

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 40

Regarding Kewaunee Power Station

Draft Report for Comment

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Generic Environmental Impact Statement for License Renewal of Nuclear Plants

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Regarding Kewaunee Power Station

Draft Report for Comment

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1 Proposed Action Issuance of a renewed operating license, DPR-43, for Kewaunee Power
2 Station, in Kewaunee County, Wisconsin, near the town of Kewaunee.

3 Type of Statement Draft Supplemental Environmental Impact Statement

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11 Comments Any interested party may submit comments on this supplemental
12 environmental impact statement. Please specify NUREG-1437,
13 Supplement 40, draft, in your comments. Comments must be received by
14 April 21, 2010. Comments received after the expiration of the comment
15 period will be considered if it is practical to do so, but assurance of
16 consideration of late comments will not be given. Comments may be
17 submitted e-mail to KewauneeEIS.Resource@nrc.gov or mailed to:

18 Chief, Rulemaking, Directives, and Editing Branch
19 Division of Administrative Services
20 Office of Administration
21 Mail Stop TWB-05-B01M
22 U.S. Nuclear Regulatory Commission
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ABSTRACT

1

2 This draft supplemental environmental impact statement (SEIS) has been prepared in response
3 to an application submitted by Dominion Energy Kewaunee, Inc. (DEK) to renew the operating
4 license for Kewaunee Power Station (KPS) for an additional 20 years.

5 This draft SEIS includes the preliminary analysis that evaluates the environmental impacts of
6 the proposed action and alternatives to the proposed action. Alternatives considered include
7 replacement power from new supercritical coal-fired generation and natural gas combined-cycle
8 generation; and a combination of alternatives that included natural gas combined-cycle
9 generation, conservation/efficiency, wood-fired generation, and wind power; and not renewing
10 the operating license (the no-action alternative).

11 The preliminary determination is that the adverse environmental impacts of license renewal for
12 KPS are not so great that preserving the option of license renewal for energy-planning decision
13 makers would be unreasonable.

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EXECUTIVE SUMMARY

BACKGROUND

By letter dated August 12, 2008, Dominion Energy Kewaunee, Inc. (DEK) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue a renewed operating license for Kewaunee Power Station (KPS) for an additional 20-year period.

The following document and the review it encompasses are requirements of NRC regulations implementing Section 102 of the National Environmental Policy Act (NEPA), of the *United States Code* (42 U.S.C. 4321), in Title 10 of the *Code of Federal Regulations* (CFR), Part 51 (10 CFR Part 51). In 10 CFR 51.20(b)(2), the Commission indicates that issuing a renewed power reactor operating license requires preparation of an Environmental Impact Statement (EIS) or a supplement to an existing EIS. In addition, 10 CFR 51.95(c) states that the EIS prepared at the operating license renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999).

Upon acceptance of DEK's application, NRC began the environmental review process described in 10 CFR Part 51 by publishing in 73 Federal Register Notice 59678, October 9, 2009, a Notice of Intent to prepare an EIS and conduct scoping. We held a public scoping meeting on October 22, 2008, in the Town of Carlton, Wisconsin, and conducted a site audit at KPS in late May 2009. During the preparation of this draft SEIS for KPS, we reviewed DEK's environmental report and compared it to the GEIS, consulted with other agencies, conducted a review of the issues following the guidance set forth in NUREG-1555, Supplement 1: *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000), and considered public comments received during the scoping process.

PROPOSED ACTION

DEK initiated the proposed Federal action—issuance of a renewed power reactor operating license—by submitting an application for license renewal of KPS, for which the existing license (DPR-43) expires December 21, 2013. NRC's Federal action is the decision whether or not to renew the license for an additional 20 years.

PURPOSE AND NEED FOR 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, and to meet future system generating needs, as determined by State, utility, and, where authorized, Federal (other than NRC) decision makers. This definition of purpose and need for action reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act of 1954 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 a particular nuclear power plant should continue to operate. If the renewed license is

Executive Summary

1 issued, State regulatory agencies and DEK will ultimately decide whether the plant will continue
2 to operate based on factors such as the need for power or other matters within the State's
3 jurisdiction or the purview of the owners. If the operating license is not renewed, then the facility
4 must be shut down on or before December 21, 2013, when the current operating license
5 expires.

6 ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL

7 The SEIS evaluates the potential environmental impacts of the proposed action. The
8 environmental impacts from the proposed action can be SMALL, MODERATE, or LARGE. The
9 NRC has established a process for identifying and evaluating the significance of any new and
10 significant information on the environmental impacts of license renewal of KPS. The NRC did
11 not identify any information that is both new and significant related to Category 1 issues that
12 would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor
13 the NRC staff's review has identified any new issue applicable to KPS that has a significant
14 environmental impact. Therefore, the NRC staff relies upon the conclusions of the GEIS for all
15 the Category 1 issues applicable to KPS.

16 LAND USE

17 SMALL. The NRC did not identify any Category 2 impact issues for land use, nor did the staff
18 identify any new or significant information during the environmental review. Therefore, there are
19 no impacts beyond those discussed in the GEIS.

20 AIR QUALITY

21 SMALL. The NRC did not identify any Category 2 issues for air quality impacts, nor did the staff
22 identify any new or significant information during the environmental review. Therefore, for plant
23 operation during the license renewal term, there are no impacts beyond those discussed in the
24 GEIS.

25 GROUND WATER USE AND QUALITY

26 SMALL. The NRC did not identify any Category 2 issues for groundwater impacts, nor did the
27 staff identify any new or significant information during the environmental review. Therefore, for
28 plant operation during the license renewal term, there are no impacts beyond those discussed in
29 the GEIS.

30 SURFACE WATER USE AND QUALITY

31 SMALL. The NRC did not identify any Category 2 issues for impacts to surface water use and
32 quality, nor did the staff identify any new or significant information during the environmental
33 review. Therefore, for plant operation during the license renewal term, there are no impacts
34 beyond those discussed in the GEIS.

1 **AQUATIC RESOURCES**

2 SMALL. The NRC identified Category 2 issues related to impingement, entrainment and heat
3 shock all associated with the use of a once-through cooling system. NRC staff believes that the
4 total impact from impingement, entrainment and heat shock on aquatic resources would be
5 SMALL through the period of license renewal.

6 **TERRESTRIAL RESOURCES**

7 SMALL. The NRC did not identify any Category 2 issues for terrestrial resources, nor did the
8 staff identify any new or significant information during the environmental review. Therefore,
9 there are no impacts beyond those discussed in the GEIS.

10 **THREATENED AND ENDANGERED SPECIES**

11 SMALL. Impacts to threatened and endangered species during the period of extended operation
12 is a Category 2 issue. However, operation of the KPS site and its associated transmission lines
13 is not expected to adversely affect any threatened or endangered species during the license
14 renewal term. Therefore, the NRC staff concludes that adverse impacts to threatened or
15 endangered species during the period of extended operation would be SMALL. The NRC staff
16 finds several adequate mitigation measures currently in place at the KPS site and along its
17 transmission corridors. They include: nest construction and placement for the peregrine falcon,
18 environmental review checklists, environmental evaluation forms, and best management
19 practices.

20 **HUMAN HEALTH**

21 SMALL. With regard to Category 1 human health issues during the license renewal term—
22 microbiological organisms (occupational health), noise, radiation exposures to public, and
23 occupational radiation exposures—the NRC staff did not identify any new or significant
24 information during the environmental review. Therefore, there are no impacts beyond those
25 discussed in the GEIS.

26 Electromagnetic fields—acute effects (electric shock) is a Category 2 human health issue. The
27 NRC staff evaluated the potential impacts for electric shock resulting from operation of KPS and
28 its associated transmission lines. The NRC staff concludes that the potential impacts from
29 electric shock during the renewal period would be SMALL.

30 For electromagnetic fields—chronic effects, the NRC staff considers the GEIS finding of
31 “uncertain” still appropriate and will continue to follow developments on this issue.

32 **SOCIOECONOMICS**

33 SMALL. Category 2 socioeconomic impacts include housing impacts, public services (public
34 utilities), offsite land use, public services (public transportation), and historic and archaeological
35 resources. DEK has indicated they have no plans to add non-outage employees during the
36 license renewal period; therefore non-outage employment levels at KPS would remain relatively
37 unchanged with no additional demand for public water and sewer services. Because non-outage

Executive Summary

1 employment levels at KPS would remain relatively unchanged during the license renewal
2 period, there would be no land use impacts related to population or tax revenues, and no
3 transportation impacts.

4 No impacts to known historic and archaeological resources are expected from the continued
5 operation of KPS during the license renewal term. DEK has indicated no plans to engage in
6 activities that could result in changes to the plant or any ground disturbing activities associated
7 with license renewal at KPS. Based on the review of the Wisconsin Historical Society files,
8 archaeological surveys, assessments, and other information, the potential impacts of continued
9 operations and maintenance on historic and archaeological resources at KPS would be SMALL.

10 With respect to environmental justice, an analysis of minority and low-income populations
11 residing within a 50-mile (80-kilometer) radius of KPS indicated there would be no
12 disproportionately high and adverse impacts to these populations from the continued operation
13 of KPS during the license renewal period. Based on recent monitoring results, concentrations of
14 contaminants in native leafy vegetation, soils and sediments, surface water, and fish in areas
15 surrounding KPS have been low (at or near the threshold of detection) and seldom above
16 background levels. Consequently, no disproportionately high and adverse human health
17 impacts would be expected in special pathway receptor populations in the region as a result of
18 subsistence consumption of fish and wildlife.

19 SEVERE ACCIDENT MITIGATION ALTERNATIVES

20 Since KPS had not previously considered alternatives to reduce the likelihood or potential
21 consequences of a variety of highly uncommon but potentially serious accidents, NRC
22 regulation 10 CFR 51.53(c)(3)(ii)(L) requires that KPS evaluate Severe Accident Mitigation
23 Alternatives (SAMAs) in the course of license renewal review. SAMAs are potential ways to
24 reduce the risk or potential impacts of uncommon but potentially severe accidents, and may
25 include changes to plant components, systems, procedures, and training.

26 Based on our review of potential SAMAs, we conclude that KPS made a reasonable,
27 comprehensive effort to identify and evaluate SAMAs. Based on the review of the SAMAs for
28 KPS, and the plant improvements already made, we conclude that none of the potentially cost-
29 beneficial SAMAs relate to adequately managing the effects of aging during the period of
30 extended operation; therefore, they need not be implemented as part of the license renewal
31 pursuant to 10 CFR Part 54.

32 ALTERNATIVES

33 We considered the environmental impacts associated with alternatives to license renewal.
34 These alternatives include other methods of power generation and not renewing the KPS
35 operating license (the no-action alternative). Replacement power options considered were
36 supercritical coal-fired generation, natural gas combined-cycle generation, and as part of the
37 combination alternative, conservation/efficiency, wood-fired generation, and wind power.
38 Wherever possible, we evaluated potential environmental impacts for these alternatives located
39 both at the KPS site and at some other unspecified alternate location. We evaluated each

1 alternative using the same impact areas that we used in evaluating impacts from license
2 renewal. The results of this evaluation are summarized in the table on the following page.

3 **COMPARISON OF ALTERNATIVES**

4 The NRC notes that the impacts of license renewal for KPS are similar to or smaller than the
5 impacts of the alternatives considered in all resource areas, with the exception of no action. No
6 action, however, would necessitate additional action on the part of other entities to either
7 replace or offset the power produced by KPS, and thus would result in additional impacts similar
8 to those discussed in this document.

9 The coal-fired alternative is the least environmentally favorable alternative, due to its impact on
10 air quality and human health from nitrogen oxides, sulfur oxides, particulate matter, polycyclic
11 aromatic hydrocarbons, carbon monoxide, carbon dioxide, and mercury. Construction impacts
12 to aquatic, terrestrial, and potentially historic and archaeological resources are also factors that
13 contribute toward the coal-fired alternative being the least environmentally favorable alternative.
14 The gas-fired alternative would have slightly lower air emissions, and impacts to aquatic,
15 terrestrial, and historic and archaeological resources would vary depending upon location of the
16 plant.

17 **RECOMMENDATION**

18 Our preliminary determination is that the adverse environmental impacts of license renewal for
19 KPS are not so great that preserving the option of license renewal for energy planning decision
20 makers would be unreasonable. This determination is based on (1) the analysis and findings in
21 the GEIS; (2) information submitted in DEK's Environmental Report; (3) consultation with other
22 Federal, State, and local agencies; (4) a review of other pertinent studies and reports; and (5) a
23 consideration of public comments received during the scoping process.

Executive Summary

1

Alternative	Impact Area						
	Air Quality	Ground Water	Surface Water	Aquatic and Terrestrial Resources	Human Health	Socioeconomics	Waste Management
KPS License Renewal	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL
Supercritical coal-fired at KPS site	MODERATE	SMALL	SMALL	MODERATE	SMALL	SMALL to LARGE	MODERATE
Supercritical coal-fired at an alternate site	MODERATE	SMALL	SMALL	MODERATE	SMALL	SMALL to LARGE	MODERATE
Gas-fired at KPS site	MODERATE	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL
Gas-fired at an alternative site	MODERATE	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL
Combination of Alternatives #1	MODERATE	SMALL	SMALL to MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL
No Action Alternative	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL

2

ABBREVIATIONS AND ACRONYMS

1		
2	AADT	average annual daily traffic
3	ACC	cleanup and decontamination costs
4	ACHP	Advisory Council on Historic Preservation
5	ADAMS	Agencywide Documents Access and Management System
6	AEA	Atomic Energy Act of 1954
7	AEC	U.S. Atomic Energy Commission
8	AEO	Annual Energy Outlook
9	AEP	area of potential effect
10	AFW	auxiliary feedwater
11	ALARA	as low as reasonably achievable
12	AOC	Averted Offsite Property Damage Costs
13	AOCs	Areas of Concern
14	AOE	Averted Occupational Exposure
15	AOSC	Averted onsite costs
16	APE	Averted Public Exposure
17	AQCR	air quality control region
18	ATC	American Transmission Company
19	ATWS	anticipated transient without scram
20	AVD	AVD Archaeological Services, Inc.
21		
22	BPJ	best professional judgment
23	BTA	best technology available
24	Btu/ft ³	British thermal units per cubic feet
25	Btu/kWh	British thermal units per kilowatt hour
26	Btu/lb	British thermal units per pound
27		
28	CAA	Clean Air Act
29	CAIR	Clean Air Interstate Rule
30	CAMR	Clean Air Mercury Rule
31	CDF	core damage frequency
32	CDM	clean development mechanism

Abbreviations and Acronyms

1	CEQ	Council on Environmental Quality
2	CET	containment event tree
3	cf _d	cubic feet per day
4	CFR	<i>Code of Federal Regulations</i>
5	cfs	cubic feet per second
6	CFT	core flood tank
7	CH ₄	methane
8	CO	carbon monoxide
9	CO ₂	carbon dioxide
10	CST	condensate storage tank
11	CVCS	chemical and volume control system
12	CWA	Clean Water Act
13		
14	DBA	design-basis accident
15	DEK	Dominion Energy Kewaunee, Inc.
16	DG	diesel generator
17		diesel-engine generator
18	DOE	Department of Energy
19	DOT	Department of Transportation
20		
21	ECCS	emergency core cooling system
22	EDG	emergency diesel generator
23	EIA	Energy Information Administration
24	EIS	environmental impact statement
25	ELF	extremely low frequency
26	EMF	electromagnetic fields
27	EMS	environmental management system
28	EPA	Environmental Protection Agency
29	ER	environmental report
30		
31	F&O	Fact & Observation
32	FERC	Federal Energy Regulatory Commission

Abbreviation and Acronyms

1	FES	final environmental statement
2	FIPs	Federal Implementation Plans
3	FIVE	fire-induced vulnerability evaluation
4	fps	foot per second
5	FR	final regulations
6	FSAR	final safety analysis report
7	FV	Fussell-Vesely
8		
9	gCeq/kWh	grams conversion equivalent per kilowatt-hour
10	GE	General Electric Company
11	GEIS	generic environmental impact statement
12	GHG	greenhouse gas
13	GLFC	Great Lakes Fishery Commission
14	GLWQA	Great Lakes Water Quality Agreement
15	gpd	gallons per day
16	gpm	gallons per minute
17	GWh	gigawatt hours
18		
19	HAP	hazardous air pollutants
20	HCLPF	high confidence in low probability of failure
21	HEP	human error probability
22	HFC	hydrofluorocarbons
23	HFE	hydrofluorinated ethers
24	HFO	high winds, floods, and other
25	Hg	mercury
26	HVAC	heating, ventilation, and air conditioning
27	Hz	hertz
28		
29	IAEA	International Atomic Energy Agency
30	IEEE	Institute of Electrical and Electronics Safety Code
31	IJC	International Joint Commission
32	IPA	integrated plant assessment

Abbreviations and Acronyms

1	IPCC	Intergovernmental Panel on Climate Change
2	IPE	individual plant examination
3	IPEEE	individual plant examination of external events
4	ISLOCA	interfacing systems loss-of-coolant accident
5		
6	J	joule
7		
8	KPS	Kewaunee Power Station
9	kV	kilovolt
10	kW	kilowatt
11	kWh	kilowatt-hours
12		
13	LaMPs	Lakewide Management Plans
14	LERF	large early release frequency
15	LLMW	low-level mixed waste
16	LMMB	Lake Michigan Mass Balance Study
17	LOCA	loss of coolant accident
18	Lpd	liters per day
19		
20	m/s	meters per second
21	m ³ /s	cubic meters per second
22	MAAP	Modular Accident Analysis Program
23	MACCS2	MELCOR Accident Consequence Code System 2
24	MACT	Maximum Achievable Control Technology
25	MCC	motor control center
26		movement control center
27	mgd	millions of gallons per day
28	Midwest RPO	Midwest Regional Planning Organization
29	MISO	Midwest Independent Transmission System Operator
30	MIT	Massachusetts Institute of Technology
31	MMACR	Modified Maximum Averted Cost Risk
32	mrem	milliroentgen equivalent man

