the "Salem-New Freedom South" line also connects Salem to the New Freedom substation.

The only new transmission lines constructed as a result of HCGS are the HCGS-New Freedom line, the tie line, and short reconnections for Salem-New Freedom North and Salem-Keeney. The HCGS-Salem tie line and the short reconnections do not pass beyond the site boundary.

Transmission lines considered in-scope for license renewal are those constructed specifically to connect the facility to the transmission system (10 CFR 51.53(c)(3)(ii)(H)); therefore, the Salem-New Freedom North, Salem-Red Lion, Red Lion-Keeney, Salem-New Freedom South, HCGS-New Freedom, and HCGS-Salem lines are considered in-scope for this supplemental environmental impact statement (SEIS) and are discussed in detail below.

[redacted] contains a map of the Salem and HCGS transmission system. The five transmission lines are described below within the designated ROW corridor ([redacted]):

**New Freedom North ROW**

- *Salem-New Freedom North* – This 500-kV line, which is operated by PSE&G, runs northeast from HCGS for 63 km (39 mi) in a 107-m-(350-ft)-wide corridor to the New Freedom Switching Station north of Williamstown, New Jersey. This line shares the corridor with the 500-kV HCGS-New Freedom line.

- *HCGS-New Freedom* – This 500-kV line, which is operated by PSE&G, extends northeast from Salem for 69 km (43 mi) in a 107-m-(350-ft)-wide corridor to the New Freedom switching station north of Williamstown, New Jersey. This line shares the corridor with the 500-kV Salem-New Freedom North line. During 2008, a new substation (Orchard) was installed along this line, dividing it into two segments.

New Freedom South ROW

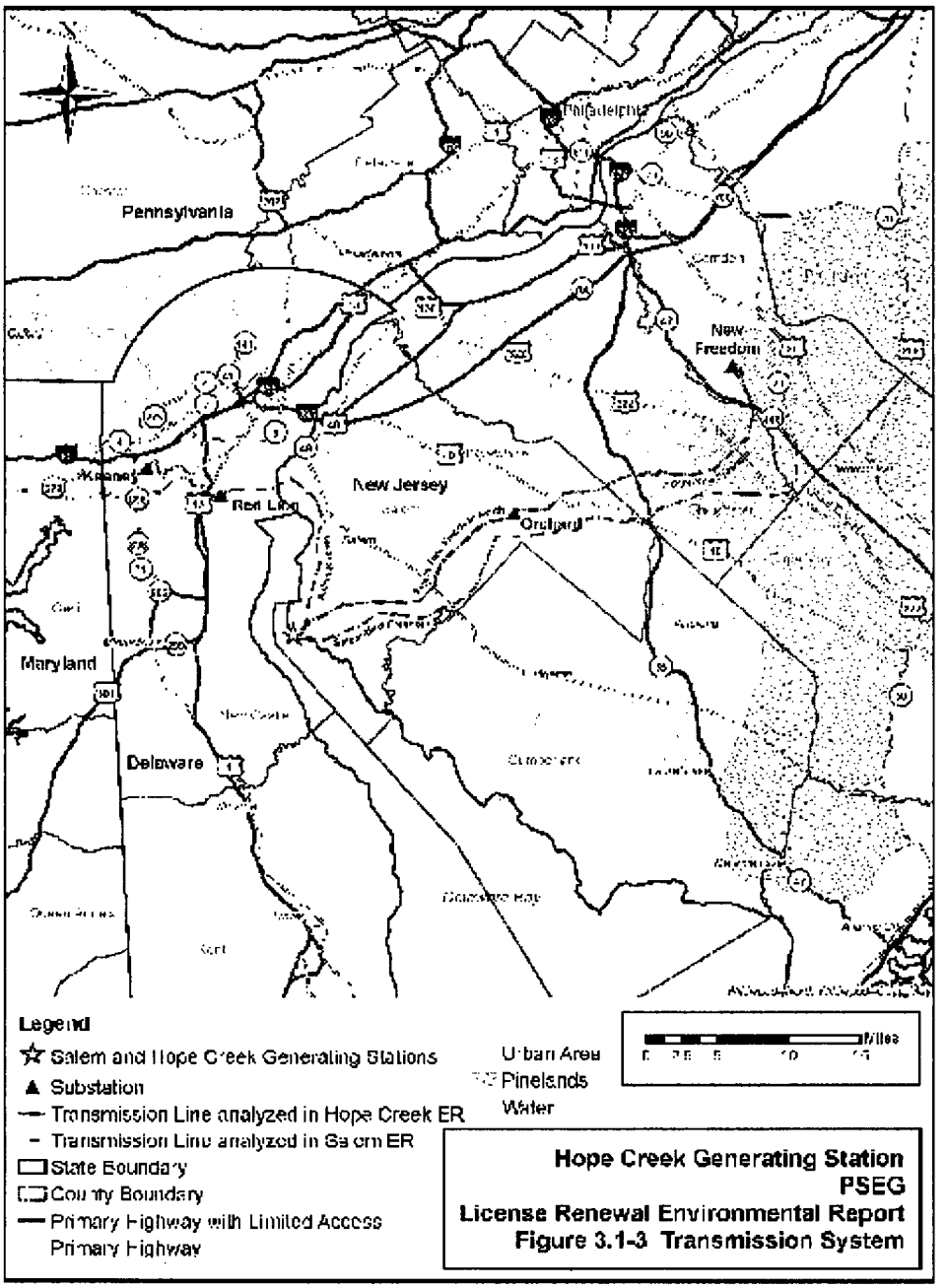
- *Salem-New Freedom South* - This 500-kV line operated by PSE&G extends northeast from Salem for 68 km (42 mi) in a 107-m-(350-ft)-wide corridor from Salem to the New Freedom substation north of Williamstown, New Jersey.

Red Lion ROW

- *HCGS - Red Lion* – This 500-kV line extends north from HCGS for 21 km (13 mi) and then crosses over the New Jersey-Delaware state line. It then continues west over the Delaware River about six km (four mi) to the Red Lion substation. In New Jersey the line is operated by PSE&G, and in Delaware it is operated by PHI. Two thirds of the 27-km (17-mi) corridor is 61 m (200 ft) wide, and the remainder is 107 m (350 ft) wide.

- *Red Lion - Keeney* – This 500-kV line, which is operated by PHI, extends from the Red Lion substation 13 km (eight mi) northwest to the Keeney switch station. Two thirds of the corridor is 70 m (200 ft) wide, and the remainder is 107 m (350 ft) wide.

## [redacted]. Salem and Hope Creek Generating Station




**Source: (NRC 2009 Salem and HCGS ER)**

The ROW corridors comprised approximately 149 miles and 6,019.2 acres; the lines cross within Camden, Gloucester and Salem counties in New Jersey and New Castle County in Delaware. All of the ROW corridors traverse the marshes and wetlands adjacent to the Salem and HCGS sites, including agricultural and forested lands.

All transmission lines were designed and built in accordance with industry standards in place at the time of construction. All transmission lines will remain a permanent part of the transmission system and will be maintained by PSE&G and PHI regardless of Salem and HCGS continued operation (PSEG 2009a, PSEG 2009b). The HCGS-Salem line, which connects the two substations, would be deactivated if the Salem and HCGS switchyards were no longer in use and would need to be reconnected to the grid if they were to remain in service beyond the operation of Salem and HCGS.

**Salem and HCGS Transmission Lines.** Five 500 kV transmission lines connect electricity from Salem and HCGS to the regional electric transmission system via three ROW outside of the property boundary. "HCGS – Salem" tie-line is approximately 610m (2000 ft); this line does not pass beyond the site boundary and is not discussed as an off-site ROW.

| | Approximate Distance | | | ROW width | Approx. ROW area |
|---|---|---|---|---|---|
| Line | **Owner** | **kV** | **mi (km)** | **ft (m)** | **ac (ha)** |
| New Freedom North ROW | | | | | |
| Salem – New Freedom North | PSE&G | 500 | 39 (63) | 350 (107) | 1654.5 |
| HCGS – New Freedom | PSE&G | 500 | 43 (69) | | 1824.2 |
| New Freedom South ROW | | | | | |
| Salem – New Freedom South | PSE&G | 500 | 42 (68) | 350 (107) | 1781.8 |
| Red Lion ROW | | | | | |
| HCGS Red – Lion | PSE&G | 500 | 17 (27) | *200/350 (107) | 515.7 |
| Red-Lion Keeney | PHI | 500 | 8 (13) | *200/350 (107) | 243 |
| **Total acreage within ROW** | | | | | 6,019.2 |

* two – thirds of the corridor is 200 ft (70 m) wide

Source: PSEG 2009a, PSEG 2009b

# 2.0 AFFECTED ENVIRONMENT

Salem and HCGS are located at the southern end of Artificial Island in Lower Alloways Creek Township, Salem County, New Jersey. The facilities are located at River Mile 50 [28 km (18 mi)] and River Mile 51[27 km (17 mi)], respectively, south of the Delaware Memorial Bridge. Philadelphia is about 64 km (40 mi) northeast and the city of Salem, New Jersey, is 13 km (8 mi) northeast of the site (AEC 1973; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference). Figure 2-1 shows the location of Salem and HCGS within a six-mile radius.

Because existing conditions are partially the result of past construction and operation at the plants, the impacts of these past and ongoing actions and how they have shaped the environment are presented in this chapter. Section 2.1 of this report describes Salem and HCGS as a combined site (site), the individual facilities, and their operations; Section 2.2 discusses the affected environment; and Section 2.3 describes related Federal and State activities near the site.