Abbreviation and Acronyms

1	mSv	mean square voltage
2	MT	metric tons
3	MW	megawatts
4	MWd/MTU	megawatt days per metric ton of uranium
5	MWe	megawatts-electric
6	MWh	megawatt hours
7	MWt	megawatts-thermal
8		
9	N ₂ O	nitrous oxide
10	NAS	National Academy of Sciences
11	NCDC	National Climatic Data Center
12	NCore	national core
13	NEA	Nuclear Energy Agency
14	NEPA	National Environmental Policy Act
15	NES	Nalco Environmental Sciences
16	NESC	National Electric Safety Code
17	NF ₃	nitrogen trifluoride
18	ng	nanograms
19	NHPA	National Historic Preservation Act
20	NIEHS	National Institute of Environmental Health and Sciences
21	NIRS/WISE	Nuclear Information and Resource Service/World
22		Information Service on Energy
23	NOAA	National Oceanic and Atmospheric Administration
24	NO _x	Nitrogen oxides
25	NPDES	National Pollutant Discharge Elimination System
26	NRC	U.S. Nuclear Regulatory Commission
27	NRHP	National Register of Historic Places
28	NSR	New Source Review
29	NUREG/BR	nuclear regulatory brochure
30	NWS	National Weather Service
31		
32	ODCM	offsite dose calculation manual
33		

Abbreviations and Acronyms

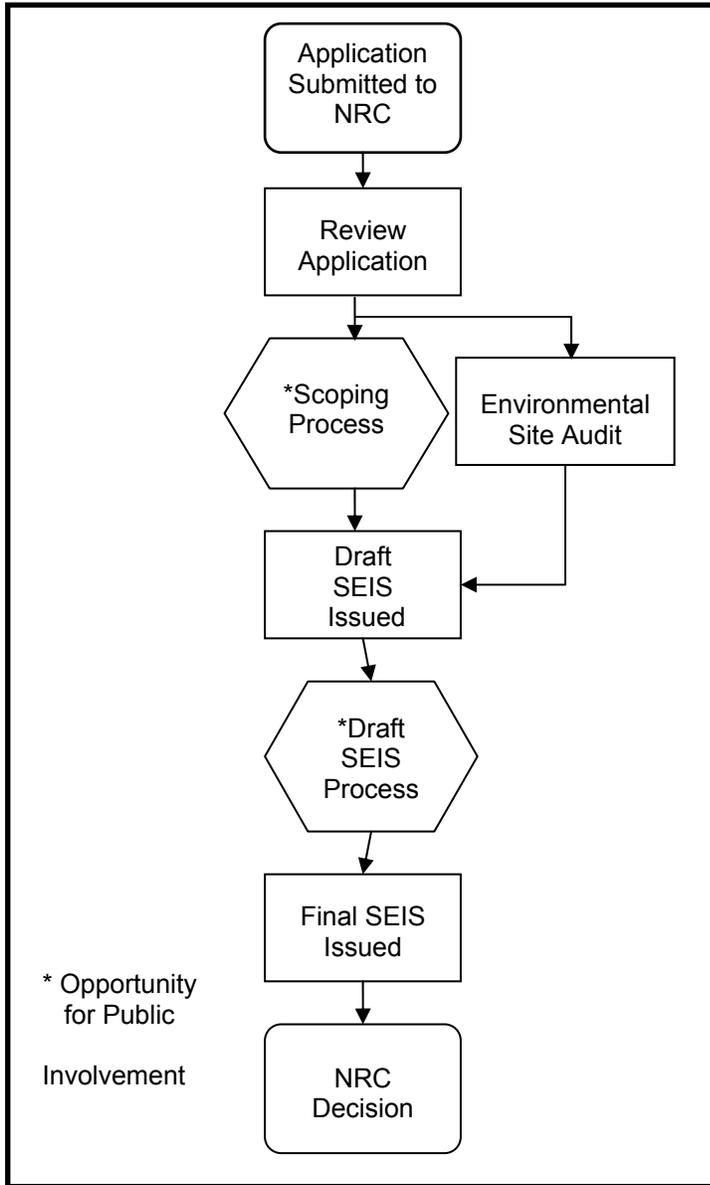
1	PBNP	Point Beach Nuclear Plant
2	PCBs	polychlorinated biphenyls
3	PDS	plant damage state
4	PFC	perfluorocarbons
5	PIC	Proposal for Information Collection
6	PILOT	payment in lieu of taxes
7	PMNP	platform mounted nuclear plant
8	PORV	power-operated relief valve
9		plant-operated relief valve
10	POST	Parliamentary Office of Science and Technology
11	ppt	parts per thousand
12	PRA	probabilistic risk assessment
13	PWR	pressurized water reactor
14		
15	RAI	request for additional information
16	RAP	remedial action program
17	RCP	reactor coolant pump
18	RCRA	Resource Conservation and Recovery Act
19	RCS	reactor coolant system
20	rem	roentgen equivalent man
21	REMP	radiological environmental monitoring program
22	RHR	residual heat removal
23	RLE	Review Level Earthquake
24	RO	reverse osmosis
25	ROI	region of interest
26	ROW	right of way
27	RPC	replacement power cost
28	RPO	regional planning organizations
29	RWST	refueling water storage tank
30		
31	SAMA	severe accident mitigation alternative
32	SAR	safety analysis report

Abbreviation and Acronyms

1	SBO	station blackout
2	SCR	selective catalytic reduction
3	SEIS	supplemental environmental impact statement
4	SER	safety evaluation Report
5	SF ₆	sulfur hexafluoride
6	SGTR	steam generator tube rupture
7	SHPO	State Historic Preservation Officer
8	SMA	seismic margins assessment
9	SO ₂	sulfur dioxide
10	SO _x	sulfur oxides
11	SP	sampling points
12	SPDES	State Pollutant Discharge Elimination System
13	SR	supporting requirement
14	STC	source term category
15	Sv	sievert
16		
17	TER	Technical Evaluation Report
18	TWh	terawatt-hours
19		
20	USFWS	U.S. Fish and Wildlife Service
21	U.S.C.	<i>United States Code</i>
22	USCB	U.S. Census Bureau
23	USGCRP	United States Global Change Research Program
24		
25	VCT	volume control tank
26	WDHS	Wisconsin Department of Health Services
27	WDNR	Wisconsin Department of Natural Resources
28	WET	Whole Effluent Toxicity
29	WHS	Wisconsin Historical Society
30	WOG	Westinghouse Owner's Group
31	WPDES	Wisconsin pollutant discharge elimination system
32	WPSC	Wisconsin Public Service Corporation

1 **1.3 MAJOR ENVIRONMENTAL REVIEW MILESTONES**

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



4
5 DEK submitted an environmental report (ER) (DEK, 2008) as part of its license renewal
6 application in August 2008 (DEK, 2008a). After reviewing the application for sufficiency, the
7 NRC staff published a Notice of Acceptability and Opportunity for Hearing on October 1, 2008,
8 in the *Federal Register* (Volume 73, p. 57154, (73 FR 57154)). The NRC published another
9 notice on October 9, 2008, in the *Federal Register* (73 FR 59678) on its intent to conduct
10 scoping, thereby beginning the 60-day scoping period.

1 A preliminary site audit was conducted during October 21–22, 2008 (NRC, 2009b). The
2 objectives of the preliminary audit were to tour KPS's general vicinity and gain familiarity with
3 the ecological, historical, and cultural resources in the area.

4 The agency held two public scoping meetings on October 22, 2008, in the town of Carlton,
5 Wisconsin. The NRC report entitled, "Environmental Impact Statement Scoping Process
6 Summary Report for Kewaunee Power Station," dated April 2009, presents the comments
7 received during the scoping process (NRC, 2009a). Appendix A to this draft supplemental EIS
8 presents the comments considered to be within the scope of the environmental license renewal
9 review and the associated NRC responses.

10 To independently verify information provided in the ER, the NRC staff conducted a site audit at
11 KPS from May 26–28, 2009. During the site audit, staff met with plant personnel, reviewed
12 specific documentation, toured the facility, and met with interested State and local agencies.
13 The agency published a summary of that site audit and a list of the attendees in a report
14 entitled, "Summary of Site Audit Related to the Review of the License Renewal Application for
15 Kewaunee Power Station," dated August 12, 2009 (NRC, 2009c).

16 Upon completion of the scoping period and site audit, the staff compiled its findings in this draft
17 supplemental environmental impact statement (SEIS), as shown in Figure 1-1. This document is
18 made available for public comment for 75 days. During this time, NRC staff will host public
19 meetings and collect public comments. Based on the information gathered, the staff will amend
20 the draft SEIS findings as necessary and publish the final SEIS.

21 The safety review is conducted simultaneously with the environmental review. The staff
22 documents the findings of the safety review in a safety evaluation report (SER). The
23 Commission considers the findings in both the SEIS and the SER in its decision to either grant
24 or deny the issuance of a new license.

25 **1.4 GENERIC ENVIRONMENTAL IMPACT STATEMENT**

26 The NRC performed a generic assessment of the environmental impacts associated with
27 license renewal to improve the efficiency of the license renewal process. The *Generic*
28 *Environmental Impact Statement (GEIS) for License Renewal of Nuclear Power Plants*,
29 NUREG-1437 (NRC, 1996) documented the results of the NRC staff's systematic approach to
30 evaluate the environmental consequences of renewing the licenses of individual nuclear power
31 plants and operating them for an additional 20 years. NRC staff analyzed in detail and resolved
32 those environmental issues that could be resolved generically in the GEIS.

33 The GEIS establishes 92 separate issues for NRC staff to consider. Of these issues, NRC staff
34 determined that 69 are generic to all plants (Category 1) while 21 issues do not lend themselves
35 to generic consideration (Category 2). Two other issues remained uncategorized: environmental
36 justice and chronic effects of electromagnetic fields, which must be evaluated on a site-specific
37 basis. A list of all 92 issues can be found in Appendix B.

38 For each potential environmental issue, the GEIS: (1) describes the activity that affects the
39 environment, (2) identifies the population or resource that is affected; (3) assesses the nature
40 and magnitude of the impact on the affected population or resource; (4) characterizes the
41 significance of the effect for both beneficial and adverse effects; (5) determines whether or not
42 the results of the analysis apply to all plants, and (6) considers whether additional mitigation

Purpose and Need for Action

1 measures would be warranted for impacts that would have the same significance level for all
2 plants.

3 The NRC's standard of significance for impacts was established using the Council on
4 Environmental Quality (CEQ) terminology for "significant." The NRC established three levels of
5 significance for potential impacts: SMALL, MODERATE, and LARGE, as defined below.

6

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

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

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

16 The GEIS includes a determination of whether or
17 not the analysis of the environmental issue could
18 be applied to all plants and whether or not
19 additional mitigation measures would be

20 warranted (Figure 1-2). Issues are assigned a Category 1 or a Category 2 designation. As set
21 forth in the GEIS, Category 1 issues are those that meet the following criteria:

- 22 (1) The environmental impacts associated with the issue have been determined to apply
23 either to all plants or, for some issues, to plants having a specific type of cooling system
24 or other specified plant or site characteristics.
- 25 (2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to
26 the impacts (except for collective offsite radiological impacts from the fuel cycle and from
27 high-level waste and spent fuel disposal).
- 28 (3) Mitigation of adverse impacts associated with the issue has been considered in the
29 analysis, and it has been determined that additional plant-specific mitigation measures
30 are likely not to be sufficiently beneficial to warrant implementation.

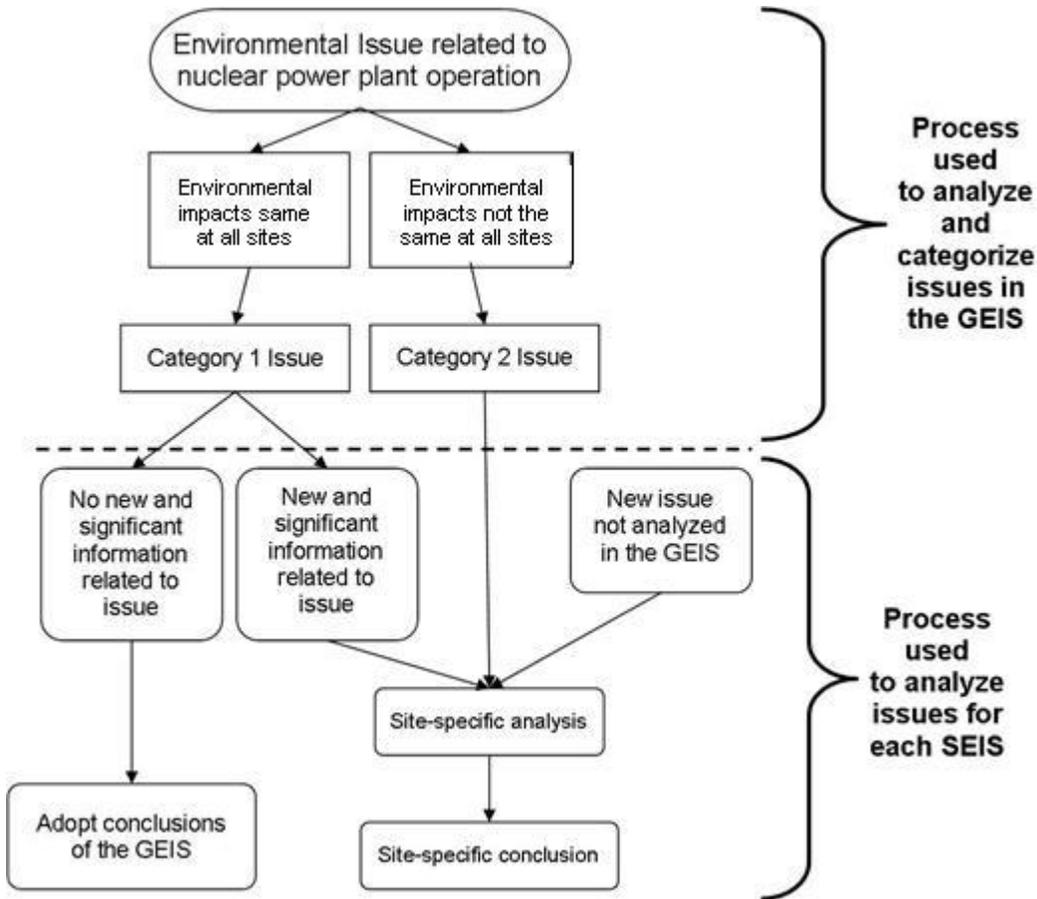
31 For generic issues (Category 1), no additional site-specific analysis is required in this
32 supplemental EIS unless new and significant information is identified. The process for
33 identifying new and significant information is presented in Chapter 4. Site-specific issues
34 (Category 2) are those that do not meet one or more of the criteria of Category 1 issues and,
35 therefore, additional site-specific review for these issues is required. The results of that site-
36 specific review are documented in the SEIS.

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 **Figure 1-2. Environmental Issues Evaluated during License Renewal.** *Ninety-two issues*
 2 *were initially evaluated in the GEIS. A site-specific analysis is required for 23 of those 92 issues.*



3
4

5 **1.5 SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT**

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

14 In the preparation of this SEIS for KPS, the NRC staff:

15
16
17

- reviewed the information provided in the DEK ER;
- consulted with other Federal, State, and local agencies;

Purpose and Need for Action

- 1 • conducted an independent review of the issues during site audit; and
- 2 • considered the public comments received during the scoping process
- 3 and on the draft SEIS.

5 New information can be identified from a
7 number of sources, including the applicant,
9 NRC, other agencies, or public comments.
11 If a new issue is revealed, then it is first
13 analyzed to determine whether or not it is
15 within the scope of the license renewal
17 evaluation. If it is not addressed in the
19 GEIS, then the NRC determines its
20 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.

21 1.6 COOPERATING AGENCIES

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

24 1.7 CONSULTATIONS

25 The Endangered Species Act (ESA) of 1973, as amended, the Magnuson-Stevens Fisheries
26 Management Act of 1996, as amended, and the National Historic Preservation Act (NHPA) of
27 1966 require that Federal agencies consult with applicable State and Federal agencies and
28 groups prior to taking action that may affect endangered species, fisheries, or historic and
29 archaeological resources, respectively. Below are the agencies and groups with whom NRC
30 consulted. Consultation documents are included in Appendix E.

31 **Table 1-1. Consultation Correspondences.** *List of the consultation documents sent by the*
32 *NRC to other agencies, based on NEPA requirements.*

Recipient	Date of Letter
U.S. Fish and Wildlife Service (L. Clemency) ML082610748	September 30, 2008
Advisory Council on Historic Preservation (D. Klima) ML082610168	October 8, 2008
Wisconsin Historical Society (S. Banker) ML082670685	October 10, 2008
Wisconsin Coastal Management Program (K. Angel) ML082680027	October 10, 2008
Wisconsin Department of Natural Resources (R. Kazmierczak) ML082661119	October 10, 2008
Menominee Indian Tribe of Wisconsin (T. Virden) ML082800098	October 16, 2008 ^(a)

^(a) Similar letters were sent to 23 other Native American Tribes listed in Section 1.8 and Appendix E.

1 **1.8 CORRESPONDENCE**

2 During the course of the environmental review, the NRC staff contacted the following Federal,
3 State, regional, local, and tribal agencies. Appendix E contains a chronological list of all the
4 documents sent and received during the environmental review.

- 5 Advisory Council on Historic Preservation, Washington, D.C.
- 6 Bad River Band of Lake Superior Tribe of Chippewa Indians, Odanah, Wisconsin
- 7 Bay Mills Indian Community, Brimley, Minnesota
- 8 Bureau of Indian Affairs, Ft. Snelling, Minnesota
- 9 Citizen Potawatomi Nation, Shawnee, Oklahoma
- 10 Forest County Potawatomi Community of Wisconsin, Crandon, Wisconsin
- 11 Grand Traverse Band of Ottawa and Chippewa Indians, Suttons Bay, Minnesota
- 12 Hannahville Indian Community, Wilson, Minnesota
- 13 Ho-Chuck Nation, Black River Falls, Wisconsin
- 14 Huron Potawatomi, Inc., Fulton, Minnesota
- 15 Keweenaw Bay Indian Community, Baraga, Minnesota
- 16 Little Traverse Bay Bands of Odawa Indians, Harbor Springs, Minnesota
- 17 Little River Band of Ottawa Indians, Manistee, Minnesota
- 18 Lac Vieux Desert Band of Lake Superior Chippewa Indians, Watersmeet,
19 Minnesota
- 20 Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin,
21 Hayward, Wisconsin
- 22 Lac du Flambeau Band of Lake Superior Chippewa Indians of Wisconsin,
23 Lac du Flambeau, Wisconsin
- 24 Menominee Indian Tribe of Wisconsin, Keshena, Wisconsin
- 25 Oneida Tribe of Indians Wisconsin, Oneida, Wisconsin
- 26 Pokagon Band of Potawatomi Indians, Dowagiac, Minnesota
- 27 Prairie Band Potawatomi Nation, Mayetta, Kansas
- 28 Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin, Bayfield,
29 Wisconsin
- 30 Stockbridge Munsee Community of Wisconsin, Bowler, Wisconsin
- 31 Sault Ste. Marie Tribe of Chippewa Indians of Michigan, Sault Ste. Marie,
32 Minnesota

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- 1 Sokagon Chippewa Community, Mole Lake Band of Lake Superior Chippewa
- 2 Indians, Crandon, Wisconsin
- 3 St. Croix Chippewa Indians of Wisconsin, Webster, Wisconsin
- 4 U.S. Fish and Wildlife Service, Green Bay, Wisconsin
- 5 U.S. Fish and Wildlife Service, New Franken, Wisconsin
- 6 Wisconsin Coastal Management Program, Madison, Wisconsin
- 7 Wisconsin Historical Society, Madison, Wisconsin
- 8 Wisconsin Department of Natural Resources, Green Bay, Wisconsin

9 A list of persons who received a copy of this draft SEIS is provided below:

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Kathleen Angel, Federal Consistency and Coastal Hazards Coordinator, Wisconsin Coastal Management Program	Steven Ugoretz, Environmental Analyst, Wisconsin Department of Natural Resources	David Siebert, Director Office of Energy Wisconsin Department of Natural Resources
David A. Heacock, President and Chief Nuclear Officer Dominion Energy Kewaunee, Inc.		

10 **1.9 STATUS OF COMPLIANCE**

11 DEK is responsible for complying with all NRC regulations and other applicable Federal, State,
12 and local requirements. A description of some of the major Federal statutes can be found in
13 Appendix E of the GEIS.

14 There are numerous permits and licenses issued by Federal, State, and local authorities for
15 activities at KPS, as shown in Table 1-2.

16

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

Permit and Applicable Statute	Number	Dates	Responsible Agency
License to Operate (Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10)	DPR-43	Issued: Not Listed Expires: 12/21/13	NRC
Approval (10 CFR 20.2002 Disposal of Contaminated WWTF Sludge)	N/A	Issued: 11/13/95 Expires: Not Listed	NRC
Registration (49 USC 5108, Hazardous materials shipments)	062706 552 0750Q	Expires: 06/30/09	Department of Transportation (DOT)
Notification of Regulated Waste Activity (Federal Resource Conservation and Recovery Act, 42 USC 6912; Ch. 291 Wisconsin Statutes)	EPA ID# WID00713016	Issued: Not Listed Expires: Not Listed	Environmental Protection Agency (EPA)
Permit for construction of water intake and discharge structures in Lake Michigan (33 USC 403)	NCCOD-S 69-10	Issued: 12/12/68 Expires: Not Listed	U.S. Army Corps of Engineers (USACE)
Permit for construction of water intake and discharge structures in Lake Michigan (Ch. 283 Wisconsin Statutes)	2-WP-2570	Issued: 12/04/67 Expires: Not Listed	Wisconsin Department of Natural Resources (WDNR)
Permit to construct and operate (Ch. 281 Wisconsin Statutes)	3430 (Note: Current WPDES permit authorizes discharges.)	Issued: 11/26/85 Expires: Not Listed	WDNR
Letter Approval (Note: Continued authorization via WPDES permit.) (Ch. 283 Wisconsin Statutes)	N/A	Issued: 08/05/92 Expires: Not Listed	WDNR
Individual WPDES permit (Clean Water Act (33 USC Section 1251 et seq.), Ch. 283 Wisconsin Statutes)	WI-00001571-06	Issued: Not Listed Expires: 06/30/10	WDNR
General WPDES Industrial Storm Water Discharge Permit (Clean Water Act (33 USC Section 1251 et seq.), Ch. 283 Wisconsin Statutes)	WI-S049158-2	Issued: Not Listed Expires: 03/31/06 (Authorization continues. Automatically reissued when new permit becomes available.)	WDNR
Air Pollution Control Operation Permit (Federal Clean Air Act (42 USC 7401 et seq.), Ch. 285 Wisconsin Statutes)	431022790-F11 (Note: DEK is considering conversion of this permit to a "Type A Registration Operation Permit," Air Pollution Control Permit Number ROP-A01, issued by the WDNR.)	Issued: Not Listed Expires 06/19/07 (Note: A timely renewal application was submitted. Authorization continues under "Application shield" clause of s.285.62(8), statutes)	WDNR
Registration (Ch. 280 and 281 Wisconsin Statutes)	ID# 43104061	Issued: Not Listed Expires: Not Listed	WDNR
High-Capacity Well Approval (Ch. 281 Wisconsin Statutes)	Approval #s 52802, 52803	Issued 01/26/68 Expires: Not Listed	WDNR

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Permit and Applicable Statute	Number	Dates	Responsible Agency
Aboveground Storage Tank Registration (Ch. 101.09 Wisconsin Statutes)	Owner ID: 83035, Site ID: 679179, Tank ID: 463455	Issued: Not Listed Expires: Not Listed	Wisconsin Department of Commerce
Underground Storage Tank Registration (Federal Resource Conservation and Recovery Act (42 USC 6901 et seq.), Ch. 101.09 Wisconsin Statutes)	Owner ID: 383035 Site ID: 679179 Tank IDs: 285236, 2852239, 406492, 771175, 978062	Issued: Not Listed Expires 05/28/06 (285236, 2852239, 978062) (Timely renewal application was submitted.) Expires 10/28/08 (406492, 771175)	Wisconsin Department of Commerce
Radioactive waste transport permit (South Carolina Radioactive Waste Transportation and Disposal Act (S.C. Code of Laws 13-7-110 et seq.)	0044-48-08	Issued: Not Listed Expires: 12/31/08	South Carolina Department of Health and Environmental Control
License to ship radioactive material (Tennessee Code Annotated 68-202-206)	T-WI003-L08	Issued: Not Listed Expires: 12/31/08	Tennessee Department of Environment and Conservation
Site Access Permit (R313-26 of Utah Radiation Control Rules)	0704004220	Issued: Not Listed Expires: 6/28/08	Utah Department of Environmental Quality

1 1.10 REFERENCES

- 2 10 CFR 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection
3 Regulations for Domestic Licensing and Related Regulatory Functions."
- 4 73 FR 57154, October 1, 2008, U.S. Nuclear Regulatory Commission, Washington, D.C.,
5 "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing
6 Regarding Renewal of Facility Operating License No. DPR-43 for an Additional 20-Year Period;
7 Dominion Energy Kewaunee, Inc.; Kewaunee Power Station," *Federal Register*. Volume 73, No.
8 191, pp. 57154-57156. Washington, D.C.
- 9 73 FR 59678, October 9, 2008, U.S. Nuclear Regulatory Commission, Washington, D.C.,
10 "Dominion Energy Kewaunee, Inc., Kewaunee Power Station; Notice of Intent To Prepare an
11 Environmental Impact Statement and Conduct Scoping Process," *Federal Register*. Volume 73,
12 No. 197, pp. 59678-59679. Washington, D.C.
- 13 Dominion Energy Kewaunee, Inc. (DEK). 2008: "Applicant's Environmental Report – Operating
14 License Renewal Stage. Appendix E of Application for Renewed Operating License, Kewaunee
15 Power Station," Docket No. 50-305. August 2008. Agencywide Documents Access and
16 Management System (ADAMS) Accession No. ML082341039.
- 17 Dominion Energy Kewaunee, Inc. (DEK). 2008a: "Application for Renewed Operating License,
18 Kewaunee Power Station." Docket No. 50-305. August 2008. ADAMS Accession Nos.
19 ML082341020, ML082341038, ML082420854.
- 20 Atomic Energy Act of 1954 (AEA), 42 USC 2011, et seq.
- 21 Endangered Species Act of 1973 (ESA), 16 USC 1531, et seq.

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- 1 Magnuson-Stevens Fishery Conservation and Management Act, as amended by the
- 2 Sustainable Fisheries Act of 1996, 16 USC 1855, et seq.
- 3 National Environmental Policy Act of 1969 (NEPA), 42 USC 4321, et seq.
- 4 National Historic Preservation Act (NHPA), 16 USC 470, et seq.
- 5 U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement*
- 6 *for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C.
- 7 U.S. Nuclear Regulatory Commission (NRC). 2009a: "Environmental Impact Statement Scoping
- 8 Process Summary Report for Kewaunee Power Station," dated April 6, 2009. ADAMS
- 9 Accession No. ML090770880.
- 10 U.S. Nuclear Regulatory Commission (NRC). 2009b: "Kewaunee Power Station, October 21–
- 11 22, 2008, Site Audit Summary." ADAMS Accession No. ML092180137.
- 12 U.S. Nuclear Regulatory Commission (NRC). 2009c: "Kewaunee Power Station, May 26–28,
- 13 2009, Site Audit Summary." ADAMS Accession No. ML092050144.

2.0 AFFECTED ENVIRONMENT

1
2 Kewaunee Power Station (KPS) is a one-unit pressurized-water reactor (PWR) power plant
3 located on the west-central shore of Lake Michigan in Kewaunee County, Wisconsin. KPS is
4 approximately 30 miles east-southeast of Green Bay and 8 miles south of the city of Kewaunee.
5 The KPS site boundary encompasses approximately 908 acres. Structures, facilities, and
6 parking lots occupy approximately 60 acres, and approximately 450 acres are used for
7 agriculture. The balance remains in a mixture of woods, fields in various stages of succession,
8 small wetlands and watercourses, and open areas. The site includes approximately 2 miles of
9 continuous frontage on the western shore of Lake Michigan. For purposes of the evaluation in
10 this report, the “affected environment” is the environment that currently exists at and around
11 KPS and its associated transmission lines’ rights of way. Because existing conditions are at
12 least partially the result of past construction and operation at the plant, the impacts of the past
13 and ongoing actions and how they have shaped the environment are presented here. The
14 facility and its operation are described in Section 2.1 and the affected environment is presented
15 in Section 2.2.

16 2.1 FACILITY DESCRIPTION

17 This assessment of the affected environment begins with a description of KPS, which is the
18 source of potential environmental effects. Figures 2.1 and 2.2 present the 50-mile and
19 6-mile vicinity maps around KPS, respectively. With the exception of a highway traversing the
20 site (State Route 42), town roads, and the Sandy Bay Cemetery, a 1.13-acre cemetery that is
21 owned and maintained by the town of Carlton, all property within the site boundary is owned and
22 operated by Dominion Energy Kewaunee, Inc. (DEK) as shown in Figure 2.3.

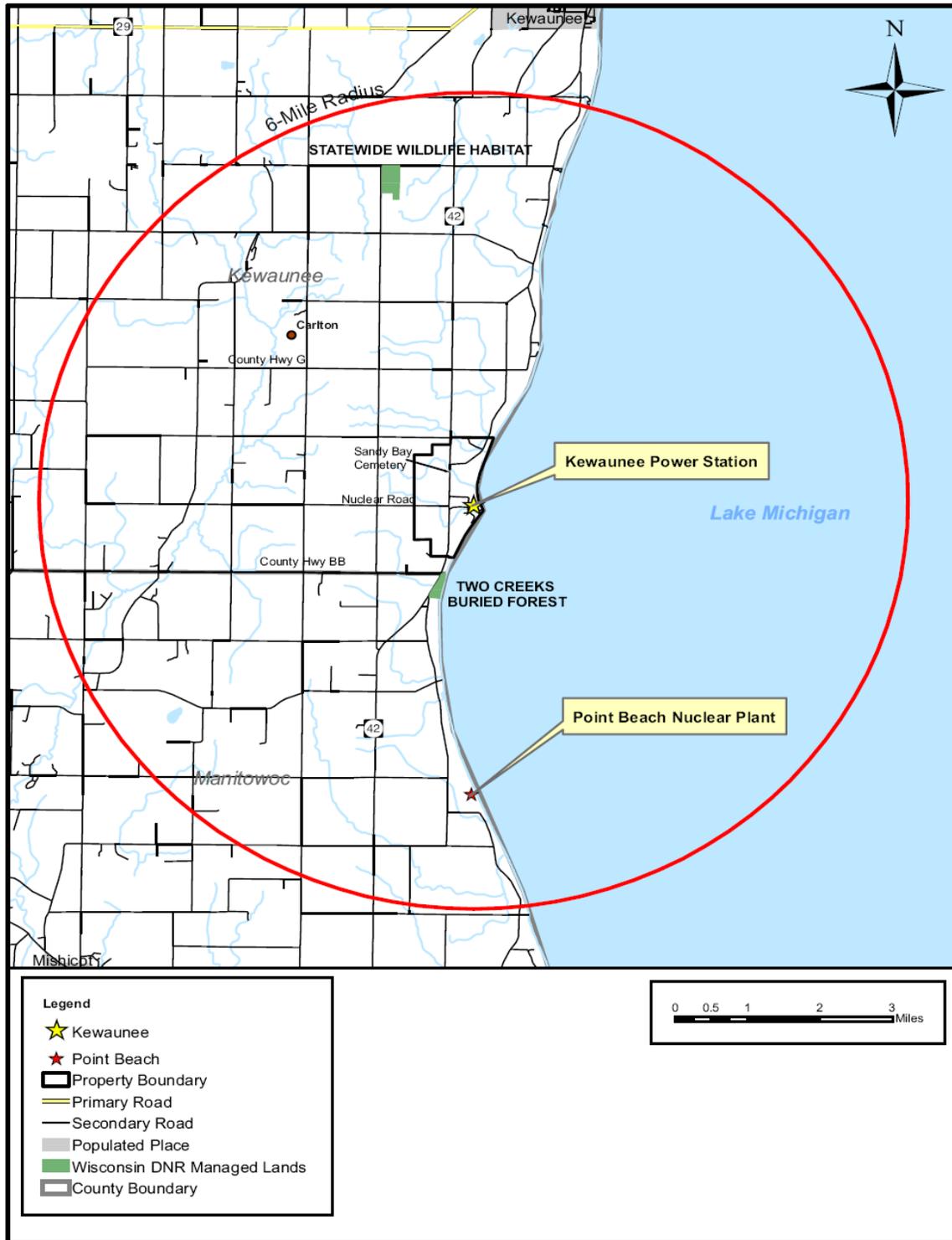
Affected Environment

1



2

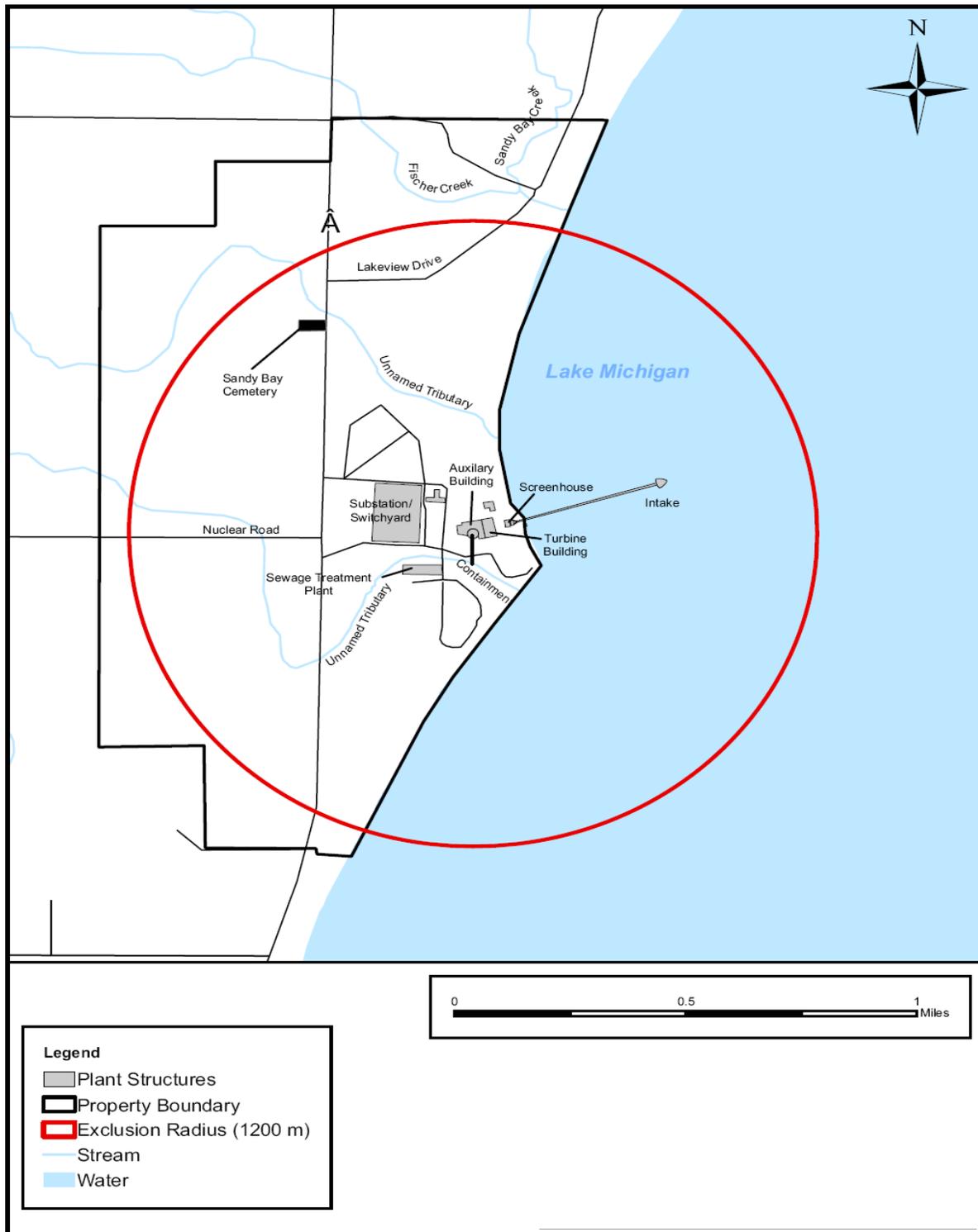
3 **Figure 2-1. Kewaunee Power Station 50-Mile Radius**



1

2 **Figure 2-2. Kewaunee Power Station 6-Mile Radius**

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1

2 **Figure 2-3. Kewaunee Power Station Site Map**

1 **2.1.1 Reactor and Containment Systems**

2 KPS is a single-unit, two-loop closed cycle PWR with a turbine-generator. The reactor and
3 turbine-generator were furnished by Westinghouse Electric Corporation. Pioneer Services and
4 Engineering supported design and construction of the unit. The reactor is housed in double
5 containment consisting of a cylindrical steel shell surrounded by a reinforced concrete cylindrical
6 shield building.