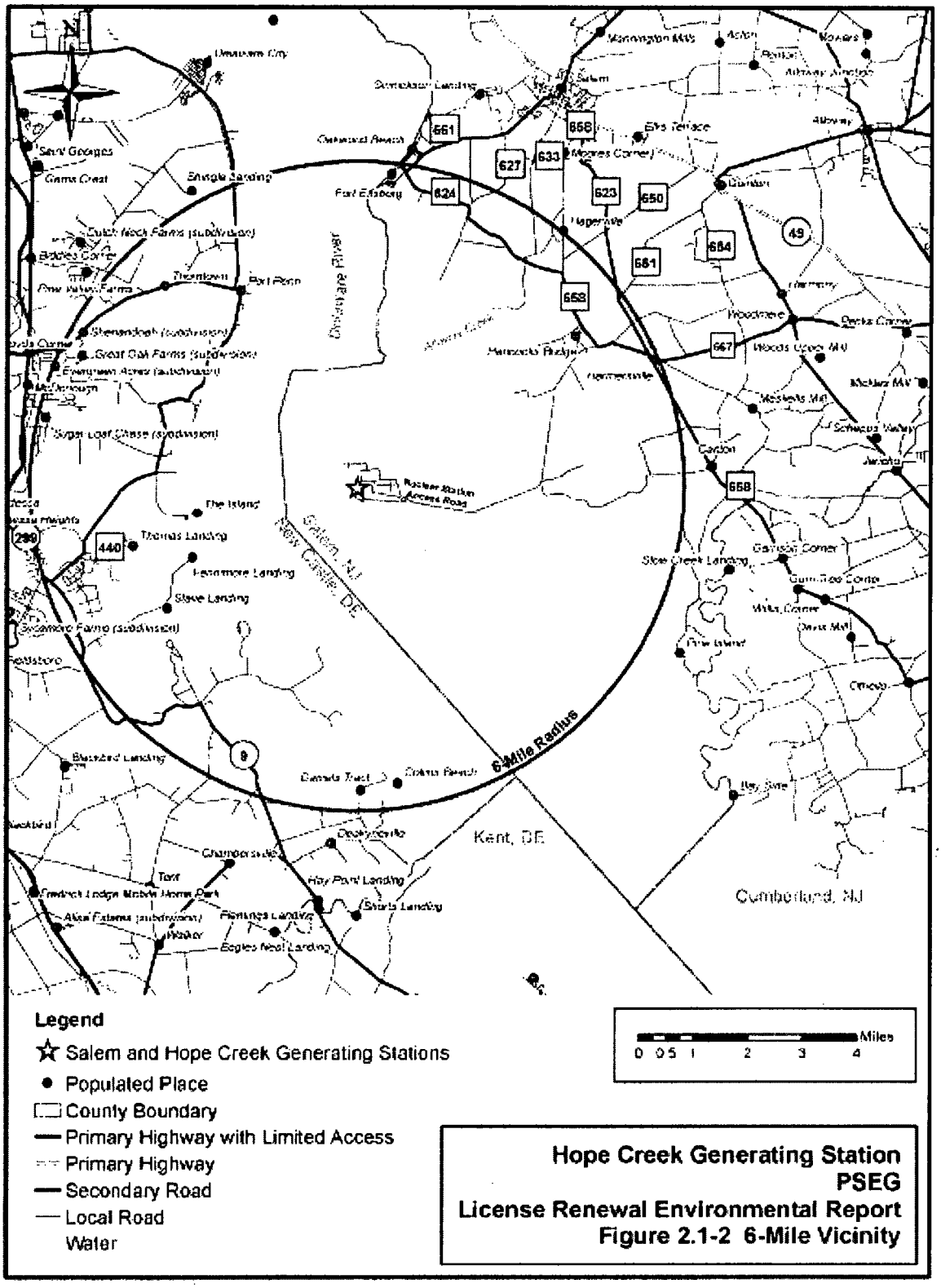



**Figure 2-1. Location of Salem and HCGS Site, within a 6-Mile Radius (Source: _____)**

## 2.1 FACILITY AND SITE DESCRIPTION AND PROPOSED PLANT OPERATION DURING THE RENEWAL TERM

**Note: Text in italic is copied form a source and needs to be rewritten with reference to specific documents.**

Artificial Island is a 607 hectare (1,500 acre) island that was created by the U.S. Army Corps of Engineers (US COE) beginning the in the early twentieth century. The island began as buildup of hydraulic dredge spoils within a progressively enlarged diked area established around a natural bar that projected into the river. The low and flat tidal marsh and grassland has an average elevation of about 2.7 meters (m; 9 feet [ft]) above mean sea level (msl) and a maximum elevation of about 5.5 m (18 ft) above msl. (AEC 1973)

PSEG owns approximately 300 hectares (740 acres) on the southern end of Artificial Island. The Salem and HCGS facilities occupy 151 hectares (373 acres) [89 hectares (220 acres) for Salem and 62 hectares (153 acres) for HCGS] in the southwestern corner of the island. The remainder of Artificial Island is undeveloped.

Adjacent land owners include the U.S. Government and the State of New Jersey. The northern portion of Artificial Island, a very small portion of which is within the State of Delaware boundary, and a 1.6-km-wide (1-mi-wide) inland strip of land abutting the island are owned by the U.S. Government (AEC 1973). The State of New Jersey owns the remainder of Artificial Island as well as much nearby inland property. Distance to the PSEG property boundary from the two Salem reactor buildings is approximately 1.3 km (4,200 ft). Distance to the PSEG property boundary from the HCGS reactor building is 902 meters (2,960 ft).

There are no major highways or railroads within about 11 km (7 mi) of the site. Land access is provided via Alloway Creek Neck Road to Bottomwood Avenue. Barge traffic has access to the site by way of the Intracoastal Waterway channel maintained in the Delaware River. (AEC 1973)

Figures 2-3 and 2-4 show the property boundaries and facility layouts for the Salem and HCGS facilities.