7 The KPS fuel is slightly enriched (less than 5 weight percent) uranium dioxide with an average
8 burnup for the peak rod of 17,500 megawatt days per metric ton uranium. KPS was originally
9 licensed for a thermal output of 1,650 megawatts-thermal (MWt) and gross electrical output of
10 535 megawatts-electric (MWe). In 2004, the plant received a license amendment that increased
11 the thermal output to 1,722 MWt and a gross electrical output of 590 MWe (DEK, 2008).

12 In a PWR power generation system, reactor heat is transferred from the primary coolant to a
13 lower pressure secondary coolant loop, allowing steam to be generated in the steam supply
14 system. Each of the primary coolant loops contain one steam generator, two reactor coolant
15 pumps, and interconnected piping. Reactor coolant is pumped from the reactor through the
16 steam generators and back to the reactor. Each steam generator has a heat exchanger that
17 produces superheated steam at a constant pressure over the reactor's operating power range.
18 Coolant flows through the tubes as steam is generated on the lower pressure shell side. The
19 steam then flows from the steam generator to the turbine unit that turns the electrical generator.

20 **2.1.2 Radioactive Waste Management**

21 KPS's radioactive waste system collects, treats, stores, and disposes of radioactive and
22 potentially radioactive wastes that are byproducts of plant operations. The byproducts are
23 activation products resulting from the irradiation of reactor water and impurities therein
24 (principally metallic corrosion products) and fission products resulting from defective fuel
25 cladding or uranium contamination within the reactor coolant system. Operating procedures for
26 the radioactive waste system ensure that radioactive wastes are safely processed and
27 discharged from the plant within the limits set forth in Title 10 of the *Code of Federal*
28 *Regulations* (CFR) Part 20 (10 CFR 20), "Standards for Protection against Radiation"
29 (DEK, 2008).

30 Radioactive wastes resulting from plant operations are classified as liquid, gaseous, or solid.
31 Radioactive liquid wastes are generated from liquids received directly from portions of the
32 reactor coolant system or that were contaminated by contact with liquids from the reactor
33 coolant system. Radioactive gaseous wastes are generated from gases or airborne particulates
34 vented from reactor and turbine equipment containing radioactive material. Radioactive solid
35 wastes are solids from the reactor coolant system, solids that contacted reactor coolant system
36 liquids or gases, or solids used in the reactor coolant system or the power conversion system.

37 Reactor fuel that has exhausted a certain percentage of its fissile uranium content is referred to
38 as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced with fresh
39 fuel assemblies during routine refueling outages. Spent fuel assemblies are stored in the spent

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1 fuel pool. In addition to the spent fuel pool, spent nuclear fuel is expected to be stored in dry
2 casks, located onsite, during the license renewal term.

3 The KPS offsite dose calculation manual (ODCM) contains the methodology and parameters
4 used to calculate offsite doses resulting from radioactive gaseous and liquid effluents, and the
5 gaseous and liquid effluent monitoring alarm and trip setpoints. The methodology is used to
6 ensure that radioactive material discharged from the plant meets regulatory dose limits. ODCM
7 also contains the radioactive effluent controls and radiological environmental monitoring
8 activities and descriptions of the information that is included in the annual environmental
9 operating report and annual radioactive effluent release report (DEK, 2008c).

10 2.1.2.1 *Radioactive Liquid Waste*

11 The KPS liquid waste disposal system collects, holds, treats, processes, stores, and monitors all
12 radioactive liquid wastes. The system is divided into subsystems so that liquid waste from
13 various sources can be segregated and processed (DEK, 2008). Prior to discharge, the waste is
14 sampled and analyzed to determine if it meets radiological release criteria. The waste is
15 discharged under controlled conditions and monitored by a radiation detector. The release is
16 terminated if the radiation level in the liquid waste exceeds a preset limit. Liquid releases to the
17 environment are limited to the maximum extent possible to satisfy the dose objectives in
18 Appendix I to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities" and
19 the dose limits in 10 CFR Part 20 (DEK, 2008).

20 The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the KPS annual radioactive
21 effluent release reports for liquid effluents from 2004 through 2008 (DEK 2005, 2006, 2007,
22 2008a, 2009). Based on the liquid waste processing system's performance from 2004 through
23 2007, the liquid discharges for 2008 are typical of previous years. Variations on the amount of
24 radioactive effluents released from year to year are expected based on the overall performance
25 of the plant and the number and scope of outages and maintenance activities. The radioactive
26 liquid wastes reported by KPS are reasonable and no unusual trends were noted.

27 2.1.2.2 *Radioactive Gaseous Waste*

28 The KPS gaseous waste disposal system processes and disposes of radioactive gaseous
29 effluent to the atmosphere. The system receives and processes gases from plant systems and
30 components, which include the reactor coolant system, the chemical volume control system,
31 cover gases in waste-holding tanks, and gases vented from plant components. The processed
32 gases are routed to a vent that is monitored by a radiation monitor and released into the
33 atmosphere (DEK, 2008).

34 KPS discharges gaseous waste in accordance with the procedures and methodology described
35 in the ODCM. The radioactive gaseous waste system is used to reduce radioactive materials in
36 gaseous effluents before discharge, per dose limits in 10 CFR Part 20 and dose design
37 objectives in Appendix I to 10 CFR Part 50. The NRC staff reviewed the KPS radioactive
38 effluent release reports for gaseous effluents from 2004 through 2008 (DEK 2005, 2006, 2007,
39 2008a, 2009). Based on the gaseous waste processing system's performance from 2004
40 through 2007, the gaseous discharges for 2008 are typical of previous years. Variations on the
41 amount of radioactive effluents released from year to year are expected based on the overall

1 performance of the plant and the number and scope of outages and maintenance activities. The
2 radioactive gaseous wastes reported by KPS are reasonable and no unusual trends were noted.

3 2.1.2.3 *Radioactive Solid Waste*

4 The radioactive solid waste management program at KPS is designed to safely collect, process,
5 store, and prepare radioactive wet and dry solid waste materials for shipment to an offsite waste
6 processor or for disposal.

7 Solid wastes consist mainly of dry active waste such as contaminated paper, plastic, wood,
8 metals, and spent resin. Solid wastes are collected, analyzed, packaged, and shipped from the
9 site according to the KPS solid radioactive waste process control program. The solid wastes are
10 prepared in accordance with the requirements in 10 CFR 61, "Licensing Requirements for Land
11 Disposal of Radioactive Waste" for waste form and classification, as well as disposal
12 site-specific regulations (DEK, 2008).

13 The State of South Carolina's licensed low-level radioactive waste disposal facility, located in
14 Barnwell, has limited the access from radioactive waste generators located in States that are
15 not part of the Atlantic Low-Level Waste Compact. Wisconsin is not a member of the Atlantic
16 Low-Level Waste Compact and this has had a minimal effect on KPS's ability to handle its
17 radioactive solid low-level waste. KPS uses an offsite vendor to perform volume reduction of its
18 waste and based on the generation rate and volume reduction practices, KPS has adequate
19 storage capacity for its radioactive waste during the license renewal term.

20 KPS also generates and stores very small quantities of low-level mixed waste (LLMW). LLMW is
21 waste that exhibits hazardous characteristics and contains low levels of radioactivity.

22 The NRC Staff reviewed the 2004 through 2008 KPS low-level radioactive waste reports
23 (DEK 2005, 2006, 2007, 2008a, 2009). The solid waste volumes and radioactivity amounts
24 generated in 2008 are typical of previous annual waste shipments made by KPS. Variations in
25 the amount of radioactive solid waste generated and shipped from year to year are expected
26 based on the overall performance of the plant and the number and scope of outages and
27 maintenance activities. The volume and activity of radioactive solid wastes reported by KPS are
28 reasonable and no unusual trends were noted.

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

1 **2.1.3 Nonradioactive Waste Management**

2 The Resource Conservation and Recovery Act (RCRA) governs the disposal of solid and
3 hazardous waste. RCRA regulations are contained in 40 CFR, *Protection of the Environment*,
4 Parts 239 through 299 (40 CFR 239, et seq.). Parts 239 through 259 of 40 CFR contain
5 regulations for solid (nonhazardous) waste, and Parts 260 through 279 contain regulations for
6 hazardous waste. RCRA Subtitle C establishes a system for controlling hazardous waste from
7 “cradle to grave,” and Subtitle D encourages States to develop comprehensive plans to manage
8 nonhazardous solid waste and mandates minimum technological standards for municipal solid
9 waste landfills (EPA, 2007).

10 In Wisconsin, RCRA regulations are administered by the Waste and Materials Management
11 Program of the Wisconsin Department of Natural Resources (WDNR). The Waste and Materials
12 Management Program has many administrative codes and state statutes that govern the
13 regulation of solid and hazardous waste. Chapter 289 of the Wisconsin State statutes and
14 chapters NR 500 and NR 502, among others, of the Wisconsin administrative code address
15 general solid waste management requirements, including storage, transportation, transfer, and
16 incineration. Chapter 291 of the Wisconsin State statutes and chapters NR 660 through NR 666,
17 NR 668, and NR 670 of the Wisconsin administrative code address the identification,
18 generation, minimization, transportation, and final treatment, storage, or disposal of hazardous
19 wastes.

20 Nonradiological waste streams generated at KPS include used oil, hazardous and
21 nonhazardous solvents and degreasers, laboratory wastes, unused expired chemicals,
22 asbestos wastes, paint strippers, universal wastes, antifreeze, one-time only (i.e., project
23 specific wastes, point-source discharges) regulated under the Wisconsin Pollutant Discharge
24 Elimination System (WPDES), sanitary waste, including sewage, and general plant trash
25 (DEK, 2009e).

26 **2.1.3.1 Hazardous Waste**

27 Hazardous waste means solid waste, or a combination of solid wastes, which, because of its
28 quantity, concentration, or physical, chemical, or infectious characteristics, may cause or
29 contribute to an increase in mortality or serious illness. Such waste may also pose a significant
30 present or potential hazard to human health or the environment if it is not properly treated,
31 stored, transported, disposed of, or otherwise handled (40 CFR Part 261, “Identification and
32 Listing of Hazardous Waste”).

33 KPS generates a small amount of hazardous waste each year, primarily consisting of unused
34 expired laboratory chemicals and hazardous solvents and degreasers (DEK, 2009e). KPS is
35 classified as a “small quantity generator” of hazardous waste because the plant generates less
36 than 2,205 pounds (1,000 kg) of hazardous waste in one month; no more than 13,228 lbs (6,000
37 kg) of hazardous waste may be accumulated on site at any one time; and accumulated
38 hazardous waste is stored in aboveground tanks or containers for no more than 180 or 270
39 days, depending on the distance the waste is transported for disposal (EPA, 2007a). During the
40 KPS site audit in May 2009, NRC staff toured the warehouse where hazardous and universal
41 wastes are safely and properly collected, sorted, packaged, and temporarily stored until offsite
42 disposal. NRC staff also reviewed the DEK hazardous waste procedures documented in the

1 “Kewaunee Power Station Hazardous Waste Plan” (DEK, 2009e) and determined that they are
2 consistent with applicable RCRA regulations.

3 2.1.3.2 *General Plant Trash*

4 As part of routine plant maintenance and operations, KPS generates solid waste, as defined by
5 RCRA. General plant trash includes paper, garbage, and construction waste. In 2008 KPS
6 generated approximately 256 tons (232 metric tons (MT)) of general plant trash, and over the
7 past five years it has generated approximately 1,000 tons (907 MT) of trash (DEK, 2009e). The
8 majority of KPS trash is collected in a compactor dumpster to minimize volume and trips to the
9 Kewaunee County landfill in West Kewaunee (DEK, 2008). The recycling program at KPS is
10 discussed below in Section 2.1.3.6.

11 2.1.3.3 *Universal Waste*

12 Universal waste is hazardous waste that is generated in a variety of settings and by a vast
13 community and poses collection and management problems. Universal waste often is not
14 appropriately managed under existing hazardous waste regulations. The Environmental
15 Protection Agency (EPA) classifies several hazardous wastes as universal wastes including
16 batteries, certain pesticides, mercury-containing devices, and fluorescent lamps (40 CFR Part
17 273, “Standards for Universal Waste Management”). KPS is a small-quantity handler of
18 universal waste (i.e., the facility cannot accumulate more than 11,000 pounds (5,000 kg) of
19 universal waste at any one time). KPS generates common operational wastes such as lighting
20 ballasts containing polychlorinated biphenyls (PCBs), lamps, and batteries. From 2006 through
21 2008, KPS generated approximately 8 tons (16,000 lbs (7,257 kg)) of universal waste
22 (DEK, 2009e). Common universal waste is packaged together and stored in the onsite
23 warehouse until disposed of offsite by a licensed disposal company.

24 2.1.3.4 *Low-Level Mixed Waste*

25 As previously discussed in Section 2.1.2.3, LLMW contains both low-level radioactive waste and
26 RCRA hazardous waste (40 CFR Part 266, “Storage, Treatment, Transportation, and Disposal
27 of Mixed-Waste”). KPS generates very small quantities of LLMW. From 2006 through 2008,
28 LLMW at KPS consisted of Agitene (a cleaning solvent), paint residue, and excess caustic from
29 testing and repair of caustic standpipe pumps. KPS generated 23 pounds (10.4 kg) of mixed
30 waste in 2006, 25 pounds (11.4 kg) in 2007, and 14 pounds (6.4 kg) in 2008. As permitted by
31 WDNR regulations, Agitene was disposed of by diluting it in the used oil stream and sent to the
32 boiler fuel oil tank, as approved by the WDNR air permit for KPS (DEK, 2009c).

33 2.1.3.5 *Permitted Discharges*

34 KPS generates two types of wastewater—industrial effluents and sanitary liquid wastes, both of
35 which are discharged to Lake Michigan according to the KPS WPDES Permit No. WI-0001571-
36 07-0, as enforced by WDNR (radioactive liquid waste is addressed in Section 2.1.2.1 of this
37 report). A hypochlorinating system intermittently injects sodium hypochlorite into the condenser
38 inlet waterboxes to clean and defoul the condenser of biological organisms and prevent the
39 build-up of zebra mussels (*Dreissena polymorpha*) within the cooling system (DEK, 2008). This
40 normal operational process generates chemical and biocide liquid wastes that are combined

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1 with the plant cooling water discharge. KPS cooling water is discharged to Lake Michigan within
2 the plant's WPDES permit limitations. Section 2.1.7.3 of this report provides more information
3 on KPS WPDES permit and effluent limitations.

4 KPS operates a permitted (WDNR Permit No. 3430) onsite sewage treatment facility to treat
5 sanitary wastewater generated by the plant. As stated above, the sewage treatment facility
6 discharges through a WPDES-permitted outfall to an unnamed tributary that flows to Lake
7 Michigan. The sewage treatment facility has a design capability of 20,000 gallons per day (gpd)
8 (75,708 liters per day (Lpd)); however, routine sewage processing is approximately 11,000 gpd
9 (41,640 Lpd). During outage periods when more workers are onsite, this number approaches
10 the design capacity (DEK, 2009e). Digested sanitary sludge is periodically transferred to a
11 sludge holding tank where it is concentrated and sent for disposal to a WDNR-approved sewage
12 treatment facility in Green Bay (DEK, 2008).

13 2.1.3.6 *Pollution Prevention and Waste Minimization*

14 Currently, KPS implements a waste minimization program that consists of steps such as
15 segregating hazardous and nonhazardous wastes, choosing nonhazardous substitutes when
16 possible, recycling or reclaiming appropriate waste materials, monitoring expired chemicals to
17 determine minimum stocking requirements to reduce recurring excess, finding alternate uses for
18 excess materials, or returning unused materials to the manufacturer. KPS also implements a
19 recycling program for common waste materials such as paper, plastic, and metal. From 2006
20 through 2008, KPS recycled 289.4 tons (263 MT) of non-metal materials (i.e., paper, plastic,
21 and cardboard) and 71.5 tons (65 MT) of metal.

22 In support of nonradiological waste minimization efforts, the EPA Office of Pollution Prevention
23 and Toxics established a clearinghouse that provides information regarding waste management
24 and technical and operational approaches to pollution prevention. The EPA clearinghouse can
25 be used as a source for additional opportunities for waste minimization and pollution prevention
26 at KPS, as appropriate (EPA, 2008f).

27 The EPA also encourages the use of environmental management systems (EMSs) for
28 organizations to assess and manage the environmental impact associated with their activities,
29 products, and services in an efficient and cost-effective manner. EPA defines an EMS as "a set
30 of processes and practices that enable an organization to reduce its environmental impacts and
31 increase its operating efficiency." EMSs help organizations fully integrate a wide range of
32 environmental initiatives, establish environmental goals, and create a continuous monitoring
33 process to help meet those goals. The EPA Office of Solid Waste especially advocates the use
34 of EMSs at RCRA-regulated facilities to improve environmental performance, compliance, and
35 pollution prevention (EPA 2008f).

1 **2.1.4 Plant Operation and Maintenance**

2 Maintenance activities conducted at KPS include inspection, testing, and surveillance to
3 maintain the current licensing basis of the facility and to ensure compliance with environmental
4 and safety requirements. Various programs and activities currently exist at KPS to maintain,
5 inspect, test, and monitor the performance of facility equipment. These maintenance activities
6 include inspection requirements for reactor vessel materials, boiler and pressure vessel
7 in-service inspection and testing, maintenance structures monitoring program, and maintenance
8 of water chemistry.

9 Additional programs include those implemented to meet technical specification surveillance
10 requirements, those implemented in response to NRC generic communications, and various
11 periodic maintenance, testing, and inspection procedures. Certain program activities are
12 performed during the operation of the unit, while others are performed during scheduled
13 refueling outages. Nuclear power plants must periodically discontinue the production of
14 electricity for refueling, periodic in-service inspection, and scheduled maintenance. KPS refuels
15 at 18-month intervals.

16 **2.1.5 Power Transmission Systems**

17 As stated in the Environmental Report for the license renewal of KPS (DEK, 2008):

18 In 1999, the Wisconsin legislature passed Act 9, which encouraged utilities with
19 service areas in Wisconsin to transfer ownership and operation of transmission
20 assets to an independent transmission company. In response to the Act, WPSC
21 [Wisconsin Public Service Corporation] and WP&L [Wisconsin Power and Light
22 Company (owners of KPS at the time)] transferred ownership of their
23 transmission lines to the American Transmission Company (ATC).

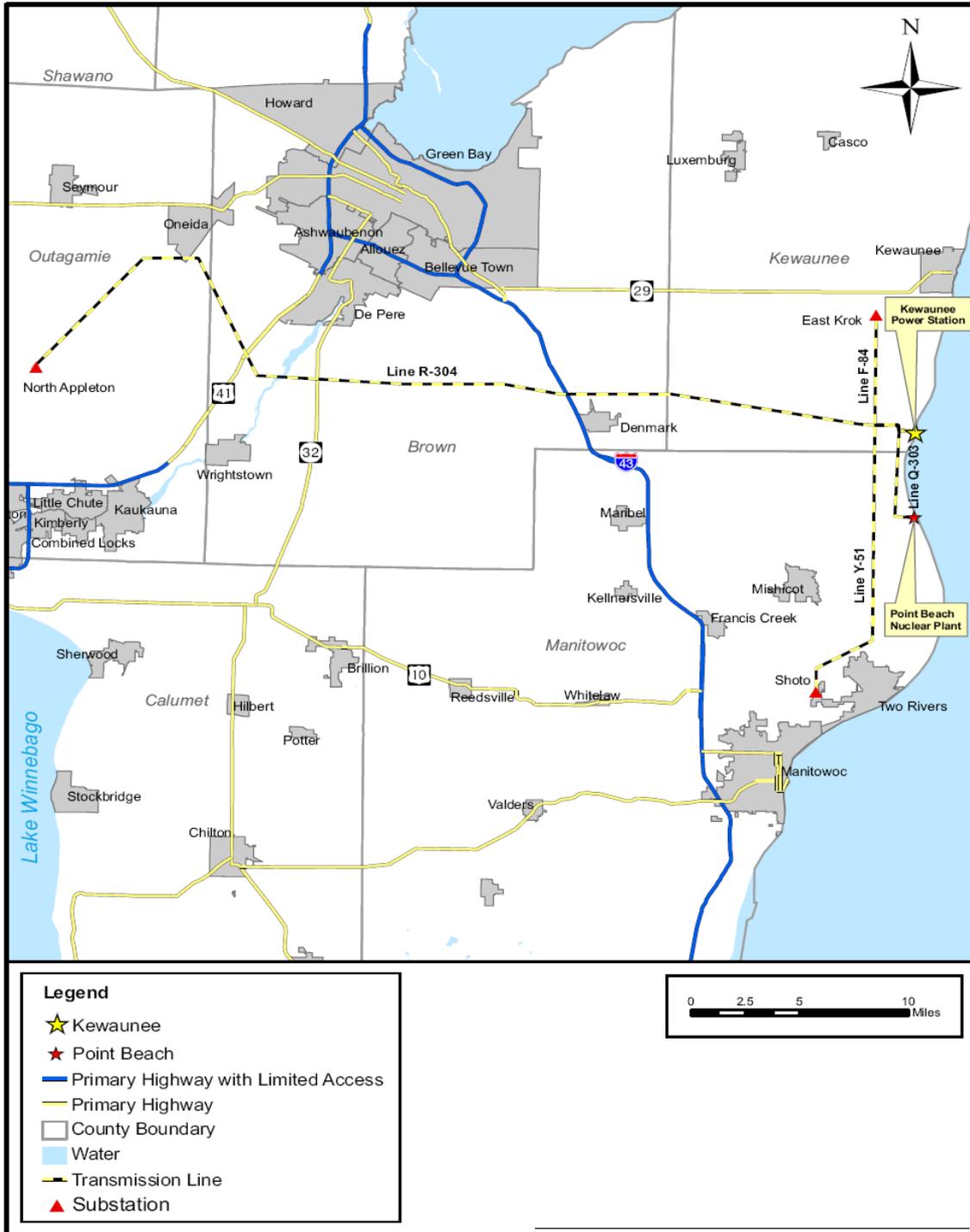
24 ATC, DEK, and Midwest Independent Transmission System Operator (MISO)
25 have a three-party Generator to Transmission Interconnection Agreement for
26 KPS filed with the Federal Energy Regulatory Commission (FERC), whereby
27 ATC transferred operation of its facilities to the MISO. In doing so, ATC acts in
28 the capacity of the transmission system operator and MISO is the independent
29 system operator.

30 KPS is connected to the regional grid via two 138-kilovolt (kV) and two 345-kV transmission
31 lines, which total 80.6 miles (129.7 km) in length. Transmission lines considered in scope for
32 license renewal are those constructed to connect the facility to the transmission system
33 (10 CFR 51.53(c)(3)(ii)(H)); therefore, the four lines (Line F-84, Line Y-51, Line R-304, and Line
34 Q-303) are considered in scope and are discussed below in detail.

35 All four transmission lines originate at the KPS switchyard and are shown in Figure 2.4.
36 Line F-84, which is a 138-kV transmission line, connects from the KPS site substation to the
37 East Krok Substation, and travels a total distance of 8.2 miles (13.2 km). Line Y-51, which is
38 also a 138-kV transmission line, connects from the KPS site to the Shoto Substation, which is
39 16.2 miles (26.1 km) in total length. Line R-304, a 345-kV transmission line, is the longest
40 transmission line associated with the KPS site, and connects from the KPS site to the North

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- 1 Appleton substation, traveling a total distance of 50.6 miles (81.4 km). Finally, line Q-303, also a
2 345-kV transmission line, travels a total distance of 5.6 miles (9.0 km), connecting from the KPS
3 site substation to the Point Beach Nuclear Plant substation
4 (DEK, 2008).
- 5 All transmission lines associated with the KPS site have rights of way (ROWs) with an average
6 width of 150 feet (45.7 m). Additionally, there is a 50-foot (15-m) minimum buffer between the
7 ROWs and any waterways and wetlands; however, buffers can vary up to 200 feet (61 m),
8 based on agreements with the landowners or the State. These transmission lines ROWs total
9 75 miles (121 km) of corridor, and account for an area of approximately 1270 acres (514 ha).
10 The substation on the KPS site, the switchyards off site, and transmission towers (poles) occupy
11 approximately 10 acres (4 ha). Ecosystem land types along the transmission line ROWs are
12 comprised of approximately 84 percent farmland, 7 percent woodland, 2 percent wetlands, and
13 7 percent scrubland (DEK, 2008).



1

2 **Figure 2-4. Kewaunee Power Station Transmission Line System**

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1 **2.1.6 Cooling and Auxiliary Water Systems**

2 KPS uses a once-through heat dissipation system that withdraws water from, and discharges it
3 to, Lake Michigan. Unless otherwise noted, the discussion of the cooling-water system is
4 adapted from the environmental report (ER) (DEK, 2008), or information gathered by the NRC
5 at the site audit.

6 Water is withdrawn from Lake Michigan via an intake structure located approximately 1,600 feet
7 (488 m) from the shore east-northeast of KPS. The circulating water intake structure consists of
8 a cluster of three inlets that are submerged at a depth of 15 feet (4.6 m). Each inlet is 22 feet
9 (6.7-m) in diameter and contains 2- by 2-foot (0.6- by 0.6-m) trash grills to prevent the intake of
10 debris. Surface water velocity at the intake inlets is less than 1 foot per second (fps) or 0.3
11 meters per second (m/s) when the plant is running at full power. The three intake inlets are each
12 reduced to 6-foot (1.8-m) diameter steel pipes, which join to one 10-foot (3-m) diameter steel
13 pipe buried approximately 3 feet (0.9 m) below the lake bottom. The buried intake pipe brings
14 water to a 56.5- by 25-foot (17.2- by 7.6-m) onshore forebay, which contains a 38.5-foot (11.7-
15 m)-long weir for overflow. Water velocity within the forebay ranges from 0.22 to 0.88 m/s (0.72
16 to 2.9 fps) at maximum flow and from 0.10 to 0.5 m/s (0.33 to 1.6 fps) at minimum flow (NES,
17 1976b). From the forebay, water passes through four 10-foot (3-m)-wide by 36-foot
18 (11-m)-long woven wire traveling screens with 3/8-inch (0.95-cm) mesh and automatic
19 backwash that extend from the forebay bottom to 10 feet (3 m) above water level (NES, 1976b).
20 During normal operation, the screens are automatically rotated every 4 hours for a 45-minute
21 duration, or for a 10-minute duration during a 6-inch (15-cm) pressure drop (NES, 1976b). Any
22 fish and debris that are automatically backwashed from the traveling screens are returned to the
23 lake via the 10-foot (3-m) diameter discharge tunnel.

24 Once taken in, water is pumped by two vertical dry-pit circulating water pumps, each designed
25 to supply 210,000 gallons per minute (gpm) (468 cubic feet per second (cfs) or 13.2 cubic
26 meters per second (m^3/s)). Normal flow rate throughout the cooling system is approximately
27 400,000 gpm (891 cfs or 25.2 m^3/s). In the winter months, the reduced temperature of the lake
28 requires less water for cooling, such that the flow rate is reduced to approximately 287,000 gpm
29 (639 cfs or 18.1 m^3/s) (AEC, 1972). Generally, higher flow rates are employed from May through
30 November, and lower flow rates are employed from December through April
31 (NES, 1976b).

32 Water is returned to Lake Michigan via a 10-foot (3-m) diameter concrete discharge tunnel after
33 passing through the condenser. The discharge tunnel connects to a discharge structure located
34 on the shoreline, just south of the forebay. During periods of sub-freezing weather, a
35 recirculating pump routes water to the intake inlet grills and traveling screens to prevent icing.

36 In addition to the circulating water intake, two auxiliary water intake tees are located 50 and 100
37 feet (15 and 30 m) shoreward of the circulating water intake. Each tee has a 30-inch (76-cm),
38 screened opening approximately 1 foot (0.3 m) above the lake bottom. The screen cover plates
39 on the openings prevent entrainment of debris and aquatic organisms. Each auxiliary water
40 intake can supply water in excess of 24,000 gpm (53.5 cfs or 1.5 m^3/s).

1 Cooling water is intermittently treated with sodium hypochlorite to prevent micro- and macro-
2 fouling within the cooling system in accordance with limits specified in the KPS WPDES Permit
3 (WDNR, 2005).

4 **2.1.7 Facility Water Use and Quality**

5 Both the KPS circulating water system and the service water system draw water from, and
6 discharge to, Lake Michigan. Onsite ground water wells also supply water for cooling water
7 makeup and for the plant equipment water system. The following sections detail water use at
8 KPS.

9 *2.1.7.1 Ground Water Use*

10 Ground water use at KPS is relatively minor compared to the total amount of water used for
11 operations. Specifically, KPS uses ground water for cooling, stand-by cooling, and for the plant
12 equipment water system (DEK, 2008). The plant draws onsite groundwater from two wells
13 installed at depths of 310 feet (94 m) and 320 feet (98 m). WDNR permits groundwater
14 withdrawals from these wells, which averaged a total annual pump rate of 3,339,176 gallons per
15 year (6.4 gpm or 4.0×10^{-4} m³/s) from 1977 to 1989 (DEK, 2009a). In 1995, this withdrawal rate
16 increased to an average total pump rate of 25 gpm (1.6×10^{-3} m³/s) to 61 gpm (3.9×10^{-3} m³/s)
17 (DEK, 2009a). An additional 14 wells were installed in 2007 for ground water monitoring
18 purposes (STS, 2007).

19 *2.1.7.2 Surface Water Use*

20 KPS withdraws 401,200 gpm (894 cfs or 25.3 m³/s) from Lake Michigan when both pumps are
21 operating. Because KPS uses a once-through cooling system, consumptive water losses are
22 minimal and the majority of the cooling water withdrawn is discharged directly back to Lake
23 Michigan in a manner complying with the plant's WPDES Wastewater Discharge Permit No. WI-
24 00001571-06 issued by WDNR in 2005 (WPDES, 2005).

25 The intake structure is designed to pump lake water into the system via a 10-foot diameter (3 m)
26 pipe. Normal lake elevation at the intake is 577 feet (176 m). During summer operations, when
27 two of the plant's circulating water pumps are in service, the water level is approximately 571
28 feet (174 m). During winter operations, when only one circulating water pump is in service, the
29 water level is approximately 574 feet (175 m). Because the circulating water pump requires a
30 level of at least 566 feet (172.5 m), low level procedures are activated for the plant if the water
31 level decreases to 567.5 feet (173 m) (DEK, 2008d).

32 *2.1.7.3 Dredging*

33 KPS does not conduct any maintenance dredging activities and does not plan to initiate any
34 during the license renewal term (DEK, 2008).

35 **2.2 AFFECTED ENVIRONMENT**

36 KPS is located on approximately 908 acres of land owned and operated by DEK, on the west-
37 central shore of Lake Michigan in Kewaunee County, Wisconsin, as shown in Figure 2.1-2. Of

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1 the 908 acres, 450 acres are currently used for agriculture. The developed portion of the site
2 consisting of the power plant structure, reactor containment, and associated buildings,
3 maintenance facilities, parking lots, and roads occupies approximately 60 acres of the site. The
4 balance of land remains in a mixture of woods, fields in various stages of succession, small
5 wetlands and watercourses, and open areas (DEK, 2008).

6 **2.2.1 Land Use**

7 The immediate area around KPS is completely enclosed by a security fence, with access to the
8 station controlled at a security gate. The exclusion area, as defined by 10 CFR 100.3, surrounds
9 the plant site as shown in Figure 2.1-3. The plant site can be accessed by road on the west side
10 or from Lake Michigan on the east. Road access to the plant site is from State Highway 42
11 (DEK, 2008). The Two Creeks Buried Forest State Natural Area, a unit of the Ice Age National
12 Scientific Reserve, is located approximately one mile south of the KPS property. The Reserve is
13 a separate affiliated area of the National Park Service.

14 **2.2.2 Air Quality and Meteorology**

15 KPS is located in Carlton, Wisconsin, approximately 27 miles (44 km) southeast of Green Bay
16 on the western shore of Lake Michigan, in the eastern part of Wisconsin. Slightly rolling
17 topography of the region was formed by continental glaciers that slowly moved across
18 Wisconsin for lengthy periods of time, leaving behind ground moraine of till, sand and gravel.

19 The climate of Wisconsin is continental and belongs to “Dfb” type of the Köppen climate
20 classification: hot summers with very cold winters and evenly distributed precipitation throughout
21 the year. The growing season is significantly longer in the eastern part of Wisconsin (from late
22 April–early May to late September–early October), due to the influence of Lake Michigan, than
23 in central and northern parts of Wisconsin. The growing season in southwestern parts of the
24 State has the same duration. The first fall freezes usually occur in mid-October, later than in
25 northern and central parts of Wisconsin, because of the close proximity to Lake Michigan.

26 The dominant wind direction throughout the State of Wisconsin is from the west. However, wind
27 direction in the vicinity of the KPS is strongly influenced by Lake Michigan. There are onshore
28 and offshore winds at the KPS location. Onshore winds are northeastern winds that blow from
29 Lake Michigan toward the land, while southwestern winds that blow from the land to Lake
30 Michigan are defined as offshore winds. There are seasonal wind direction variations such as
31 northeast wind occurrences in the spring and northwestern winds in winter that comprise the
32 majority of the winds at KPS. The average annual wind speed for the National Weather Service
33 Station located in Green Bay, Wisconsin, (27 miles (44 km) northwest of KPS) is 9.9 miles per
34 hour (mph) (8.9 knots).

35 Wisconsin belongs to the Midwestern Regional Climate Center of the National Oceanic and
36 Atmospheric Administration (NOAA). Historical data compiled by NOAA National Climatic Data
37 Center (NCDC) from 1971 to 2000 30-year period indicates that mean annual temperature in
38 Kewaunee County is 44.1°F (6.7°C) and ranges from 68.6°F (20.3°C) in July to 18°F (7.78°C) in
39 January (NCDC, 2009a). According to the Center’s historic climate data for the Kewaunee 3
40 NW, WI Station, which is located approximately 8 miles (approximately 13 km) from KPS,
41 annual precipitation is 30.30 inches (approximately 77 cm), with June–September period being

1 the wettest (NCDC, 2009). Precipitation is distributed according to the demands of the seasons
2 with the majority of the precipitation occurring during the growing, freeze-free period; however,
3 occasionally droughts do occur in the area. Severe weather is typical for Wisconsin. Floods
4 have caused the most damage to the people and property in the State. According to the data
5 recorded by NCDC, 935 floods occurred in the State of Wisconsin from 1950 to 2008 (NCDC,
6 2009b). Two flood events were reported in Kewaunee County: the flood of June 1996, which
7 affected several counties of Eastern Wisconsin and caused \$56 million in property damages,
8 and the flood of March 2007, caused by heavy snowfall, which did not cause any damages.
9 Seven tornadoes hit Kewaunee County between 1950 and 2009 (NCDC, 2009c).