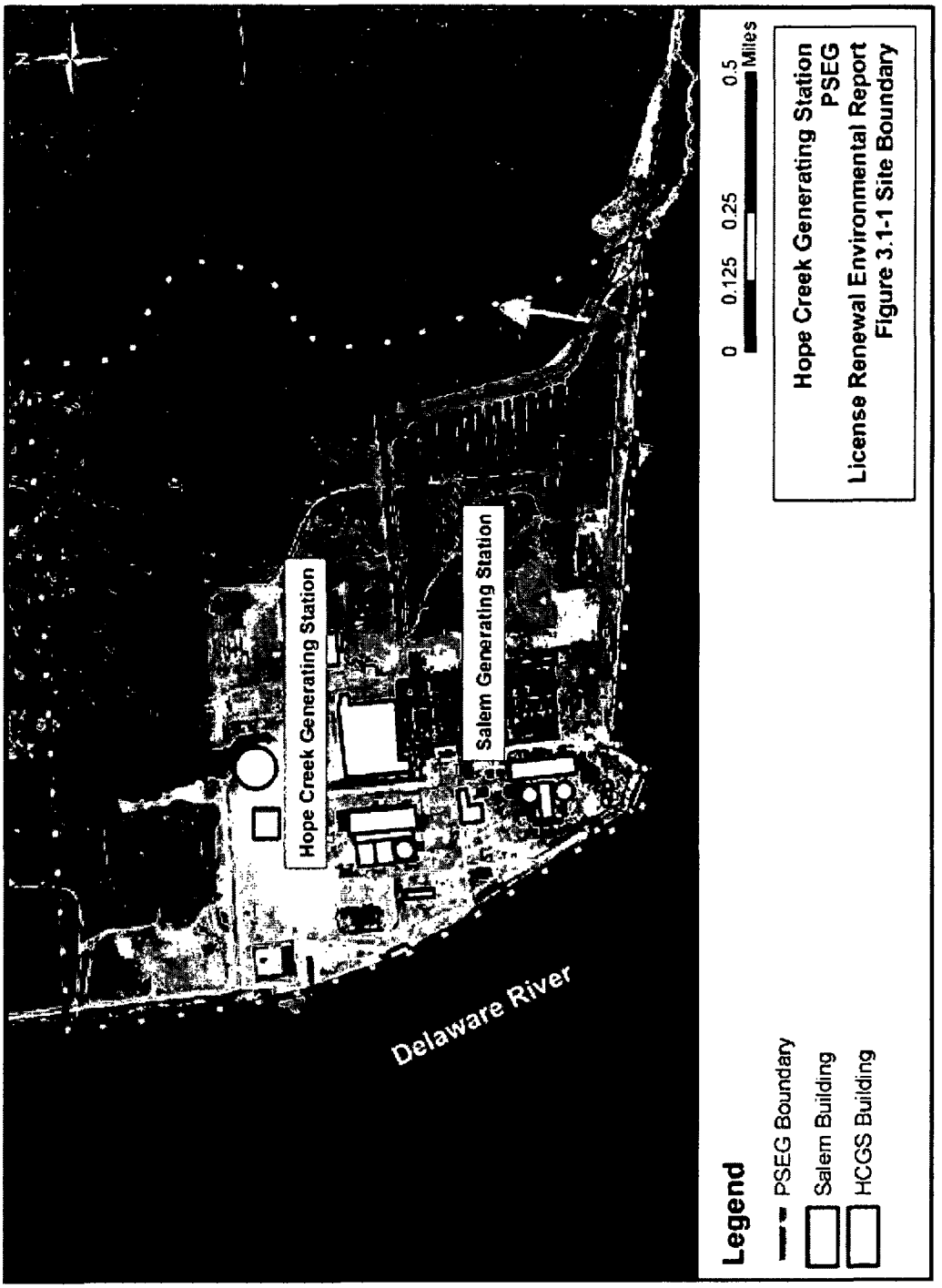



**Figure 2-2. Areal Photo (Source: _____)**

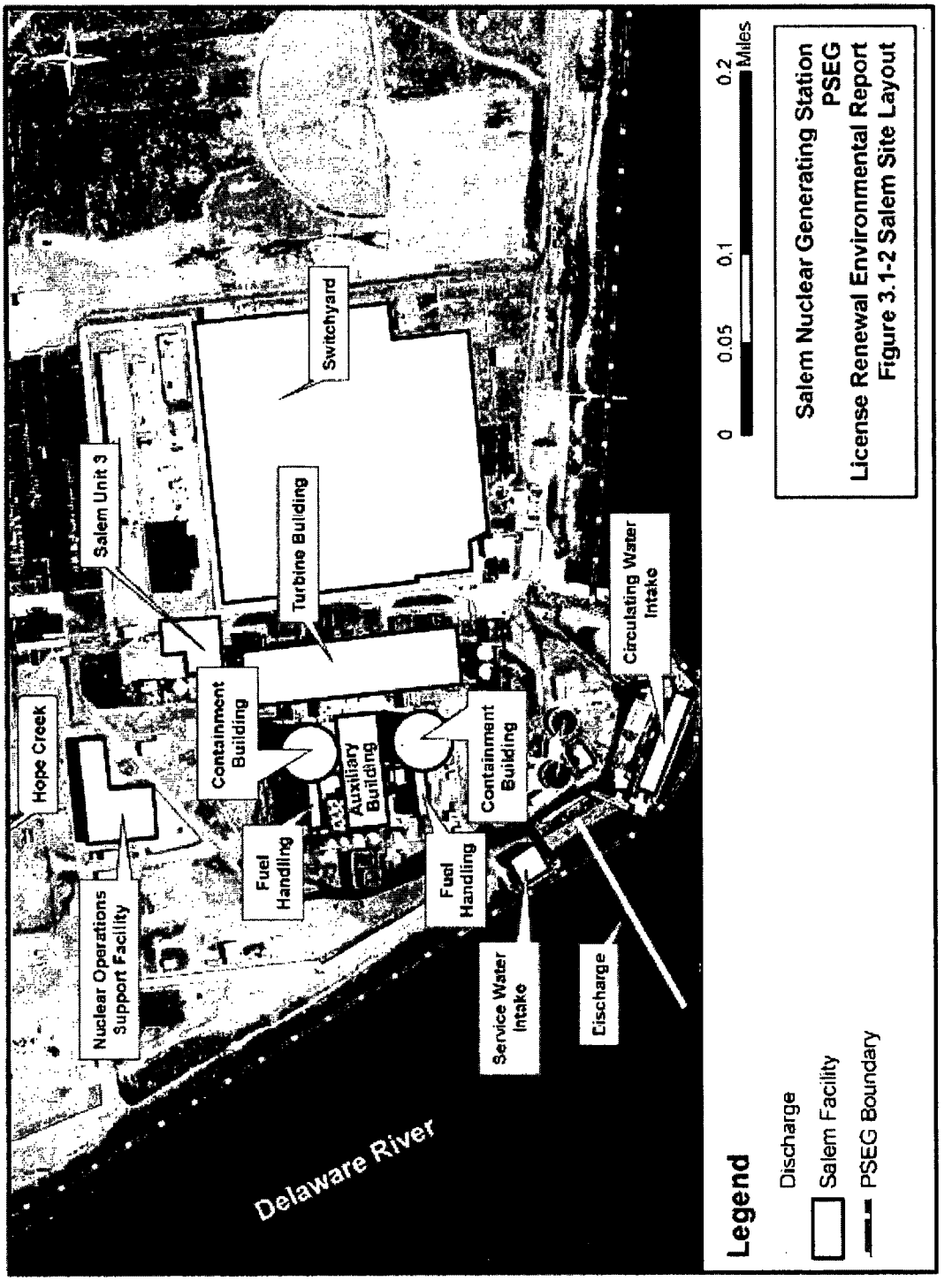



**Figure 2-3. Salem Facility Layout (Source: Salem ER)**

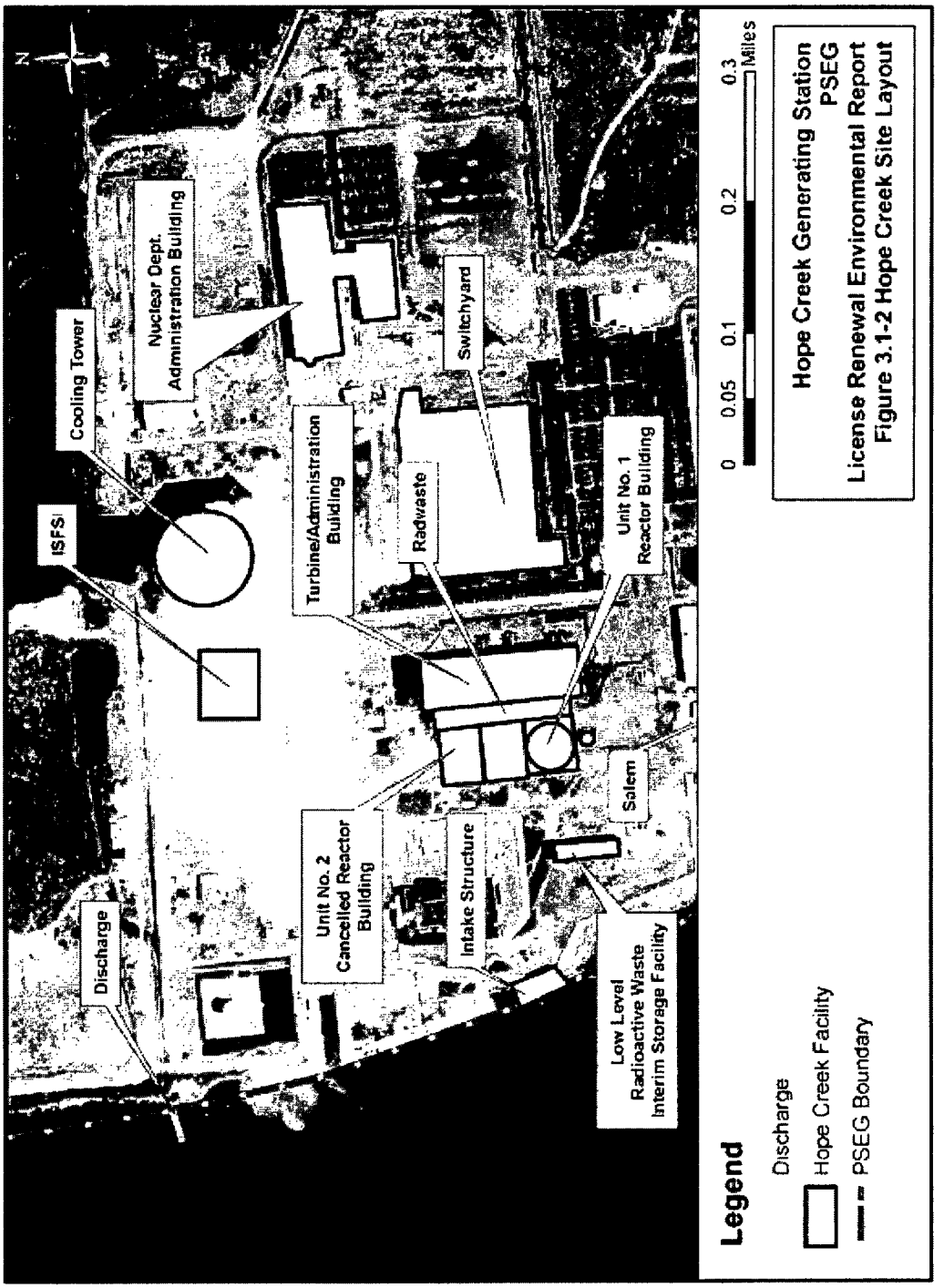



**Figure 2-4. HCGS Facility Layout (Source: _____)**

Three metropolitan areas lie within 50 miles of the PSEG site: Wilmington, Delaware, the closest city, approximately 15 miles to the northwest; Philadelphia, Pennsylvania, approximately 35 miles to the northeast; and Baltimore, Maryland, approximately 45 miles to the east-southeast (Figure 2-5 shows a map of the site within a 50-mile radius).

Industrial activities within 10 miles of the site are confined principally to the west bank of the Delaware River north of Artificial Island (Delaware City, New Castle, and Wilmington). There is

no significant industrial activity near the site. With little industry in the region, construction and retail trade account for nearly 40% of the revenues generated in the Salem County economy (USCB 2006 http://www.census.gov/epcd/nonemployer/2006/nj/NJ033.HTM ). Smaller communities in the vicinity of the site (Salem, NJ, Quinton, NJ, and Shenandoah, DE) consist of small retail businesses.

Located about two miles west of the site on the western shore of the Delaware River is the Augustine State Wildlife Management Area, a 2,667-acre wildlife management area managed by the Delaware Division of Fish and Wildlife (Delaware Division of Fish and Wildlife 2010 [L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference]). Southwest of the site, also on the Delaware side of the Delaware River, is the Appoquinimink Wildlife Area. Located less than a mile northeast of the site is the upper section of the Mad Horse Creek Fish and Wildlife Management Area. This is a non-contiguous 9,500-acre wildlife area managed by the New Jersey Division of Fish and Wildlife with sections northeast, east, and southeast of the site (New Jersey Division of Fish and Wildlife 2009; http://www.state.nj.us/dep/fgw/wmaland.htm; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference). Recreational activities at these wildlife areas within 10 miles of the site consist of boating, fishing, hunting, camping, hiking, picnicking, and swimming.

Salem currently employs a workforce of approximately 665 regular, full-time employees and HCGS currently employs a workforce of approximately 513 regular, full-time employees. The facilities share up to an additional 270 PSEG corporate and 86 matrixed employees (PSEG xxxx – Hope Creek ER; PSEG xxxx – Salem ER).

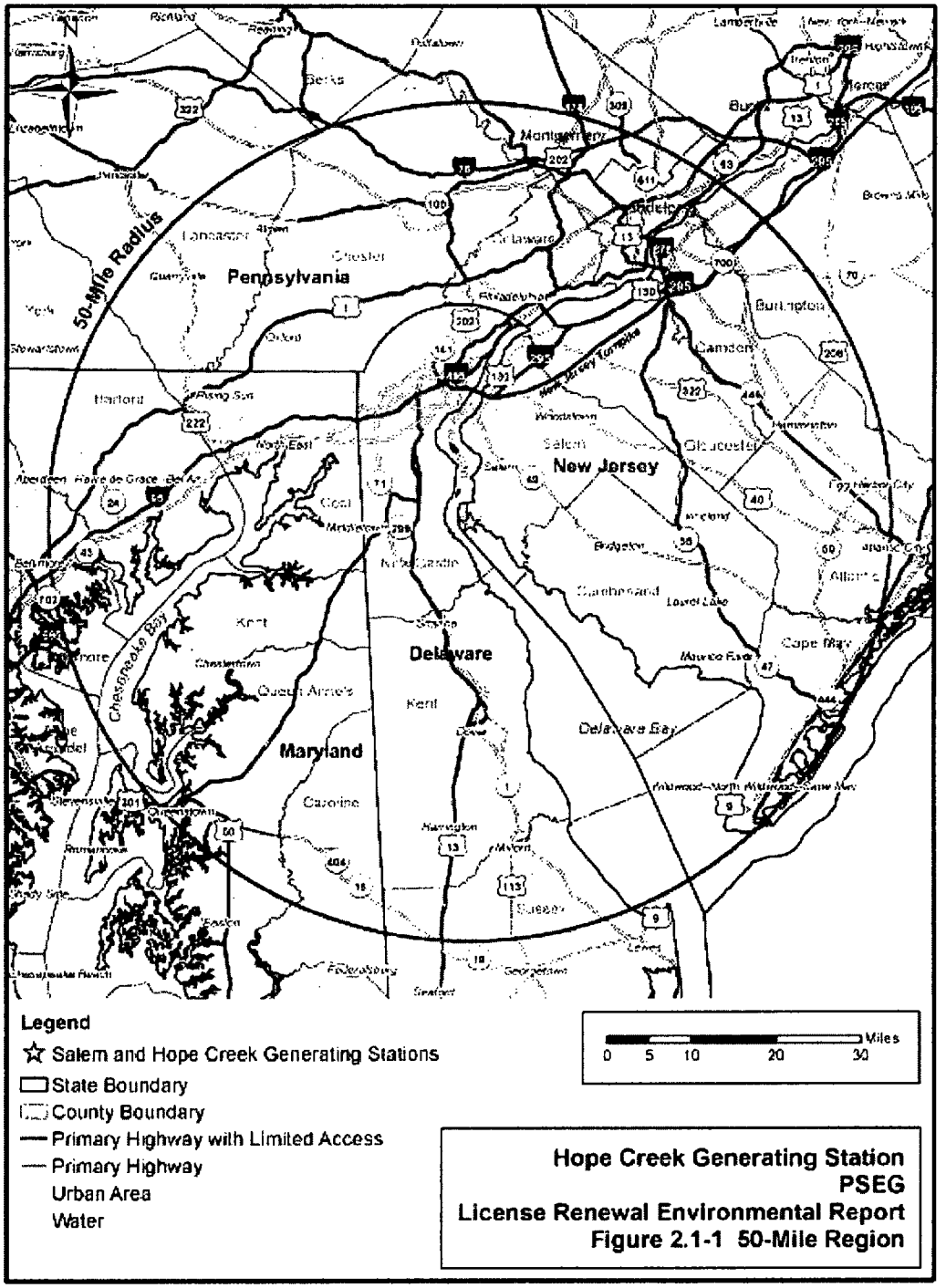



**Figure 2-5. Location of of Salem and HCGS Site, within a 50-Mile Radius (Source: _____)**

### 2.1.1 Reactor and Containment Systems

#### *2.1.1.1 Salem*

Salem is a two-unit plant utilizing pressurized water reactors (PWR) designed by Westinghouse Electric. Each unit has a current licensed thermal power at 100 percent power of 3,459 MWt (Salem ER). Salem Units 1 and 2 entered commercial service June 1977 and October 1981, respectively (Nuclear News 2009, L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference).