10 2.2.2.1 *Regional Air Quality Impacts*

11 Kewaunee County, where KPS is located, belongs to the Lake Michigan Intrastate Air Quality
12 Control Region (Wisconsin) (AQCR) designated by the EPA and codified in 40 CFR 81.67 and
13 Chapter 404.03 of the Wisconsin Administrative Code. Seventeen counties of the State of
14 Wisconsin belong to the Lake Michigan Intrastate AQCR. Three counties among them, Door
15 County, Manitowoc County and Sheboygan County, constitute subregion I and are located next
16 to or in the close proximity to Kewaunee County and are currently designated by the EPA as 8-
17 hour ozone non-attainment areas (EPA, 2008). Kewaunee County is a maintenance county for
18 8-hour ozone and is in attainment for all other criteria pollutants (EPA, 2009).

19 WDNR implements the Air Management Program and coordinates the ambient air quality
20 monitoring network in the State of Wisconsin. Kewaunee County is part of the Northeastern Air
21 Region of the WDNR. The closest KPS WDNR ozone monitoring station within the Kewaunee
22 County is located in the city of Kewaunee and has been in operation since 1994. In October
23 2006, the EPA issued final amendments to the ambient air monitoring regulations for criteria
24 pollutants (40 CFR Parts 53 and 58) containing the requirement to establish National Core
25 (NCORE) multi-pollutant higher-sensitivity monitoring stations throughout the country. The
26 Mayville WDNR monitoring site, located approximately 78 miles (126 km) southwest of KPS, is
27 proposed for this purpose.

28 KPS stationary emission sources that do not require the facility to secure a Title V permit are:
29 three standby emergency power supply diesel generators, one space heating boiler, and
30 several insignificant emission units that are listed in the KPS Air Pollution Control Operation
31 Permit. KPS is recognized as a Synthetic Minor facility, non-Part 70 by WDNR due to the
32 quantities of emissions and restrictions on the hours of operation of its stationary sources of
33 criteria pollutants (DEK, 2009d). The generators are tested periodically to ensure their continued
34 ability to perform their intended function. There are procedures in place to ensure continuous
35 monitoring, sampling, and filtering of the oil.

36 KPS operates a meteorological system that consists of weather instruments mounted on a
37 primary 197-foot (60-m) high tower and 33-foot (10-m) backup tower, which provides alternative
38 measurements and serves as a secondary data source in the event of sensor failure on the
39 primary tower. There are wind sensors mounted on the primary tower that allow for the
40 calculation of horizontal wind direction standard deviation. The sensors are located at 10 and
41 60 meters height. Vertical temperature differentials are measured with redundant sensor pairs
42 between both levels. Ambient temperature sensors are located at the 10-meter level.

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1 Precipitation is measured at ground level. The backup tower measures ambient temperature,
2 wind speed, direction, and standard deviation at the 33-foot (10-m) level in the event of primary
3 tower failure.

4 There is an established real time review and data quality assurance program for meteorological
5 data. The quality control process involves routine daily inspection of the meteorological data and
6 biweekly review, comparison and processing of the data by the meteorological staff of the
7 Dominion Weather Center. The quality assured meteorological data is then incorporated into the
8 Annual Radioactive Release Reports (DEK, 2009d).

9 Sections 101(b)(1), 110, 169(a)(2) and 301(a) of the Clean Air Act as amended (42 USC 7410,
10 7491(a)(2), 7601(a)) established Mandatory Class I Federal Areas where visibility is important.
11 There are no Mandatory Class I Federal areas in the State of Wisconsin or in close proximity to
12 KPS. The Mandatory Class I Federal Areas closest to KPS are Seney Wilderness Area,
13 Michigan, located 149 miles northeast from KPS, and Isle Royale National Park, Michigan,
14 located 255 miles northwest from KPS. Therefore, no adverse impacts on Class I areas are
15 anticipated from the KPS operation.

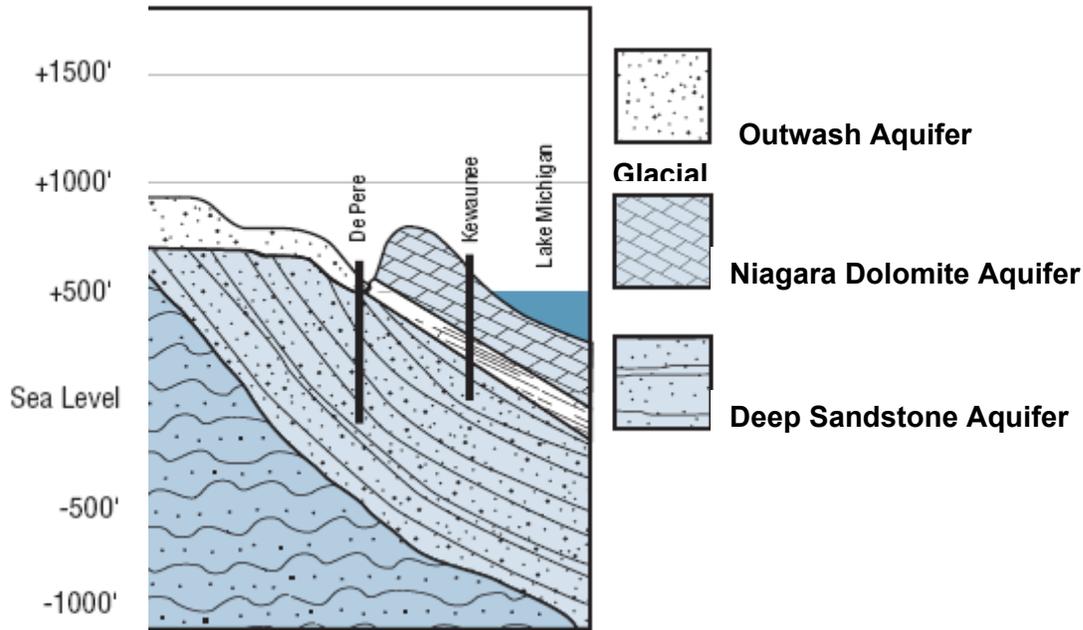
16 **2.2.3 Ground Water Resources**

17 The soil profile at the KPS site consists of glacial drift made up primarily of silty clay, ranging
18 from 60 to 150 feet (18 to 46 m) thick. Underlying the glacial material is a 350-foot (107-m) to
19 600-foot (183-m) thick layer of sedimentary bedrock. The water table underneath the KPS site
20 ranges from 10 to 30 feet (3 to 9 m) below land surface and slopes east toward Lake Michigan
21 (STS, 2007).

22 The three principal aquifers beneath the site are the Glacial Outwash Aquifer, the Niagara
23 Dolomite Aquifer, and the Deep Sandstone Aquifer. An additional minor aquifer, the St. Peter
24 Sandstone Aquifer, is of limited ground water use. About half of local wells are screened in the
25 Glacial Outwash Aquifer, which is made up of sand and gravel layers, the largest of which is not
26 continuous at the site (STS, 2007). Wells screened in this aquifer have a flow rate of
27 approximately 17 gpm ($1.1 \times 10^{-3} \text{ m}^3/\text{s}$). The other half of local wells are screened in the
28 Niagara Dolomite Aquifer, the uppermost bedrock aquifer along the Lake Michigan coastline.
29 Wells screened in this aquifer typically have a depth between 30 and 60 feet (9 to 18 m) and
30 have a flow rate of approximately 13 gpm ($8.2 \times 10^{-4} \text{ m}^3/\text{s}$). Wells pumped within this aquifer
31 have been known to affect the water levels of nearby wells, and those near the shoreline of
32 Lake Michigan may induce water flow from the lake into the aquifer (DEK, 2007b). The two
33 groundwater wells used by KPS draw water from the Niagara Dolomite Aquifer at depths of 310
34 feet (94 m) and 320 feet (98 m) (DEK, 1968).

35 The third and deepest major aquifer, the Deep Sandstone Aquifer, is between 1,200 and
36 1,700 feet (366 to 518 m) and includes the Dresbach, Franconia, and Trempealeu formations.
37 This aquifer is separated from the Niagara Dolomite by 800 feet (244 m) of shale and dolomite
38 strata. Water in the Deep Sandstone Aquifer is not potable because it is too saline (DEK,
39 2007b). Figure 2.5 illustrates the primary aquifers beneath KPS.

1 **Figure 2-5. Primary aquifers beneath the Kewaunee Power Station Site**
 2



21 Source: WDNR, 2009f

22 **2.2.3.1 Kewaunee Power Station Water Supply Wells**

23 KPS has two high capacity onsite wells screened in the Niagara Dolomite Aquifer (DEK, 1968).
 24 These wells are permitted for ground water withdrawal by WDNR. The first well (BE601) is
 25 310 feet (94 m) in depth and 10 inches (25.4 cm) in diameter. The second well (BE602) is
 26 320 feet (98 m) in depth and 10 inches (25.4 cm) in diameter (DEK, 2007a).

27 Together, both wells yield an average total of 25 gpm ($1.6 \times 10^{-3} \text{ m}^3/\text{s}$) to 61 gpm
 28 ($3.9 \times 10^{-3} \text{ m}^3/\text{s}$). The highest recorded monthly average yield occurred in January 2008 at
 29 52.6 gpm ($3.3 \times 10^{-3} \text{ m}^3/\text{s}$). The KPS wells typically do not withdraw ground water during the
 30 summer months (See Table 2-1) (DEK, 2009a).

1 **Table 2-1. Potable Water Usage (Gallons) at Kewaunee Power Station**
 2

Month	Well	Well	Total Usage	Average Usage	Average Usage	Average Usage
	1A	1B		Per Day	Per Hour	Per Min
Sep-07	2,109,465	284	2,109,749	72,750	3,031	50.5
Oct-07	2,391,263	17,339	2,408,602	72,988	3,041	50.7
Nov-07	2,139,279	0	2,139,279	71,309	2,971	49.5
Dec-07	1,858,387	435	1,858,822	58,816	2,451	40.8
Jan-08	2,247,797	0	2,247,797	72,558	3,023	50.4
Feb-08	2,193,619	0	2,193,619	75,696	3,154	52.6
Aug-08	0	0	0	0	0	0.0
Sep-08	36,977	490,822	527,799	15,093	629	10.5
Oct-08	29,988	0	29,988	968	40	0.7
Nov-08	2	0	2	0	0	0.0
Dec-08	72,999	60,415	133,414	3,814	159	2.6
Jan-09	0	615	615	20	1	0.0
Feb-09	11	0	11	0	0	0.0
Mar-09	1,628,170	0	1,628,170	58,070	2,420	40.3
Apr-09	624,874	1,135,966	1,760,840	58,776	2,449	40.8

Source: DEK 2009a.

3 **2.2.3.2 Kewaunee Power Station Ground Water Monitoring**

4 KPS monitors groundwater for the possible infiltration of radionuclides such as tritium. As tritium
 5 decays, it emits a low-energy beta particle that cannot travel far into either tissue or air. Tritium
 6 is a product of manmade sources, as well as natural processes.

7 The KPS Groundwater Monitoring Program includes 14 monitoring wells, including the two high
 8 capacity wells onsite (DEK, 2009b). The ground water monitoring wells were installed in 2007
 9 for use in tritium assessment at the plant site. This assessment concluded that the most likely
 10 potential tritium release to ground water is contained in the sand backfill beneath the site, and
 11 that the migration of this potential release would likely follow the water table east toward Lake
 12 Michigan (STS, 2007).

13 **2.2.4 Surface Water Resources**

14 In accordance with the Federal Water Pollution Control Act (or the Clean Water Act (CWA)),
 15 KPS effluent discharges are regulated by the Wisconsin Pollutant Discharge Elimination System
 16 (WPDES) Permit No. WI-00001571-06 issued and enforced by the WDNR. Section 402 of the
 17 CWA states that the NPDES (National Pollutant Discharge Elimination System) prohibits
 18 discharges of pollutants from any point source into the nation's waters except as allowed under
 19 an NPDES permit. The purpose of this permit is to regulate wastewater discharge to preserve
 20 the water quality of the surrounding water bodies. As of the most recent permit issued, there
 21 have been no notices of violation for the KPS site. Information in this section is from the most
 22 recent KPS WPDES permit, a copy of which is included in the applicant's license renewal

1 environmental report. The most recent renewal of this permit became effective August 1, 2005,
2 and expires June 30, 2010.

3 Table 2-2 shows the quantitative effluent limitations regulated under the WPDES permit, or the
4 residual concentrations of permitted chemical additives that may be discharged to Lake
5 Michigan. In accordance with this permit, any new chemical additives introduced, or current
6 dosages increased, must first be reviewed and approved by the WDNR.

Table 2-2. Wisconsin Pollutant Discharge Elimination System Effluent Limitations for Kewaunee Power Station

Sample Point No.	Total Suspended Solids (mg/L)			Total Residual Chlorine (lbs/day)	Oil and Grease (Hexane or Freon) (mg/L)		Discharge Flow (MGD)
	Monthly Average	Daily Max.	Weekly Max.	Daily Max.	Monthly Average	Daily Max.	
Outfall 001	30	100	NLR	180	10	15	494*
Outfall 002	NLR	NLR	NLR	NLR	NLR	NLR	3.96
Outfall 003	30	NLR	45	NLR	NLR	NLR	0.01
SP101	30	100	NLR	NLR	15	20	0.01
SP201	30	100	NLR	NLR	15	20	0.06
SP301	30	100	NLR	NLR	15	20	0.03
SP501	30	100	NLR	NLR	15	20	0.14

NLR: No Limit Required

*580 MGD (summer); 380 MGD (winter)

7 The permit outlines the effluent limitations and monitoring requirements of the three different
8 discharge outfalls, as well as five additional sampling points. In addition to the effluent
9 limitations shown in Table 2-2, the permit describes the minimum number of sampling events
10 required for each outfall. Flow monitoring requirements are outlined for certain outfalls, as well
11 as required pH monitoring, with pH levels expected to be between 6.0 and 9.0 year-round.

12 Outfall 001 discharges condenser cooling water and process wastewater and is sampled prior to
13 discharge to Lake Michigan. Daily temperature averages at this outfall are recorded. Outfall 002
14 monitors recirculated water from Outfall 001 to prevent icing of the intake. Only flow rate is
15 monitored at this outfall. Outfall 003 samples the sewage treatment plant effluent prior to its
16 discharge to an unnamed tributary to Lake Michigan. Both Outfall 001 and 003 are required to
17 undergo both acute and chronic Whole Effluent Toxicity (WET) testing two to three times per

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1 quarter. The permittee (DEK) is required to investigate any occurrences of serious or repeated
2 toxicity found during these WET tests.

3 Five additional sampling points are regulated by the WPDES permit. SP101 samples the steam
4 generator blowdown to Outfall 001. SP201 samples the floor drains to Outfall 101. SP301
5 samples the service water treatment lagoon overflow to Outfall 101. SP501 samples the reverse
6 osmosis discharge wastewater to Outfall 101. SP601 monitors the flow of Lake Michigan water
7 or water pumped from the turbine building basement in case of circulating water system failure
8 near the Outfall 101 discharge structure.

9 KPS implements a Storm Water Pollution Prevention Plan onsite to reduce the amount of
10 pollution discharged through storm water runoff. The purpose of this plan is to eliminate any
11 contact discharged storm water may have with potentially contaminating materials. There are
12 seven designated storm water outfalls onsite. Discharge monitoring of these outfalls is regulated
13 by a "Tier 2" WPDES permit (Permit No. WI-S067857-2) (DEK, 2009f).

14 Sanitary wastewater is treated at the site's sewage treatment plant, which was installed in 1986.
15 Typical plant operations require the plant to treat approximately 11,000 gpd (7.6 gpm; 4.8×10^{-4}
16 m^3/s); however, the plant is capable of treating up to 20,000 gallons (75.7 m^3) of sewage per
17 day. The system discharges approximately 7.6 gpm ($4.8 \times 10^{-4} \text{ m}^3/\text{s}$). Solids are disposed of at
18 an offsite facility after onsite treatment (DEK 2008).

19 **2.2.5 Aquatic Resources**

20 KPS is located on the west-central shore of Lake Michigan. Lake Michigan constitutes a total
21 area of 67,900 mi^2 (175,800 km^2) and a total volume of 1,180 mi^3 (4,920 km^3) and is the third
22 largest of the Great Lakes by area and second largest by volume (EPA, 1992). The lake's
23 average depth is 279 feet (85 m) and maximum depth is 925 feet (282 m) (GLC, 2000). The
24 lake surface lies at an average of 577 feet (176 m) above mean sea level (AEC 1972). The Lake
25 Michigan drainage basin encompasses over 45,000 mi^2 (72,400 km^2) and major tributaries
26 include the Fox-Wolf, Grand, and Kalamazoo rivers (DEK, 2008; GLC, 2000). Lake Michigan
27 flows through the Straits of Mackinac into Lake Huron at a recharge rate of once every 100
28 years (GLC, 2000). Lake Michigan has a low salinity level of less than 0.1 parts per thousand
29 (ppt) (DEK, 2008).

30 Lake Michigan is used for a variety of purposes, including commercial and recreational boating,
31 sport and commercial fishing, and tourism. The major changes and modifications that have had
32 the greatest effect on aquatic resources of Lake Michigan include lakefront industrial, urban,
33 and residential development; water quality impairment from industrial, municipal, agricultural,
34 navigational, recreational water uses, overfishing, and invasion of exotic species (EPA, 2008e).
35 The Lake Michigan ecosystem continues to experience profound changes because of
36 development, impacts of invasive species, and pollution. In the 2008 Lakewide Management
37 Plan (EPA, 2008d), Lake Michigan's status was described as mixed with a slight, but continuing
38 decline in water quality.