Each unit is licensed for 3,459 MWt. At 100 percent reactor power, the currently anticipated net electrical output is approximately 1,169 MWe for Unit 1 and 1,181 for Unit 2 (Nuclear News 2009). An air-cooled combustion turbine peaking unit rated at approximately 40 MWe (referred to as "Salem Unit 3") is also present. The Salem units have once-through circulating water systems for condenser cooling that withdraws brackish water from the Delaware Estuary through one intake structure located at the shoreline on the south end of the site (PSEG xxxx – Salem ER)

In the PWR power generation system (Figure 2._), reactor heat is transferred from the primary coolant to a lower pressure secondary coolant loop, allowing steam to be generated in the steam supply system. The primary coolant loops each contain one steam generator, two centrifugal coolant pumps, and the interconnected piping. Within the reactor coolant system (RCS), the reactor coolant is pumped from the reactor through the steam generators and back to the reactor inlet by two centrifugal coolant pumps located at the outlet of each steam generator. Each steam generator is a vertical straight tube-and-shell heat exchanger that produces superheated steam at a constant pressure over the reactor operating power range. The steam is directed to a turbine, causing it to spin. The spinning turbine is connected to a generator, which generates electricity. The steam is directed to a condenser where it cools and converts back to liquid water. This cool water is then cycled back to the steam generator, completing the loop. (NRC 2010a; http://www.nrc.gov/reactors/pwrs.html)

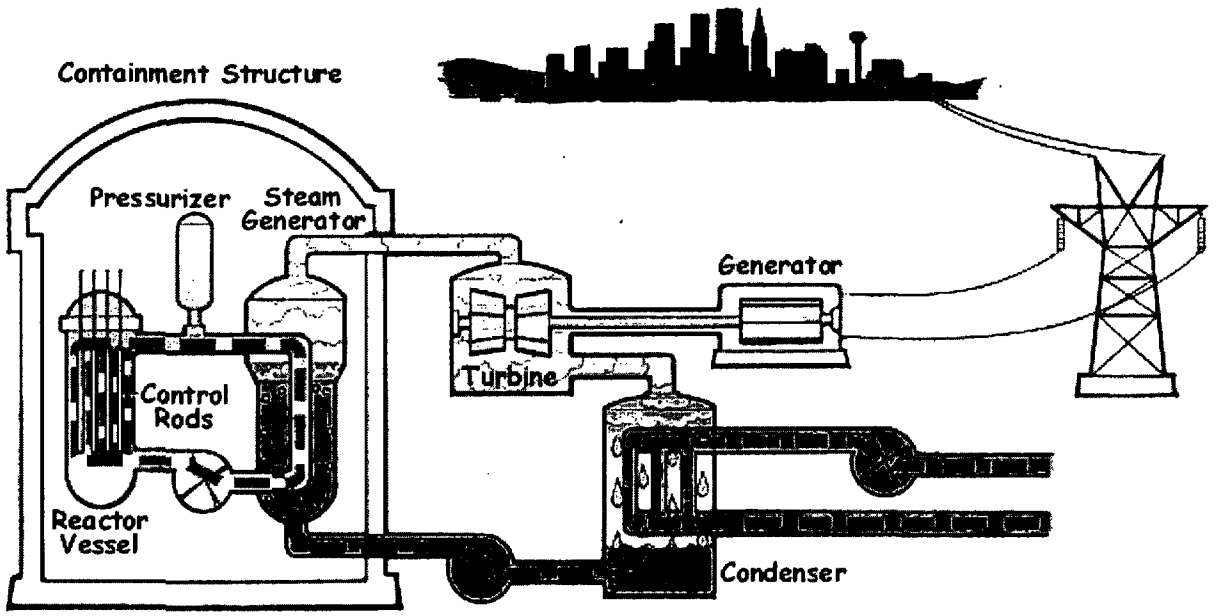



**Figure __. Simplified Design of a Pressurized Water Reactor (NRC 2010b, http://www.nrc.gov/reading-rm/basic-ref/students/animated-pwr.html)**

The secondary containment for radioactive material that might be released from the core following a loss-of-coolant accident are the units' independent Containment and Fuel Handling Buildings and their associated isolation systems. The structures serve as both a biological shield and a pressure container for the entire reactor cooling system. The reactor containment structures are vertical cylinders with 4.88 m (16 ft) thick flat foundation mats and 0.61 to 1.52 m

(2 to 5 ft) thick reinforced concrete slab floors topped with hemispherical dome roofs. The side walls of each building are 43.28 m (142 ft) high and the inside diameter is 42.67 m (140 ft). The concrete walls are 1.37 m (4.5 ft) thick and the containment building dome roofs are 1.07 m (3.5 ft) thick. The inside surface of the reactor building is lined with a carbon steel liner with a varying thickness of 0.25 inch (0.635 centimeter [cm]) to 0.5 inch (1.27 cm). (PSEG 2007a; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference)

The cores of the Salem reactors are moderated and cooled by light water ($^1H_2O$ as compared to heavy water, $^2H_2O$) at a pressure of 2250 psia. Boron is present on the light water coolant as a neutron absorber. A moderator, or neutron absorber, is a substance that slows the speed of neutrons increasing the likelihood of a fission of a uranium-235 atom in the fuel. The cooling water is circulated by the reactor coolant pumps. These pumps are vertical single stage centrifugal pumps equipped with controlled-leakage shaft seals. (PSEG 2007a)

Both Salem units utilize slightly enriched uranium-dioxide ($UO_2$) ceramic fuel pellets in zircaloy cladding (PSEG 2007a). Fuel pellets form fuel rods and fuel rods are joined together in fuel assemblies. The fuel assemblies consist of 264 fuel rods arranged in a square array. Salem uses fuel that is nominal enriched to 5.0 percent (percent uranium-235 by weight). The combined fuel characteristics and power loading result in a fuel burn-up of about 60,000 megawatt-days per metric ton uranium (Salem ER).

The original Salem steam generators have been replaced. In 1997, the Unit 1 steam generators were replaced and in 2008 the Unit 2 steam generators were replaced (Salem ER).

*2.1.1.2 Hope Creek*

HCGS is a one-unit station utilizing a boiling water reactor (BWR) designed by General Electric, and has a current licensed thermal power at 100 percent power of 3,840 MWt with an electrical output estimated to be approximately 1,083 MWe (NRC 2008; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference, Nuclear News 2009). HCGS has a closed cycle circulating water system for condenser cooling that consists of a natural draft cooling tower and associated withdrawal, circulation, and discharge facilities. HCGS withdraws brackish water with the Service Water System (SWS) from the Delaware Estuary (HC ER).

In the BWR power generation system (Figure 2._), heat from the reactor causes the cooling water which passes vertically through the reactor core to boil, producing steam. The steam is directed to a turbine, causing it to spin. The spinning turbine is connected to a generator, which generates electricity. The steam is directed to a condenser where it cools and converts back to liquid water. This cool water is then cycled back to the reactor core, completing the loop. (NRC 2010c; http://www.nrc.gov/reactors/bwrs.html)

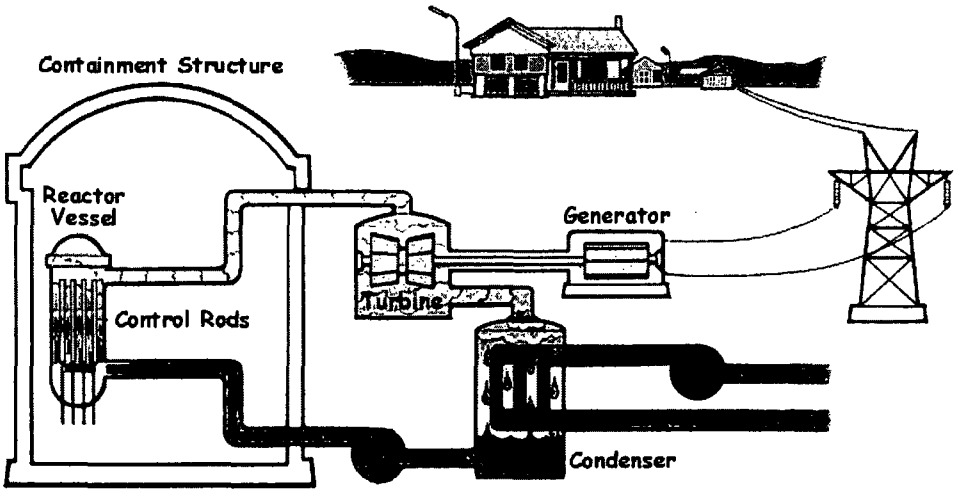



**Figure __. Simplified Design of a Boiling Water Reactor (NRC 2010d, http://www.nrc.gov/reading-rm/basic-ref/students/animated-bwr.html)**

The secondary containment for radioactive material that might be released from the core following a loss-of-coolant accident is the Reactor Building. The structure serves as both a biological shield and a pressure container for the entire reactor cooling system. The reactor building structure is a vertical cylinder with 4.28 m (14 ft) thick flat foundation mats and 0.61 to 1.52 m (2 to 5 ft) thick reinforced concrete slab floor. The side walls of the cylinder are approximately 72.2 m (250 ft) high, topped with torispherical dome roof, and surrounded by a rectangular structure that is up to 40.2 m (132 ft) tall. (PSEG 2006; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference).

The HCGS reactor utilizes slightly enriched uranium-dioxide ($UO_2$) ceramic fuel pellets in zircaloy cladding (PSEG 2007a). Fuel pellets form fuel rods and fuel rods are joined together in fuel assemblies. HCGS uses fuel that is nominal enriched to 5.0 percent (percent uranium-235 by weight) and the combined fuel characteristics and power loading result in a fuel burn-up of about 60,000 megawatt-days per metric ton uranium (NRC 2008).

### 2.1.2 Radioactive Waste Management

Radioactive wastes resulting from plant operations are classified as liquid, gaseous, or solid. Liquid radioactive wastes are generated from liquids received directly from portions of the reactor coolant system or were contaminated by contact with liquids from the reactor coolant system. Gaseous radioactive wastes are generated from gases or airborne particulates vented from reactor and turbine equipment containing radioactive material. Solid radioactive wastes are solids from the reactor coolant system, solids that came into contact with reactor coolant system liquids or gases, or solids used in the reactor coolant system or steam and power conversion system operation or maintenance.

The Salem and HCGS facilities include radioactive waste systems, which collect, treat, and provide for disposal of radioactive and potentially radioactive wastes that are byproducts of plant operations. Byproducts are activation products resulting from the irradiation of reactor water and

impurities therein (principally metallic corrosion products) and fission products resulting from defective fuel cladding or uranium contamination within the reactor coolant system. Radioactive waste system operating procedures ensure that radioactive wastes are safely processed and discharged from the plant within the limits set forth in 10 CFR Part 20, "Standards for Protection against Radiation," and 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

When reactor fuel has been exhausted, a certain percentage of its fissile uranium content is referred to as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced with fresh fuel assemblies during routine refueling outages, typically every 18 months. Spent fuel assemblies are stored in the spent fuel pool. Salem's spent fuel pool storage capacity for each unit is 1,632 fuel assemblies that will allow sufficient storage up to the year 2011 for Unit 1 and 2015 for Unit 2 (Salem ER). The HCGS spent fuel pool facility is designed to store up to 3,976 fuel assemblies (HC ER).

In 2005, the NRC issued a general license to PSEG authorizing that spend nuclear fuel could be stored at an Independent Spent Fuel Storage Installation (ISFSI) at the PSEG site. The general license allows PSEG, as a reactor licensee under 10 CFR 50, to store spent fuel from both HCGS and Salem at the ISFSI, provided that such storage occurs in pre-approved casks in accordance with the requirements of 10 CFR 72, subpart K (General License for Storage of Spent Fuel at Power Reactor Sites) (NRC 2005; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference). At this time, only the only spent fuel stored at the ISFSI in from Hope. However, transfers of spent fuel from the Salem spent fuel pool to the ISFSI are expected to begin approximately one year before the remaining capability of the pool is less than complete offload to spent fuel (HC ER).

#### 2.1.2.1 *Radioactive Liquid Waste*

Both the Salem and HCGS facilities operate systems to provide controlled handling and disposal of small quantities of low-activity liquid radioactive wastes generated during station operation. However, because the Salem units are cooled by a once-through RCS and the HCGS unit is cooled by a closed cycle RCS, the management of potentially radioactive liquids is different. Potentially radioactive liquid waste streams at the Salem facility are managed by the Radioactive Liquid Waste System (RLWS) and the Chemical and Volume Control System (CVCS). At HCGS, potentially radioactive liquid waste streams are managed under the Liquid Waste Management System (LWMS) respectively.

The bulk of the radioactive liquids discharged from the Salem RCS is processed and retained inside the plant by the CVCS recycle train. This minimizes liquid input to the RLWS. Radioactive fluids entering the RLWS are collected in tanks, sampled, and analyzed to determine the quantity of radioactivity with an isotopic breakdown, if necessary. Based on the results of the

analysis, the waste is processed prior to releasing them to the Delaware Estuary via the circulating water system. Releases are controlled as required by regulation. Discharge streams are appropriately monitored, and safety features are incorporated to preclude releases in excess of the limits of 10 CFR 20. (Salem ER)

Potentially radioactive liquid wastes entering the HCGS LWMS are collected in tanks in the Auxiliary Building. Radioactive contaminants are removed from the wastewater either by demineralization or filtration. This ensures that the water quality is restored prior to being returned to the condensate storage tank (CST) or discharged via the cooling tower blowdown line to the Delaware Estuary via a permitted outfall. If the liquid is recycled to the plant, it meets the purity requirements for CST makeup. Liquid discharges to the Delaware Estuary are maintained in compliance with 10 CFR 20, *Standards for Protection Against Radiation.* (HC ER)

Both Salem and HCGS release liquid effluents into the environment. Rereleases are controlled and monitored. Doses from these releases represent a fraction of the regulatory allowable 100 millirem per year (mrem/yr) doses specified in the facility operating license and NRC regulations. Radiological monitoring began in 1968. Monitoring results are presented in the Radiological Environmental Monitoring Program reports. The NRC staff reviewed the Salem/ HCGS radioactive effluent release reports for 2004 through 2009 for liquid effluents were reviewed by the NRC Staff (Staff) (References we have PSEG 2007b at L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference\Env Monitoring Reports and the NRC has other 2004-2008 reports and we will get the 2009 report at the audit).

Radioactivity removed from the liquid wastes is concentrated in the filter media and ion exchange resins, which are managed as solid radioactive wastes.

2.1.2.2 *Radioactive Gaseous Waste*

The Salem and HCGS radioactive gaseous waste disposal systems process and dispose of routine radioactive gaseous effluent to the atmosphere. Gaseous wastes are processed through to reduce radioactive materials in gaseous effluents before discharge to meet the dose limits in 10 CFR Part 20 and the dose design objectives in Appendix I to 10 CFR Part 50.

At both facilities radioactive gases are collected gaseous waste so that the short-lived gaseous isotopes (principally air with traces of krypton and xenon) are allowed to decay. At Salem, these gasses are collected in tanks in the Auxiliary Building and released intermittently in a controlled manner. At HCGS, gasses are held up in holdup pipes prior to entering a treatment section where adsorption of gases on charcoal provides additional time for delay. At HCGS, gases are then filtered using high efficiency particulate air (HEPA) filters prior to being released to the atmosphere from the north plant vent.

Radioactive effluent release reports for 2004 through 2009 for gaseous effluents were reviewed by the Staff (References we have PSEG 2007b at L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference\Env Monitoring Reports and the NRC has other 2004-2008 reports and we will get the 2009 report at the audit). While variations in total effluents and effluent concentrations can

vary from year to year due to outages and plant performance, based on the gaseous waste processing system's performance from 2004 through 2008, the gaseous discharges for 2009 are consistent with prior year effluents. The NRC identified no unusual trends.

2.1.2.3 *Radioactive Solid Waste*

Solid radioactive waste generated at the Salem and HCGS facilities' are managed by a single Solid Radioactive Waste System. This System manages radioactive solid waste, including packaging and storage, until the waste is shipped offsite. Offsite, wastes are processed by volume reduction and/or shipped for disposal at a licensed disposal facility.

The State of South Carolina's licensed low-level radioactive waste (LLW) disposal facility, located in Barnwell, has limited the access from radioactive waste generators located in states that are not part of the Atlantic Low-Level Waste Compact. New Jersey is a member of the Atlantic Interstate Compact and has access to the Barnwell Low Level Radioactive Waste facility (Barnwell). Shipments to Barnwell include spent resins from the demineralizers and filter cartridges (wet processing waste). To control releases to the environment, these wastes are packaged in the Salem and HCGS Auxiliary Buildings.

The PSEG Low Level Radwaste Storage Facility (LLRSF) supports normal Dry Active Waste (DAW) handling activities for HCGS and Salem. DAW consists of compactable trash such as contaminated or potentially contaminated rags, clothing, and paper. This waste is generally bagged, placed in Sea-van containers, and stored prior to being shipped for volume reduction by a licensed off-site vendor. The volume-reduced DAW is repackaged at the vendor and shipped for disposal at a licensed low-level waste disposal facility (Salem and HC ERs). DAW and other non-compactable contaminated wastes are typically shipped to the Energy*Solutions* Class A disposal facility in Clive, Utah.

The LLRSF also maintains a NRC-approved Process Control Program. The Process Control Program helps to ensure that waste is properly characterized, profiled, labeled, and shipped in accordance with the waste disposal facility's waste acceptance criteria and U.S. Department of Transportation (DOT) and NRC requirements. The NRC staff has reviewed the LLRSF procedures and has found that the LLRSF performs _____ and was used for temporary staging of DAW before preparation for shipment and disposal. *The LLRSF was designed to provide a controlled but ready access for material handling operations, to ensure that worker radiation exposures are controlled in accordance with the ALARA criteria, and to ensure that the offsite dose does not exceed any of the Federal limits specified in 10 CFR Part 20, as well as the EPA radiation standards in 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations.*

*LLRSF LLW reports for ____ through 2009 were reviewed by the Staff (_____). The solid waste volumes and radioactivity amounts generated in 2009 are typical of previous annual*

*waste shipments. Variations in the amount of solid radioactive waste generated and shipped from year to year are expected based on the overall performance of the plant and the number and scope of outages and maintenance activities. The volume and activity of solid radioactive wastes reported are reasonable and no unusual trends were noted.* ***There could be some differences in the last 2 years based adjustments in shipping/receiving operations at Barnwell.***

No plant refurbishment activities were identified by the applicant as necessary for the continued operation of either Salem or HPGS through the license renewal terms. Routine plant operational and maintenance activities currently performed will continue during the license renewal term. Based on past performance of the radioactive waste system, and the lack of any planned refurbishment activities, similar amounts of radioactive solid waste are expected to be generated during the license renewal term.

2.1.2.4 *Mixed Waste*

The term "mixed waste" refers to waste that contain both radioactive and hazardous constituents. Neither Salem nor HCGS have processes that generate mixed wastes and there are no mixed wastes stored at either facility.

### 2.1.3 Nonradioactive Waste Management

The Resources Conservation and Recovery Act (RCRA) governs the disposal of solid and hazardous waste. RCRA regulations are contained in Title 40, "Protection of the Environment," Parts 239 through 299 (40 CFR 239, et seq.). Parts 239 through 259 of these regulations cover solid (nonhazardous) waste, and Parts 260 through 279 regulate hazardous waste. RCRA Subtitle C establishes a system for controlling hazardous waste from "cradle to grave," and RCRA Subtitle D encourages States to develop comprehensive plans to manage nonhazardous solid waste and mandates minimum technological standards for municipal solid waste landfills.

RCRA regulations are administered by New Jersey Department of Environmental Protection (NJ DEP) and address the identification, generation, minimization, transportation, and final treatment, storage, or disposal of hazardous and nonhazardous wastes. Salem and HCGS generate nonradiological waste including *oils, hazardous and nonhazardous solvents and degreasers, laboratory wastes, expired shelf-life chemicals and reagents, asbestos wastes, paints and paint thinners, antifreeze, non-routine (i.e., project-specific) wastes, point-source discharges regulated under the National Pollutant Discharge Elimination System (NPDES), sanitary waste (including sewage), and routine, daily refuse (_____).*

2.1.3.1 *Hazardous Waste*

The EPA classifies certain nonradioactive wastes as "hazardous" based on characteristics including ignitability, corrosivity, reactivity, or toxicity (identification and listing of hazardous waste is available in 40 CFR Part 261). State-level regulators may add wastes to the EPA's list of hazardous wastes. RCRA provides standards for the treatment, storage, and disposal of hazardous waste for hazardous waste generators (40 CFR Part 262). The Salem and HCGS facilities generate small amounts of hazardous wastes including spent and expired chemicals, laboratory chemical wastes, and occasional project-specific wastes.