39 There have been a series of milestones in the management of the Great Lakes. In 1955, the
40 Canadian/U.S. Convention on Great Lakes Fisheries created the Great Lakes Fishery
41 Commission (GLFC), which coordinates fisheries research and facilitates cooperative fishery

1 management among the State, provincial, tribal, and Federal agencies. The GLFC is
2 responsible for implementing the Joint Strategic Plan for Management of Great Lakes Fisheries
3 (GLFC, 1997). Eight States bordering the Great Lakes, the Province of Ontario, two intertribal
4 agencies, and several Federal agencies are signatory to this management plan and work
5 together to rehabilitate native lake species, control exotic species, prevent and manage fishery
6 disease, coordinate law enforcement, produce new research, publish state-of-the-lake reports,
7 and determine total allowable catch and allocation agreements and fish stocking levels (GLFC,
8 2009).

9 In 1972, the first Great Lakes Water Quality Agreement (GLWQA) was signed between the
10 International Joint Commission (IJC) of Canada and the United States. Both countries pledged
11 to address the deterioration of Great Lakes water quality from point source and non-point
12 source pollution. A new GLWQA was signed in 1978 that outlined additional commitments to
13 restore and maintain the “chemical, physical, and biological integrity” of the Great Lakes by
14 seeking to eliminate persistent toxic substances (IJC 2006). In 1987, the GLWQA established
15 processes and basic commitments for developing and implementing remedial action programs
16 (RAPs) in geographic areas of concern (AOCs) and within the context of existing Lakewide
17 Management Plans (LaMPs) (EPA and Environment Canada, 1997).

18 Forty-two AOCs have been identified across the Great Lakes basin, ten of which are in the Lake
19 Michigan basin (EPA, 2008d). The closest AOC in relation to KPS is the Lower Green Bay and
20 Fox-Wolf River AOC, which suffers from eutrophication, degradation of phytoplankton and
21 zooplankton populations, and has consumption advisories for mallard ducks and 12 species of
22 fish (EPA, 2008e). Water contaminants of concern in this area include phosphorus, suspended
23 solids, PCBs, ammonia, and various pesticides. Sediment contaminants include PCBs,
24 cadmium, mercury, lead, and pesticides (EPA, 2008d). The Great Lakes Binational Toxics
25 Strategy was created in 1997 for the purpose of reducing the environmental threats posed by
26 persistent toxic substances such as those mentioned above (EPA and Environment Canada,
27 1997). By 2006, as a result of this effort, deliberate mercury use and mercury releases were
28 reduced by 50 percent in the United States, dioxin/furan releases were reduced by 75 percent in
29 the United States, and less PCB-containing equipment use was documented (EPA and
30 Environment Canada, 2007).

31 The EPA conducted a study from 1994 to 2000, called the Lake Michigan Mass Balance Study
32 (LMMB), which focused on the pathways of four major chemicals: PCBs, representative of
33 conservative organic compounds; atrazine, a widely-used herbicide representative of reactive,
34 biodegradable compounds; trans-nonachlor, a component of the pesticide chlordane,
35 representative of persistent, bioaccumulative compounds; and mercury, also a persistent,
36 bioaccumulative compound in the atmosphere, tributaries, lake water, sediments, and food
37 webs of Lake Michigan and its basin. The Great Lakes Binational Toxics Strategy was
38 implemented within the last three years of the LMMB study. Because the Great Lakes Binational
39 Toxics Strategy has reported successes at reducing levels of toxins in all categories the
40 Strategy addresses, actual levels of toxins may now be further reduced than the LMMB
41 indicates. Therefore, only general trends for toxin levels identified in the LMMB are discussed.

Affected Environment

1 PCBs are organochlorines that were once widely used for industrial purposes until the EPA
2 banned them from use in 1979 in all but completely enclosed systems due to their
3 environmental and health effects. PCBs have been linked to reproductive problems and
4 deformities in fish and wildlife. Trans-nonachlor is a component of the pesticide chlordane that
5 can rapidly bioaccumulate. During the LMMB, PCB and trans-nonachlor trends indicated that
6 levels are declining overall. Levels of dissolved and particulate PCBs in the atmosphere, Lake
7 Michigan tributaries, the Lake Michigan Water column, and sediments were generally highest in
8 the southern portion of the Lake Michigan basin and near urbanized and industrialized areas
9 (McCarty et al., 2004). However, trans-nonachlor concentrations were higher in rural,
10 agricultural areas with decreasing concentrations northward (McCarty et al., 2004). This trend
11 may be a result of historical application, since this chemical is no longer produced in the United
12 States (McCarty et al., 2004). The WDNR advises against eating lake trout (larger than 27
13 inches (69 cm)) within Lake Michigan due to the risk of high PCB levels (WDNR, 2009). The
14 WDNR also advises against eating brown trout (larger than 25 inches (64 cm)), Chinook salmon
15 (larger than 36 inches (91 cm)), and lake trout (23 to 27 inches (58 to 69 cm)) more than once
16 every two months due to the potential for elevated PCB levels (WDNR, 2009).

17 Atrazine is one of the most widely-used herbicides in the United States and is most commonly
18 applied to corn crops in spring months within the Lake Michigan basin. The chemical does not
19 bioaccumulate, but persists in the water column due to its slow decay rate. Atrazine
20 concentrations were found to be highly seasonal, corresponding to agricultural application
21 during the spring months, and regionally, were elevated in areas of high agricultural production.
22 Tributaries were found to be the most prevalent source of atrazine, though levels in the Lake
23 Michigan water column were generally persistent with a slow decay rate of one percent per
24 year. Results suggested that lake-wide levels of atrazine in Lake Michigan may be increasing
25 under present loads (Brent et al., 2001).

26 Mercury is a persistent metal that can bioaccumulate and cause reproductive and growth effects
27 in fish and wildlife. Vapor, particulate, and precipitate were all major contributors of mercury to
28 Lake Michigan, with seasonal patterns—the highest concentrations were observed in summer
29 months—and regional patterns, with Chicago having significantly higher concentration of
30 mercury in both particulate and vapor phases. Mercury levels in Lake Michigan tributaries were
31 comparable to previously recorded levels in other Midwestern rivers and well below the
32 nationwide criteria for water quality. Levels were highest in the Fox River, which had
33 concentrations averaging up to 2.7 times higher than other tributaries (McCarty et al., 2004a).
34 Water column levels of mercury in Lake Michigan were lower than measured levels in tributaries
35 and generally well mixed within the water column (McCarty et al., 2004a). Mercury levels in trout
36 and coho salmon were found to exceed the EPA guidelines for unrestricted consumption and at
37 levels that warrant consumption advisories for these species (McCarty et al., 2004a). As of
38 2009, no consumption advisories exist for fish in Lake Michigan bordering Keweenaw or its
39 neighboring counties (WDNR, 2009).

40 In the near vicinity of KPS, Lake Michigan is shallow with depths of 15 to 20 feet (4.6 to 6.1 m)
41 1,600 feet (488 m) offshore of the intake structure (DEK, 2008). Near shore substrate consists
42 mainly of cobble and gravel, and bottom sediment consists mainly of hard red clay and fine to
43 medium sand (AEC, 1972; EA Engineering, 2007). The depth reaches over 600 feet (82 m) in
44 the central part of the lake, referred to as the Chippewa Basin (EA Engineering, 2007).

1 The native fish community consists of deepwater species including the bloater (*Coregonus*
2 *hoyi*), lake herring (*Coregonus artedii*), and lake whitefish (*Coregonus clupeaformis*), predators,
3 including lake trout (*Salvelinus namaycush*) and walleye (*Stizostedion vitreum*), and
4 intermediate predators, such as white bass (*Morone chrysops*) and yellow perch (*Perca*
5 *flavescens*). Demersal species such as white sucker (*Catostomus commersoni*) and freshwater
6 drum (*Aplodinotus grunniens*), small forage species such as the emerald shiner (*Notropis*
7 *atherinoides*), and sunfish family species such as pumpkinseed (*Lepomis gibbosus*) and
8 smallmouth bass (*Micropterus dolomieu*) are also characteristic of the native fish community
9 near KPS (EA, Engineering 2007; UWSGI, 2002b).

10 Preoperational monitoring indicated that the fish population in Lake Michigan near the KPS site
11 was primarily composed of alewife (*Alosa pseudoharengus*), lake trout (*Salvelinus namaycush*),
12 and rainbow smelt (*Osmerus mordax*) (AEC, 1972). Lake chub, yellow perch, white suckers,
13 longnose dace, and slimy sculpin were also captured during 1971 fish collections (AEC, 1972).
14 The most prevalent sport fish in the area was lake trout, most of which had been recently
15 stocked in Wisconsin waters by Federal or State agencies (AEC, 1972).

16 Catch data for the period of 1971 through 1975 for the KPS Clean Water Act Section 316(a)
17 Demonstration (NES, 1976a) included both preoperational and operational data. Alewife was
18 the most prevalent species, constituting 65 percent of total catch. Other recorded species
19 included rainbow smelt, yellow perch, lake trout, lake chub, white sucker, longnose dace, and
20 longnose sucker. Sport fishing species included lake trout, rainbow trout, brown trout, brook
21 trout, coho salmon, and Chinook salmon, the abundance of which was attributed to the activity
22 of stocking in the KPS area. The 316(a) Demonstration did not identify any significant increases
23 or decreases in fish densities. (NES, 1976a)

24 The Lake Michigan biological community has changed numerous times since the mid-
25 nineteenth century as a result of introduced fish and invertebrate species. Major introductions
26 include the common carp (*Cyprinus carpio*) and brown trout (*Salmo trutta*) in the 1890s (EA
27 Engineering, 2007), the rainbow smelt in the early 1900s (Crowder, 1980; UWSGI, 2002c), the
28 sea lamprey (*Petromyzon marinus*) in the late 1930s (USGS, 2008), the alewife in the 1950s
29 (EA Engineering, 2007; Crowder, 1980), and the round goby in the 1990s (EA Engineering,
30 2007). Two dreissenid mussels, the zebra mussel (*Dreissena polymorpha*) and the quagga
31 mussel (*Dreissena bugensis*), have also invaded Lake Michigan beginning in the 1990s (Brandt,
32 2004; EA Engineering, 2007).

33 Common carp were brought to North America as a farmed food source in the late 1800s, and
34 spread to the Great Lakes beginning in 1983 (UWSGI, 2002a). Carp are particularly abundant
35 near the southeastern shore of Lake Michigan and lower Green Bay and can reproduce quickly
36 and outcompete native fish species due to their large size and voracious appetite (EPA, 2008c;
37 UWSGI, 2002a). Brown trout were introduced to North America in 1883 and to Wisconsin,
38 specifically, in 1887 (UWSGI, 2002). Brown trout have not negatively affected native species
39 because brown trout adapt readily to degraded habitats and are regularly harvested as game
40 fish (UWSGI, 2002).

Affected Environment

1 The sea lamprey entered the Great Lakes via ship canals and locks from the Atlantic Ocean in
2 the 1930s (USGS, 2008). Sea lamprey is a primitive fish that feeds parasitically on the blood of
3 host fish during part of its life cycle (USGS, 2008). Within Lake Michigan, common host fish
4 include lake trout, whitefish, and other top predator species (EA Engineering, 2007). Prey
5 species in the Great Lakes are smaller than natural prey species in the Atlantic Ocean, which
6 makes Great Lakes prey species more likely to be killed from a sea lamprey attack or die of
7 secondary infection from wounds (DEK, 2008; USGS, 2008). Approximately 40 to 60 percent of
8 lake trout attacked by sea lamprey die from loss of blood (USGS, 2008). A combination of
9 overfishing and sea lamprey predation are attributed to the lake trout's (*Salvelinus namaycush*)
10 extirpation from lakes Michigan, Ontario, Eerie, and Huron (USGS, 2008). Sea lamprey
11 predation, in combination with overfishing and other factors, has led to the extinction of the
12 longjaw cisco (*Coregonus alpenae*), the deepwater cisco (*C. johannae*), and the blackfin cisco
13 (*C. nigripinnis*) (Fuller et al., 2007). Sea lamprey is also responsible for the whitefish and chub
14 population collapses during the 1940s and 1950s (USGS, 2008).

15 As a result of sea lamprey introductions, many top predator species' populations were reduced,
16 which allowed populations of their prey, rainbow smelt and alewife, to flourish. Rainbow smelt
17 were initially released into Crystal River, Michigan, in 1912 as food for stocked salmon and soon
18 after spread to the Great Lakes (Crowder, 1980; UWSGI, 2002c). The alewife was first
19 observed in Lake Michigan in 1949 and was able to outcompete and prey on the young of
20 dwindling populations of several native fish species (Crowder, 1980). During the period of time
21 rainbow smelt and alewife were introduced to Lake Michigan, the numbers of numerous native
22 species declined and some became extremely rare. These species include emerald shiner
23 (*Notropis atherinoides*), lake herring (*Coregonus artedii*), kiyi (*C. kiyi*), and five other species of
24 cisco (*Coregonus* spp.) (Crowder, 1980). Numerous hypotheses may explain native fish
25 population declines, but the effects of invasive species are the most commonly put forth.
26 Alewives may contribute to a decline in native fish populations because alewives are able to
27 outcompete native species for planktonic and other smaller organisms, and alewives may also
28 prey on the eggs and larvae of native fish species (Crowder, 1980; EA Engineering, 2007).
29 Rainbow smelt are thought to prey on eggs and larvae of native fish, including lake trout,
30 whitefish, walleye, and cisco and have a negative impact on the native fish population (Crowder,
31 1980; WDNR, 2004). Native fish that consume smelt may have a decreased ability to
32 successfully reproduce because smelt are rich in thiaminase, an enzyme that destroys thiamin,
33 which is necessary for embryo development (WDNR, 2004). Rainbow smelt are harvested
34 commercially and recreationally in Wisconsin, which serves as a controlling force on the
35 population. In 2004, 155,000 pounds (70,300 kg) of smelt were harvested by commercial
36 trawlers in Lake Michigan and Green Bay alone (WDNR, 2004).

37 Annual die-offs of alewives became common in the 1950s and 1960s due to overcrowding
38 (Crawford, 2001). Alewives prey on zooplankton, which decreases the population of
39 zooplankton available to graze on phytoplankton, thereby decreasing the clarity of water
40 (Crawford, 2001). Evidence also suggests that selective predation on zooplankton caused a
41 shift in the size structure of zooplankton in Lake Michigan. Larger cladocerans (including
42 *Leptodora kindtii*, *Daphnia galeata*, and *D. retrocurva*), three species of larger calanoid
43 copepods, and the cyclopoid copepod *Mesocyclops edax* sharply declined between the
44 introduction of the alewife and 1966, while medium and small-sized zooplankton species
45 increased in numbers (Wells 1970). Some populations, such as *D. retrocurva*, experienced a

1 decrease in average size and size at onset of maturity (Wells, 1970). In 1965, WDNR initiated a
2 stocking program that included pacific salmon and other salmonids to control alewife
3 populations (EA Engineering, 2007). By the mid-to-late 1980s, alewife numbers were visibly
4 reduced as a result of salmon stocking (Crawford, 2001). Stocking of salmonids continues, in
5 reduced numbers, which has created a better balance between alewife and salmonid predator
6 populations and provides for sport fishing (EA Engineering, 2007). Currently, the only objective
7 for salmonid stocking is to maintain the recreational fishery base as stream temperatures are
8 too high for natural spawning along the Wisconsin shoreline of Lake Michigan (Crawford, 2001).

9 Two dreissenid mussels, the zebra mussel and the quagga mussel, established populations in
10 Lake Michigan in the 1990s as a result of ship ballast-water discharges (EA Engineering, 2007).
11 Zebra mussels displace native clams and unionid mussels by interfering with their feeding,
12 growth, and reproduction when they attach themselves to live clams and mussels (DEK, 2007a).
13 The reduction of available phytoplankton mass as a result of these mussel species is attributed
14 to the decline of *Diporeia* spp., which were dominant amphipods, by 90 percent between 1993
15 and 2002, though the exact mechanism is uncertain (Brandt, 2004). Community alterations by
16 the dreissenid mussels are also thought to contribute to the population decline and poorer
17 observed body condition of whitefish species and yellow perch because of the decline of
18 *Diporeia* as their food source (Platt, 2009). Though the cause-and-effect relationship between
19 the quagga mussel increase and the loss of *Diporeia* is not completely understood, the Great
20 Lakes Coalition and the Natural Resources Defense Council, among others, are pushing for
21 stronger regulations regarding ship ballast water to limit additional spread of the mussel species
22 (Platt, 2009).

23 The Lake Michigan phytoplankton and zooplankton communities are highly variable and may be
24 experiencing changes due to contaminant and nutrient levels, sedimentation, and invasive
25 species (EPA, 2008d). Phytoplankton abundance and production in nearshore waters of Lake
26 Michigan have been decreasing since 1970 and has been suggested to be caused by a
27 reduction in phosphorus loadings (Madenjian et al., 2002). Makarewicz et al. (1994) examined
28 trends in phytoplankton abundance in Lake Michigan from 1983 to 1992 and related them to
29 “top-down mediated changes” observed in the fish and zooplankton communities.
30 Bacillariophyta (diatoms) dominated spring samples in all but one year and accounted for 69 to
31 95 percent of total algal biomass. Summer phytoplankton samples were dominated by diatoms,
32 Chlorophyta (green algae), Chrysophyta (yellow-green or yellow-brown algae), and Pyrrophyta
33 (dinoflagellates). The presence of large-bodied zooplankton (e.g., *Daphnia* spp.) resulted in
34 increasing abundance of colonial and filamentous algae; low numbers of *Daphnia* spp. were
35 associated with an increasing abundance of small, unicellular phytoplankton. Makarewicz et al.
36 (1994) also noted that large zooplankton became more abundant from 1983 through 1985 after
37 a sharp decline in the abundance of alewife in 1982 and 1983.