According to the EPA Envirofacts Warehouse: *PSEG currently is a conditionally exempt small-quantity hazardous waste generator, generating less than 100 kilograms/month (220*

*pounds/month)* (EPA Registry ID No. 110015068987 – PSEG Nuclear Corp Hope Creek Salem Generating Station). Conditionally exempt small quantity generators (CESQGs) generate 220 pounds (100 kg) or less per month of hazardous waste, or 2.2 pounds (1 kg) or less per month of acutely hazardous waste, or less than 220 pounds (100 kg) per month of acute spill residue or soil. *Because of episodic generation of hazardous wastes, during outages for example, PSEG maintains the program required of a small-quantity generator and monitors the amount of hazardous waste generated each month to determine the correct status. Hazardous waste is disposed of through a licensed broker. (Salem ER)*

The EPA authorized the State of New Jersey to regulate and oversee most of the solid waste disposal programs, as recognized by Subtitle D of the RCRA. Compliance is assured through State-issued permits. _____ showed no violations for PSEG (_____). During the site audit, the NRC viewed the PSEG hazardous waste storage ____, which is a central facility designed for the safe and proper collection, sorting, packaging, and shipment of hazardous wastes. Also during the site audit, NRC staff reviewed PSEG's hazardous waste procedures and determined they complied with applicable RCRA regulations.

Used oil, produced during facility operations, is sent _____ to the EPA-approved hazardous waste disposal facility (_____).

*Under the Emergency Planning and Community Right-to-Know Act (EPCRA), applicable facilities are required to provide information on hazardous and toxic chemicals to local emergency planning authorities and the EPA (Title 42, Section 11001, of the United States Code (U.S.C.) (42 U.S.C. 11001)). On October 17, 2008, the EPA finalized several changes to the Emergency Planning (Section 302), Emergency Release Notification (Section 304), and Hazardous Chemical Reporting (Sections 311 and 312) regulations that were proposed on June 8, 1998 (63 Federal Register (FR) 31268). PSEG is subject to Federal EPCRA reporting requirements, and thus submits an annual Section 312 (TIER II) report on hazardous substances to local emergency agencies.*

#### 2.1.3.2 *Solid Waste*

A solid waste is defined by N.J.A.C. 7:26-1.6. as "any garbage, refuse, sludge, or any other waste material except it shall not include the following: 1. Source separated food waste collected by livestock producers, approved by the State Department of Agriculture, who collect, prepare and feed such wastes to livestock on their own farms; 2. Recyclable materials that are exempted from regulation pursuant to N.J.A.C. 7:26A; [and] 3. Materials approved for beneficial use or categorically approved for beneficial use pursuant to N.J.A.C. 7:26-1.7(g)." The definition of solid waste in N.J.A.C. 7:26-1.6. applies only to wastes that are not also defined as hazardous in accordance with N.J.A.C. 7:26G.

Solid waste is segregated and about 55 percent is transferred to recycling vendors (Salem ER). The remaining volume of solid waste is disposed at a local landfill. In ____ PSECG generated approximately __ tons (t) (__ MT) of solid waste.

#### 2.1.3.3 *Universal Waste*

In accordance with N.J.A.C. 7:26G-4.2, "Universal waste" means any of the following hazardous wastes that are managed under the universal waste requirements of N.J.A.C. 7:26A-7, whether

incorporated prospectively by reference from 40 C.F.R. Part 273, "Standards for Universal Waste Management," or listed additionally by the NJ DEP: paint waste, batteries, pesticides, thermostats, fluorescent lamps, mercury-containing devices, oil-based finishes, and consumer electronics.

PSEG is a small quantity handler of universal waste (meaning the facility cannot accumulate more than 5000 kilograms (approximately 11,000 pounds) of universal waste at any one time), generating common operational wastes such as lighting ballasts containing polychlorinated biphenyls (PCBs), lamps, and batteries. In ____ PSEG generated approximately ____ pounds (___ kilograms) of universal wastes. Universal waste is segregated and disposed of through a licensed broker.

2.1.3.4 *Permitted Discharges*

Salem facility maintains a New Jersey Pollutant Discharge Elimination System (NJPDES) permit, NJ 0005622, which authorizes the discharge of wastewater to the Delaware Estuary and stipulates the conditions of the permit. HCGS maintains a separate NJPDES permit, NJ 0025411 for discharges to the Delaware Estuary. All monitoring shall be conducted in accordance with the NJ DEP's "Field Sampling Procedures Manual" applicable at the time of sampling (N.J.A.C. 7: 14A-6.5(b)4), and/or 2) the method approved by the NJ DEP in Part IV of the site permits (NJ DEP 2003; Fact Sheet, Section 5, page 5 0(28 - Station Outfalls and Discharge Components; we have requested this for the site audit)

*A common sewage treatment system located at HCGS and operated by HCGS staff treats domestic wastewater from both HCGS and Salem. Wastewater and activated sludge are introduced into the single-channel oxidation ditch where extended aeration, a modification of the activated sludge process, oxidizes the organic constituents of the wastewater. This process lowers Biochemical Oxygen Demand (BOD), reduces suspended solids, nitrifies, and partially denitrifies the wastewater. Rotor aerators mix air into the contents of the basin and keep the contents moving through the oxidation ditch. Following aeration, mechanical settling in the biological clarifiers separates suspended solids from the liquid flow. The settled solids (i.e., sludge) are either returned to the oxidation ditch or removed to a sludge-holding tank, based upon process requirements. Sludge directed to the sludge-holding tank is aerated and dewatered before being trucked offsite to a licensed disposal facility, or to an NRC-licensed facility if the residuals contain low levels of radioactivity. The sewage treatment system waste stream is a facility internal outfall monitored in accordance with the current Hope Creek NJPDES Permit (No. _____). The sewage treatment system effluent discharges through the Hope Creek cooling tower blowdown outfall to the Delaware Estuary. Residual cooling tower blowdown dechlorination chemical, ammonium bisulfite, de-chlorinates the sewage treatment effluent. (NJDEP 2002, Tab DSN 462B – Sewage Treatment System [Explanation of Summary Notes]).* The sewage treatment plant averages approximately _____ gallons (_____ liters [L]) of effluent per day.

*A common chemical waste treatment system, known as the Non-Radioactive Liquid Waste Disposal System (NRLWDS), is located at Salem and operated by Salem staff. The NRLWDS collects and treats secondary plant wastewater from HCGS and Salem which may contain chemicals, especially acidic and caustic wastewater, prior to discharge. The NRLWDS processes and treats the non-radioactive low-volume wastes from various Station processes, such as demineralizer regenerations, steam generator blowdown, chemical handling operations, and reverse osmosis reject waste. The NRLWDS discharge commingles with the non-contact cooling water prior to discharge to the environment. Treatment processes include thorough*

*mixing in an equalization-mixing basin to provide homogeneity and some self-neutralization of acid and caustic wastes, solids removal by settling, chlorination, and pH adjustment to induce precipitation of any remaining metals prior to commingling with cooling water for ultimate discharge to the Delaware Estuary. The outfall is monitored in accordance with the current Hope Creek NJPDES Permit (No. _____). (PSEG 2007c; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference)*

*At HCGS, the low-volume and oily waste system collects and treats potentially oily wastewater from area, building, and equipment drains throughout the site. Collected waste streams are processed through an API-type oil water separator for removal of solid and floatable materials. Treated effluent is then discharged through the internal monitoring point which is combined with cooling tower blowdown before discharge to the Delaware Estuary. The outfall is monitored in accordance with the current Hope Creek NJPDES Permit (No. _____).*

Section 2.1.7of this report provides more information on site's NPDES permits and effluent limitations.

2.1.3.5 *Pollution Prevention and Waste Minimization*

There is no information in the Salem or HC ERs on pollution prevention.

### 2.1.4 Facility Operation and Maintenance

Various types of maintenance activities are performed at the Salem and HCGS facilities, including inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements. Various programs and activities currently exist at Salem and HCGS to maintain, inspect, test, and monitor the performance of facility equipment. These maintenance activities include inspection requirements for reactor vessel materials, boiler and pressure vessel in-service inspection and testing, a maintenance structures monitoring program, and maintenance of water chemistry.

Additional programs include those implemented in response to NRC generic communications, those implemented to meet technical specification surveillance requirements, and various periodic maintenance, testing, and inspection procedures. Certain program activities are performed during the operation of the unit, while others are performed during scheduled refueling outages. Nuclear power plants must periodically discontinue the production of electricity for refueling, periodic in-service inspection, and scheduled maintenance. Salem and HCGS are on an 18-month refueling cycle (Salem ER, HC ER).

Aging effects at Salem and HCGS are managed by integrated plant assessments required by 10 CFR 54.21. These programs are described in Section 2 of the facilities' Nuclear Generating Station License Renewal Applications - Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results (Salem ER, HC ER).

### 2.1.5 Power Transmission System (see also Power Transmission System.docx by Meredith Herndon)

Salem and HCGS are connected to the regional grid via four, 500-kilovolt (kV) transmission lines. Transmission lines in New Jersey are owned by PSEG and Pepco Holdings, Inc. (PHI) owns transmission lines in Delaware. Transmission lines considered in scope for license renewal are those constructed to connect the facility to the transmission system (10 CFR 51.53(c)(3)(ii)(H)); therefore, details are provided for the four lines that are considered in scope.

The transmission lines of interest are provided in Tale 2-1 and they shown in Figure 2-XX. In total, 171 km (106 mi) of transmission lines occupy about 1,720 hectares (4,250 acres) of transmission line corridor or right-of-way. While on Artificial Island, these corridors cross the marshes and wetlands north and east. Once leaving these areas, the transmission lines primarily traverse low population forested, agricultural, and some residential land and terminate in more urban areas. The transmission lines cross several major roadways including State Highway 55, U.S. Highway 40, and the Atlantic City Expressway to the east and U.S. Highway 13 to the northwest (Salem ER, HC ER).

*_____ has vegetative maintenance procedures in place to prevent vegetation from interfering with the lines (_____). ROW vegetative maintenance practices use an integrated vegetation management approach that includes both mechanical and chemical control methods. Mechanical methods consist primarily of mowing, with supplementary pruning, felling, and hand trimming as needed. Chemical control methods consist of application of EPA-approved herbicides and tree-growth-regulating chemicals (_____). Procedures are in place to manage environmental incidents that might occur within the ROW, such as a chemical buildup in a wetland area. _____, in conjunction with _____ staff, limits erosion around stream crossings and wetlands by using appropriate procedures and methods. ROWs that cross farmland or pastures are not maintained by _____, as the land is cultivated by the local farmers. _____ will maintain the existing ROWs regardless of whether operating licenses are renewed (_____). (Copied from TMI SEIS)*

*All transmission lines were designed and built in accordance with industry standards in place at the time of construction. All transmission lines will remain a permanent part of the transmission system and will be maintained by _____ regardless of _____ continued operation (_____); however, the _____ lines, would be deactivated if the _____ switchyard were no longer in use and would need to be reconnected to the grid if they were to remain in service beyond the operation of _____. (Copied from DA SEIS)*

**Table 2-1. Transmission Lines Associated with the Salem and HCGS Facilities (Salem and HCGS ERs)**

| Name | Voltage (kV) | Length and Direction | Corridor Width | Originates From | Terminates At | Operated By |
|---|---|---|---|---|---|---|
| Salem-New Freedom North | 500 | 63 km (39 mi) Northeast | 107 m (350 ft) | HCGS | New Freedom Switching Station[a] | PSEG |
| Salem-New Freedom South | 500 | 68 km (42 mi) Northeast | 107 m (350 ft) | Salem | New Freedom Switching Station[a] | PSEG |
| Salem-Keeney | 500 | 27 km (17 mi) North | 61 m (200 ft) and 107 m (350 ft)[b] | HCGS | Red Lion Substation | PSEG (in NJ) & PHI (in DE) |
| Red Lion-Keeney | 500 | 13 km (8 mi) Northwest | 61 m (200 ft) and 107 m (350 ft)[b] | Red Lion Substation | Keeney Substation | PHI |
| HCGS-New Freedom | 500 | 69 km (43 mi)[c] Northeast | 107 m (350 ft) | HCGS | New Freedom Switching Station[a] | PSEG |
| HCGS-Salem | 500 | 610 m (2,000 ft)[d] | NA | NA | NA | PSEG |

[a] North of Williamstown, New Jersey.

[b] Two thirds is 61 m (200 ft) wide and the remainder is 107 m (350 ft) wide.

[c] During 2008, a new substation (Orchard) was installed along this line, dividing it into two segments.

1 [d] Does not pass beyond the site boundary.

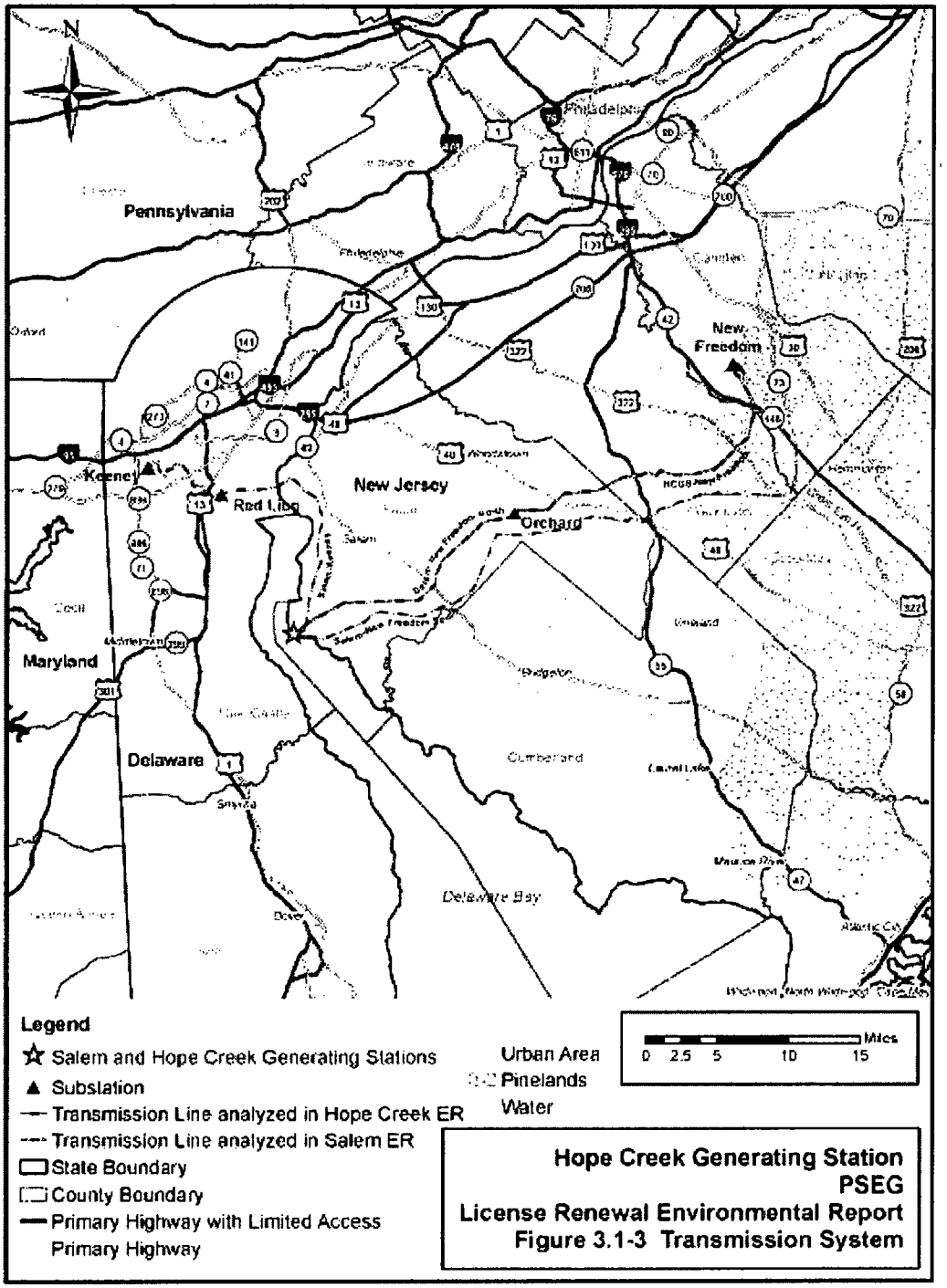



**Figure 2-XX. Salem and HCGS Transmission Line System (Source: _____)**

### 2.1.6 Cooling and Auxiliary Water Systems

Salem and HCGS use different types of cooling water systems (CWS) for condenser cooling but both withdraw from and discharge water to the Delaware Estuary. Salem Units 1 and 2 use once-through circulating water systems. HCGS uses a closed-cycle system that employs a single natural draft cooling tower. Unless otherwise noted, the discussions below were adapted from the Salem and HCGS ERs (Salem and HC ERs), or information gathered at the site audit.

Both sites use groundwater as the source for fresh potable water, fire protection water, industrial process make-up water, and for other sanitary water supplies. Under authorization from the NJDEP (NJDEP 2004; *L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference*) and DRBC (DRBC 2000; *L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference*), PSEG can services both facilities with up to 163 million liters (43.2 million gallons) of groundwater per month.

Discussions on surface water and groundwater use and quality are provided in Section 2.1.7.

*2.1.6.1 Salem*

The Salem facility includes two intake structures, each equipped with equipment used to remove debris and biota from the intake water stream (i.e., removable ice barriers, trash racks, traveling screens, and a fish return system). Equipment designed for the protection of wildlife is described in detail in Section _____. The CWS withdraws brackish water from the Delaware Estuary using 12 circulating water pumps through a 12-bay intake structure located on the shoreline at the south end of the site and discharges water north on the CWS intake structure via a discharge pipe that extends 152 m (500 ft) from the shore line. Heavy duty trash racks protect the circulating water pumps and traveling screens from damage by large debris. The trash racks are constructed of 1.27-cm (0.5-in.) wide steel bars with slot opening that are 7.6 cm (3 in) wide. No biocides are required in the CWS.

The CWS provides approximately 3,974,670 liters per minute (lpm) (1,050,000 gallons per minute [gpm]) to each of Salem's two reactor units. The total design flow is 4,201,794 lpm (1,110,000 gpm) through each unit. The intake velocity is approximately 0.3 meters per second (1 ft per second [fps]) at mean low tide, a rate that is compatible with the protection of aquatic wildlife (EPA 2001; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference). The CWS provides water to the main condenser to condense steam from the turbine and the heated water is returned back to Estuary (flow path shown in the lower right of Figure 2-_).

Approximately 122 m (400 ft) north of the CWS intake structure, a separate intake structure withdraws water for the SWS which supplies cooling water to the reactor safeguard and auxiliary systems. The structure contains four bays, each containing three pumps. The 12

service-water pumps have a total design rating of 493,922 liters per minutes (130,500 gpm). The average velocity throughout the SWS intake is less than 0.3 m per second (1 fps) at the design flow rate. Like the CWS intake structure, the SWS intake structure is equipped with trash racks, traveling screens, and filters to remove debris and biota from the intake water stream. Debris collected from the system is removed and transported to a landfill for disposal. Backwash water is returned to the Estuary.

To prevent organic buildup and biofouling in the heat exchangers and piping of the SWS, sodium hypochlorite is injected into the system. SWS water is discharged via the discharge pipe shared with the CWS. Residual chlorine levels are maintained in accordance with the site's are NJPDES Permit.

*2.1.6.2 Hope Creek*

HCGS uses a single intake structure to supply water from the Delaware Estuary to the SWS. The intake structure consists of four active bays that are equipped with pumps and associated equipment (trash racks, traveling screens, and a fish-return system) and four empty bays that were originally intended to service a second reactor which was never built. Water is drawn into the SWS at a rate of 0.09 meters per second (0.3 fps) passing through trash racks and traveling screens. Equipment designed for the protection of wildlife is described in detail in Section _____. After passing through the traveling screens, the estuary water enters the service water pumps. Depending on the temperature of the Delaware Estuary water, two or three pumps are normally needed to supply service water. Each pump is rated at 62,459 lpm(16,500 gpm). To prevent organic buildup and biofouling in the heat exchangers and piping of the SWS, sodium hypochlorite is continuously injected into the system.

Water is them pumped into the stilling basin in the pump house. The stilling basin supplies water to the general SWS and the fire protection system. The stilling basin also supplies water for back-up residual heat removal service water and for emergency service water.

The SWS also provides makeup water for the CWS by supplying water to the cooling tower basin. The cooling tower basin contains approximately 34 million liters (9 million gallons) of water and provides approximately 2.317 million lpm (612,000 gpm) of water to the CWS via four pumps. The CWS provides water to the main condenser to condense steam from the turbine and the heated water is returned back to Estuary (flow path shown in the lower right of Figure 2-_).

The HCGS cooling tower is a 512-foot high single counterflow, hyperbolic, natural draft cooling tower (PSEG 2008; L:\work\114570\WP\Pre-Audit Draft\Chapter 2 Reference). While the CWS

is a closed-cycle system, water is lost due to evaporation. Monthly losses average from 36,340 lpm (9,600 gpm) in January to 49,210 lpm (13,000 gpm) in July. Makeup water is provided by the SWS.

# 3.0 ENVIRONMENTAL IMPACTS OF REFURBISHMENT

License renewal actions include refurbishment actions for the extended plant life. These actions may have an impact on the environment that requires evaluation, depending on the type of action and the plant-specific design. If such actions were planned, the potential environmental effects of refurbishment actions would be identified and the analysis would be summarized within this section.

Environmental issues associated with refurbishment activities are discussed in the "Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants", NUREG-1437, Vol. 1 and 2 (U.S. Nuclear Regulatory Commission (NRC) 1996, 1999).[1] The GEIS includes a determination of whether or not the analysis of the environmental issues can be applied to all plants and whether or not additional mitigation measures are warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system, or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this supplemental environmental impact statement (SEIS) unless new and significant information is identified. Category 2 issues are those that do not meet one or more of the criteria for Category 1 and, therefore, an additional plant-specific review of these issues is required. Environmental issues associated with refurbishment, which were determined to be Category 1 and Category 2 issues, are listed in Tables 3-1 and 3-2, respectively.

Requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) pursuant to Section 54.21 of Title 10 of the Code of Federal Regulations (CFR). The IPA must identify and list systems, structures, and components subject to an aging management review. The GEIS (NRC, 1996) provides helpful information on the scope and preparation of refurbishment activities to be evaluated. Environmental resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources. Items that are subject to aging and might require refurbishment include, for example,

1 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.

the reactor vessel piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as items that are not subject to periodic replacement.

PSEG Nuclear, LLC (PSEG) performed IPAs on Salem Nuclear Generating Station, Units 1 and 2 (Salem) and Hope Creek Generating Station (HCGS) pursuant to 10 CFR 54.21. This assessment did not identify the need to undertake any major refurbishment or replacement actions to maintain the functionality of important systems, structures, and components during the Salem or HCGS license renewal periods or other facility modifications associated with license renewals that would affect the environment or plant effluents (PSEG 2009a, PSEG 2009b); therefore, an assessment of refurbishment activities is not considered in this SEIS.

**Table 3-1. Category 1 Issues for Refurbishment Evaluation**

| ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1 | GEIS Sections |
|---|---|
| **Surface Water Quality, Hydrology, and Use (for all plants)** | |
| Impacts of refurbishment on surface water quality | 3.4.1 |
| Impacts of refurbishment on surface water use | 3.4.1 |
| **Aquatic Ecology (for all plants)** | |
| Refurbishment | 3.5 |
| **Ground Water Use and Quality** | |
| Impacts of refurbishment on ground water use and quality | 3.4.2 |
| **Land Use** | |
| Onsite land use | 3.2 |
| **Human Health** | |
| Radiation exposures to the public during refurbishment | 3.8.1 |
| Occupational radiation exposures during refurbishment | 3.8.2 |
| Socioeconomics | |
| Public services: public safety, social services, and tourism and recreation | 3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6 |
| Aesthetic impacts (refurbishment) | 3.7.8 |

**Table 3-2. Category 2 Issues for Refurbishment Evaluation**

| ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1 | GEIS Sections | 10 CFR 51.53 (c)(3)(ii) Subparagraph |
|---|---|---|
| **Terrestrial Resources** | | |
| Refurbishment impacts | 3.6 | E |
| **Threatened or Endangered Species (for all plants)** | | |
| Threatened or endangered species | 3.9 | E |
| **Air Quality** | | |
| Air quality during refurbishment (nonattainment and maintenance areas) | 3.3 | F |
| **Socioeconomics** | | |
| Housing impacts | 3.7.2 | I |
| Public services: public utilities | 3.7.4.5 | I |
| Public services: education (refurbishment) | 3.7.4.1 | I |
| Offsite land use (refurbishment) | 3.7.5 | I |
| Public services, transportation | 3.7.4.2 | J |
| Historic and archaeological resources | 3.7.7 | K |
| **Environmental Justice** | | |
| Environmental justice | Not addressed[a] | Not addressed[a] |

[a] Guidance related to environmental justice was not in place at the time the NRC prepared the GEIS and the associated revision to 10 CFR Part 51. If an applicant plans to undertake refurbishment activities for license renewal, the applicant's ER and NRC staff's environmental impact statement must address environmental justice.

## 3.1 REFERENCES

CFR (*U.S. Code of Federal Regulations*). "*Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*," Part 51, Title 10, "Energy." NUREG-1437, Supplement 33 3-4 August 2008.

*CFR*. "*Requirements for Renewal of Operating Licenses for Nuclear Power Plants*," Part 54, Title 10, "Energy."

NRC (U.S. Nuclear Regulatory Commission). *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Vol., 1 and 2. Office of Nuclear Regulatory Research, Washington, DC, 1996.

NRC. *Generic Environmental Impact Statement for License Renewal of Nuclear Plant*. NUREG-1437, Vol. 1, Add. 1, Office of Nuclear Reactor Regulation, Washington, DC, 1999.

PSEG Nuclear, LLC (PSEG). 2009a. Salem Nuclear Generating Station, Units 1 and 2, License Renewal Application, Appendix E - Applicant's Environmental Report – Operating

License Renewal Stage. Lower Alloways Creek Township, New Jersey. August, 2009. ADAMS Nos. ML092400532, ML092400531, ML092430231

PSEG Nuclear, LLC (PSEG). 2009b. Hope Creek Generating Station, License Renewal Application, Appendix E - Applicant's Environmental Report – Operating License Renewal Stage. Lower Alloways Creek Township, New Jersey. August, 2009. ADAMs No. ML092430389

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# 6.0 ENVIRONMENTAL IMPACTS OF THE URANIUM FUEL CYCLE AND SOLID WASTE MANAGEMENT

This chapter addresses issues related to the uranium fuel cycle and solid waste management during the period of extended operation. The uranium cycle includes uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level wastes and high-level wastes related to uranium fuel cycle activities. The generic environmental impact statement (GEIS) (NRC 1996, 1999) details the potential generic impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes, as listed in Table 6-1 below. The GEIS is based, in part, on the generic impacts provided in Table S-3, "Table of Uranium Fuel Cycle Environmental Data," in Title 10, Section 51.51(b), of the Code of Federal Regulations (10 CFR 51.51(b)), and in Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor," in 10 CFR 51.52(c). The GEIS also addresses the impacts from radon-222 and technetium-99.

The staff of the U.S. Nuclear Regulatory Commission (NRC) did not identify any new and significant information related to the uranium fuel cycle during the review of the PSEG environmental reports for Salem and Hope Creek Generating Station (HCGS) (Salem and HC ERs), the site audit, and the scoping process. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS. For these Category 1 issues, the GEIS concludes that the impacts are SMALL, except for the collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal.

**Table 6-1. Issues Related to the Uranium Fuel Cycle and Solid Waste Management.** *Nine generic issues are related to the fuel cycle and solid waste management. There are no site-specific issues.*

| Issues | GEIS Section | Category |
|---|---|---|
| Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste) | 6.1, 6.2.1, 6.2.2.1, 6.2.2.3, 6.2.3, 6.2.4, 6.6 | 1 |
| Offsite radiological impacts (collective effects) | 6.1, 6.2.2.1, 6.2.3, 6.2.4, 6.6 | 1 |
| Offsite radiological impacts (spent fuel and high-level waste disposal) | 6.1, 6.2.2.1, 6.2.3, 6.2.4, 6.6 | 1 |
| Nonradiological impacts of the uranium fuel cycle | 6.1, 6.2.2.6, 6.2.2.7, 6.2.2.8, 6.2.2.9, 6.2.3, 6.2.4, 6.6 | 1 |
| Low-level waste storage and disposal | 6.1, 6.2.2.2, 6.4.2, 6.4.3, 6.4.3.1, 6.4.3.2, 6.4.3.3, 6.4.4, 6.4.4.1, 6.4.4.2, 6.4.4.3, 6.4.4.4, 6.4.4.5, 6.4.4.5.1, 6.4.4.5.2, 6.4.4.5.3, 6.4.4.5.4, 6.4.4.6, 6.6 | 1 |
| Mixed waste storage and disposal | 6.4.5.1, 6.4.5.2, 6.4.5.3, 6.4.5.4, 6.4.5.5, 6.4.5.6, | 1 |

| Issues | GEIS Section | Category |
|---|---|---|
| | 6.4.5.6.1, 6.4.5.6.2, 6.4.5.6.3, 6.4.5.6.4, 6.6 | |
| Onsite spent fuel | 6.1, 6.4.6, 6.4.6.1, 6.4.6.2, 6.4.6.3, 6.4.6.4, 6.4.6.5, 6.4.6.6, 6.4.6.7, 6.6 | 1 |
| Nonradiological waste | 6.1, 6.5, 6.5.1, 6.5.2, 6.5.3, 6.6 | 1 |
| Transportation | 6.1, 6.3.1, 6.3.2.3, 6.3.3, 6.3.4, 6.6, Addendum 1 | 1 |

## 6.1 References


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

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants,* NUREG-1437, Volumes 1 and 2. Washington, D.C. ADAMS No. ML061770605.

NRC (U.S. Nuclear Regulatory Commission). 1999. G*eneric Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, Section 6.3, "Transportation," Table 9.1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report." NUREG-1437, Volume 1, Addendum 1. Washington, D.C.

# 7.0 ENVIRONMENTAL IMPACTS OF DECOMMISSIONING

Decommissioning is defined as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. The U.S. Nuclear Regulatory Commission (NRC) issued a generic environmental impact statement (GEIS) for decommissioning (NRC 2002) that evaluated the environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license.

The NRC staff has not identified any new and significant information during the review of the PSEG environmental reports for Salem and Hope Creek Generating Station (HCGS) (Salem and HC ERs), the site audit, or the scoping process. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996, 1999). For the issues listed in table 7-1 below, the GEIS concluded that the impacts are SMALL.

**Table 7-1. Issues Related Decommissioning.** *Decommissioning would occur regardless of whether the Salem and HCGS units were shut down at the end of their currect operating licenses or at the end of the extended operation periods. There are no site-specific issues related to decommissioning.*

| Issues | GEIS Section | Category |
|---|---|---|
| Radiation doses | 7.3.1; 7.4 | 1 |
| Waste management | 7.3.2; 7.4 | 1 |
| Air quality | 7.3.3; 7.4 | 1 |
| Water quality | 7.3.4; 7.4 | 1 |
| Ecological resources | 7.3.5; 7.4 | 1 |
| Socioeconomic impacts | 7.3.7; 7.4 | 1 |

## 7.1 References


NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants,* NUREG-1437, Vols. 1 and 2. Washington, D.C. ADAMS No. ML061770605.

NRC (U.S. Nuclear Regulatory Commission). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3, Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report." NUREG-1437, Volume 1, Addendum 1. Washington, D.C.

NRC (U.S. Nuclear Regulatory Commission). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*: Supplement 1, *Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1, Volumes 1 and 2. Washington, D.C.