38 The introduction of the non-native spiny water flea (*Bythotrephes cederstroemi*), a cladoceran,
39 caused a significant decline in three native species of *Daphnia* (Lehman 1991). Another non-
40 native cladoceran, the fishhook water flea (*Cercopagis pengoi*), has also invaded the Great
41 Lakes (WDNR, 2004a). These species compete with planktivorous larval fish for food and have
42 been implicated as a factor in the decline of alewives in Lake Erie, Lake Huron, Lake Michigan,
43 and Lake Ontario (Liebig and Benson, 2007).

1 **2.2.6 Terrestrial Resources**

2 The KPS site and its associated transmission lines are located within the Lake Michigan
3 watershed and drainage basin. The KPS site is located in the town of Carlton, Kewaunee
4 County, Wisconsin, and is approximately 37 miles (59.5 km) southeast of Green Bay,
5 Wisconsin. The KPS site is 908 acres (367 ha), of which 450 acres (182 ha) are leased for
6 farmland (DEK, 2008). These farmlands would be allowed to return to forested or wetland areas
7 if the leases ran out or were terminated. The KPS reactor buildings, other building facilities,
8 parking lots, and switchyard cover 60 acres (24 ha) of the overall site (DEK, 2008). The
9 remaining 398 acres (161 ha) is mixed use and is comprised of forested plots, fields, wetlands,
10 and water courses (DEK, 2008). Site land use consists of about 53 percent agriculture, 16
11 percent open fields/early successional, 18 percent forest communities, 1 percent shoreline, 7
12 percent plant site facilities, and 3 percent mowed fields (DEK, 2009c). Figure 2.1-3 shows the
13 KPS site boundary. Some open fields may be due to ROW maintenance, which keeps the
14 forested areas in stages of early succession.

15 Upland areas at the KPS site support a variety of trees including quaking aspen (*Populus*
16 *tremuloides*), northern white cedar (*Thuja occidentalis*), eastern cottonwood (*Populus deltoides*),
17 black willow (*Salix nigra*), green ash (*Fraxinus pennsylvanica*), American beech (*Fagus*
18 *grandifolia*), and paper birch (*Betula papyrifera*) (DEK, 2008). Low-story trees and shrubs
19 include red osier dogwood (*Cornus stolonifera*), hazelnuts (*Corylus* spp.), blueberry (*Vaccinium*
20 spp.), and brambles (*Rubus* spp.) (WDNR, 2009c). Open field and grassland species include
21 Bird's-foot violet (*Viola pedata*), rosinweed (*Silphium integrifolium*), rattlesnake master
22 (*Eryngium yuccifolium*), and blazing star (*Liatris pycnostachya*) (WDNR, 2009d). The farmland
23 that DEK leases out produces common Wisconsin crops including soybeans.

24 The Lake Michigan shoreline on the KPS site is comprised mostly of narrow (0- to 100-foot-wide
25 (0- to 30.5-m-wide)) beaches with sparse vegetation. The beaches are bordered by bluffs or
26 cliffs, which have been created over years of erosion induced by the fluctuating lake levels. In
27 the late 1980s, DEK placed riprap along the edges of the bluffs of the southern end of the site
28 shoreline to combat cliff erosion. The beach is at its narrowest at the south of KPS. North of the
29 plant, the beaches are slightly wider, ranging from 20 to 80 feet (6 to 24 m) and also contain the
30 most vegetation comprised of low-lying growth, shrubs, and trees. The beaches are the widest
31 (more than 80 feet (24 m)) where the slope to the lake is more gradual (DEK, 2008).

32 The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory database shows
33 wetlands, some of which are classified as significant habitats, on the KPS site, as well as the
34 neighboring shorelines of Lake Michigan surrounding the site (USFWS, 2009). Two wetland
35 areas have been delineated by DEK. The first is an area referred to by DEK staff as the
36 "Independent Spent Fuel Storage Installation wetland", which was delineated in 2005–2006 for
37 purposes of pad construction and expansion. The second delineated wetland surrounds the
38 KPS switchyard on three sides. Typical wetland species for the KPS site and surrounding area
39 include tussock sedge (*Carex stricta*), northern white cedar (*Thuja occidentalis*), and wild rice
40 (*Zizania aquatica*) (WDNR, 2009e).

41 Invasive plant species common to the KPS site and surrounding areas may include Amur
42 honeysuckle (*Lonicera maackii*), European alder (*Alnus glutinosa*), bull thistle (*Cirsium vulgare*),
43 butter and eggs (*Linarea vulgaris*), Canada bluegrass (*Poa compressa*), Canada thistle (*Cirsium*
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1 *arvense*), common buckthorn (*Rhamnus cathartica*), crown vetch (*Coronilla varia*), cottonwood
2 (*Populus deltoides*), Kentucky bluegrass (*Poa pratensis*), kudzu (*Pueraria lobata syn Pueraria*
3 *montana var lobata*), multiflora rose (*Rosa multiflora*), tree-of-heaven (*Ailanthus altissima*), big
4 tooth (or large tooth) aspen (*Populus grandidentata*), quaking aspen (*Populus tremuloides*),
5 black locust (*Robinia pseudoacacia*), willows (*Salix* spp.), white sweet clover (*Melilotus alba*),
6 Queen Anne's lace (*Daucus carota*), and box elder (*Acer negundo*) (WDNR, 2009b). Invasive
7 animal species common to the KPS site and surrounding area may include Asian longhorned
8 beetle (*Anoplophora glabripennis*), emerald ash borer (*Agrilus planipennis*), mute swan (*Cygnus*
9 *olor*), European gypsy moth (*Lymantria dispar*), and eastern tent caterpillar (*Malacosoma*
10 *americanum*) (WDNR, 2009a). DEK does not manage any invasive species on the KPS site,
11 and has not managed invasive species in the past. DEK is not required to keep records of
12 known invasive species and does not have programs or procedures in place to control terrestrial
13 plant or animal invasive populations on the KPS site.

14 A variety of wildlife exists on and in the vicinity of the KPS site. Mammals common to the KPS
15 site include white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*),
16 raccoon (*Procyon lotor*), coyote (*Canis latrans*), fox squirrel (*Sciurus niger*), eastern chipmunk
17 (*Tamias striatus*), and short-tailed shrew (*Blarina brevicauda*) (DEK, 2008). Reptiles and
18 amphibians common to the KPS site include spring peepers (*Pseudacris crucifer*), green frogs
19 (*Rana clamitans*), wood frogs (*Rana sylvatica*), American toads (*Bufo americanus*), chorus frogs
20 (*Pseudacris triserata*) as well as numerous species of snakes, turtles, lizards, and salamanders
21 (DEK, 2008). Additionally, several common amphibian species, including spring peepers
22 (*Pseudacris crucifer*), green frogs (*Rana clamitans*), wood frogs (*Rana sylvatica*), American
23 toads (*Bufo americanus*), and chorus frogs (*Pseudacris triserata*) were recorded during a recent
24 KPS terrestrial survey (DEK, 2008a).

25 The KPS site provides habitat to a variety of songbirds, upland game birds, waterfowl, and
26 raptors. Birds common to the KPS site include red-winged blackbird (*Agelaius phoeniceus*),
27 European starling (*Sturnus vulgaris*), American goldfinch (*Carduelis tristis*), clay-colored
28 sparrow (*Spizella pallida*), American robin (*Turdus migratorius*), ring-billed gull (*Larus*
29 *delawarensis*), Canada goose (*Branta canadensis*), and mallards (*Anas platyrhynchos*) (DEK,
30 2008). Bank swallows (*Riparia riparia*) nest in the cliffs along the Lake Michigan shore (DEK,
31 2008). A registered peregrine falcon (*Falco peregrinus*) breeding pair has nested on the KPS
32 reactor building since 2001. An osprey (*Pandion haliaetus*) was seen flying over the KPS site in
33 2006; however, there have been no recorded sightings since.

34 DEK has several procedures for protecting the environment, including vegetation and wildlife,
35 from impacts that could result from activities at KPS. Generally, procedures require KPS activity
36 planners to complete an environmental review checklist to determine if a proposed activity
37 requires further evaluation for environmental impacts and risk. If the environmental review
38 checklist reveals that a planned activity could disturb vegetation or wildlife habitat, then an
39 environmental evaluation must also be completed, and a qualified subject matter expert must
40 evaluate the potential for adverse impacts on endangered or threatened wildlife and plant
41 species or critical habitat. If the evaluation concludes that the proposed activity would result in
42 an environmental impact, then the activity may not proceed until the impact has been resolved
43 through avoidance, mitigation, or a compliance plan, when allowed by regulation.

Affected Environment

1 DEK actively manages the Joe Krofta Memorial Forest, named for a previous landowner. The
2 forest is a 15-acre (6-ha) site with various planted trees and is located within the southern half of
3 the KPS site. It was previously used as an outdoor classroom by local schools, but since
4 September 11, 2001, access to this site has been restricted for security reasons (DEK, 2008).

5 **2.2.7 Threatened and Endangered Species**

6 *2.2.7.1 Aquatic Threatened and Endangered Species*

7 Table 2-3 lists threatened, endangered, or candidate species known to occur in Kewaunee
8 County, in which KPS is located, or Brown, Manitowoc, or Outagamie Counties, where
9 transmission line ROWs associated with KPS traverse.

10 No Federally-listed aquatic species are known to occur on or in the vicinity of KPS or its
11 associated transmission line ROWs. Three fish species and six mussel species are State-listed
12 as threatened or endangered and have the potential to occur in the vicinity of KPS. None of
13 these species were identified during the February 2006 to February 2007 impingement and
14 entrainment study conducted by EA Engineering, Science, and Technology, Inc. (EA
15 Engineering, 2007).

1 **Table 2-3. Listed Aquatic Species.** *The species below are Federally-listed or Wisconsin-listed*
 2 *as threatened, endangered, or candidate species. These species may occur on the KPS site,*
 3 *within Lake Michigan, or within the transmission line ROWs.*

Scientific Name	Common Name	Federal Status(a)	State Status(a)	County of Occurrence(b)
Fish				
<i>Acipenser fulvescens</i>	lake sturgeon	-	SSC	Brown, Outagamie
<i>Anguilla rostrata</i>	American eel	-	SSC	Brown
<i>Clinostomus elongates</i>	reidside dace	-	SSC	Brown, Manitowoc
<i>Erimyzon sucetta</i>	lake chubsucker	-	SSC	Manitowoc
<i>Etheostoma clarum</i>	western sand darter	-	SSC	Outagamie
<i>Fundulus diaphanous</i>	banded killifish	-	SSC	Kewaunee, Manitowoc
<i>Lepomis megalotis</i>	longear sunfish	-	T	Brown
<i>Moxostoma valenciennesi</i>	greater redhorse	-	T	Brown, Kewaunee, Manitowoc
<i>Notropis anogenus</i>	pugnose shiner	-	T	
<i>Notropis texanus</i>	weed shiner	-	SSC	Outagamie
<i>Opsopoeodus emiliae</i>	pugnose minnow	-	SSC	Outagamie
Mussels				
<i>Tritogonia verrucosa</i>	buckhorn	-	T	Outagamie
<i>Alasmidonta marginata</i>	elktoe	-	SSC	Manitowoc; Outagamie
<i>Alasmidonta viridis</i>	slippershell mussel	-	T	Manitowoc
<i>Epioblasma triquetra</i>	snuffbox	-	E	Outagamie
<i>Pleurobema sintoxia</i>	round pigtoe	-	SSC	Outagamie
<i>Quadrula metanevra</i>	monkeyface	-	T	Manitowoc
<i>Simpsonaias ambigua</i>	salamander mussel	-	T	Outagamie
<i>Venustaconcha ellipsiformis</i>	ellipse	-	T	Manitowoc

^(a)C = Candidate; E = Federally endangered; SSC = species of special concern; T = Federally threatened; - = No listing

^(b)Species has recorded occurrence in the listed counties within the past 50 years according to the WDNR

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Scientific Name	Common Name	Federal Status(a)	State Status(a)	County of Occurrence(b)
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Sources: DEK 2008; FWS 2008; WDNR 2004a; WDNR 2008; WDNR 2008a; WDNR 2008b; WDNR 2008c; WNHP 2006

1 2.2.7.2 Terrestrial Threatened and Endangered Species

2 There are five Federally-listed threatened or endangered terrestrial species that have potential
 3 habitat on the KPS site: the piping plover (*Charadrius melodus*), the Hine’s emerald dragonfly
 4 (*Somatochlora hineana*), the Karner blue butterfly (*Lycaeides melissa samuelis*), the dune or
 5 Pitcher’s thistle (*Cirsium pitcheri*), and the dwarf lake iris (*Iris lacustris*). The bald eagle
 6 (*Haliaeetus leucocephalus*) and the peregrine falcon (*Falco peregrinus*) were formerly listed as
 7 Federally threatened and may also be found in the vicinity of the KPS site. A peregrine falcon
 8 (*Falco peregrinus*) breeding pair, mentioned in Section 2.2.6 of this draft SEIS, has nested on
 9 the KPS reactor building since 2001. Four State-listed species were identified as species for
 10 consideration of the proposed license renewal of KPS, including the Caspian tern (*Sterna*
 11 *caspia*), the osprey (*Pandion haliaetus*), and the formerly listed bald eagle and peregrine falcon
 12 (USFWS, 2008; DEK, 2008).

13 Federally Protected and Formerly Protected Terrestrial Species

14 The piping plover, a Federally- and State-listed endangered bird, is known to live on the
 15 shorelines in the vicinity of KPS. The USFWS has stated in a letter to the NRC that the habitat is
 16 not suitable for piping plovers on the KPS site (USFWS, 2008). The minimum piping plover
 17 nesting habitat requirements, as stated by the USFWS and outlined in the ER (DEK, 2008)
 18 include:

19 Total shoreline length of at least 200 meters (660 feet) of gently sloping, sparsely
 20 vegetated (<50 percent herbaceous and low woody cover) sand beach with a total
 21 beach area of at least 2 hectares (5 acres); appropriately sized sites must have an area
 22 50 meters (160 feet) in length where the beach width is at least 7 meters (23 feet).

23 The shoreline from the northern boundary of the KPS site to just below the reactor buildings are
 24 deemed to have “marginal” potential as plover nesting habitat while the southern end of the KPS
 25 site have no potential piping plover habitat (DEK, 2008). Recent surveys of KPS for piping
 26 plovers have not documented the species onsite (DEK, 2008). The piping plover is a small
 27 shorebird with long legs, brown feathered wings, and a white body (USFWS, 2009a). Piping
 28 plovers nest in the sand along the coastline. High human traffic to the beaches of the Atlantic
 29 coast and Great Lakes is considered to be the main reason for the decline of the species
 30 populations (USFWS, 2009a). Activity on beaches can destroy nests, eggs, and the young of
 31 the piping plover.

32 The Hine’s emerald dragonfly, a Federally- and State-listed endangered species, has been
 33 listed by the USFWS mostly due to loss and fragmentation of habitat (DEK, 2008; USFWS,
 34 2009). The dragonfly inhabits calcareous, spring-fed marshes and sedge meadows (DEK, 2008;
 35 USFWS, 2009). The dragonfly has bright emerald-green eyes and yellow stripes on its side, and
 36 grows to about 2.5 inches (6.4 cm) in length and has a wingspan of about 3.3 inches (8.4 cm)
 37 (USFWS, 2009). The dragonfly has been reported in Kewaunee County, and the closest
 38 location to the KPS site was a small population of the dragonflies from the Black Ash swamp in
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1 northern Kewaunee County in 2001 (DEK, 2009b). Recent wildlife surveys on KPS lands did not
2 detect the presence of Hine's emerald dragonflies (DEK, 2008).

3 The Karner blue butterfly is Federally-listed by the USFWS as endangered; however, the State
4 of Wisconsin does not list the species as either threatened or endangered (DEK, 2008; USFWS,
5 2009c). Of the counties that contain the KPS site and its associated transmission lines,
6 Outagamie County is the only one with known populations of the butterfly (DEK, 2008). The
7 butterfly has about a 1 inch (2.5 cm) wingspan and the males and females are different in
8 appearance (USFWS, 2009c). The upper side of the male has shades of bright silver or dark
9 blue with narrow black margins (USFWS, 2009c). Females are grayish brown, with very dark
10 brown nodes on the outer portions of the wings, and the upper sides of the females are blue,
11 with irregular bands of orange crescents inside the narrow black border. The underside of both
12 the males and females are gray, and have a continuous band of orange crescents traveling the
13 edges of both wings and the underside have scattered black spots circled with white (USFWS
14 2009c). For habitat, the butterfly prefers pine and oak trees, as well as savannas and barrens,
15 which contain wild lupine (*Lupinus perennis*) and other flowering plants (DEK, 2008). After the
16 species hatches, the caterpillars will only feed on the wild lupine species leaves and are,
17 therefore, limited to breed in habitats containing that plant species (DEK, 2008). Habitat
18 fragmentation, development in Wisconsin, and protection against forest fires (wild lupine
19 requires early stages of forest succession for maximum growth), have all reduced the
20 populations of wild lupine and its ability to reproduce (DEK, 2008). Surveys of the KPS site and
21 its associated transmission line ROWs did not show any presence of the Karner blue butterfly
22 (DEK, 2008).

23 The dune or Pitcher's thistle, a Federally- and State-listed threatened species, is known to live
24 in Manitowoc County, a county crossed by KPS-associated transmission lines (WDNR, 2008b).
25 The thistle is native to Wisconsin and grows on the beaches and dunes associated with the
26 Great Lakes (WDNR, 2008b). The thistle can grow to heights of up to 3 feet (1 m) tall, and is
27 covered with hairs along the stem (USFWS, 2009d). Leaves of the thistle can be 1 foot (0.3 m)
28 long each, and usually have deep lobes (USFWS, 2009d). The Pitcher's thistle takes five to
29 eight years of growing before it begins to flower (USFWS, 2009d). Its non-flowering form is a
30 grouping or cluster of bright silvery leaves, while the flowering form of the thistle typically has a
31 single stem with many branches that have cream or pink flowers at the ends (USFWS, 2009d).
32 Pitcher's thistle is most often found along the shoreline of the Great Lakes or in unforested
33 fields, and always near other plant communities. Surveys performed by DEK for Pitcher's thistle
34 on the KPS site or in associated transmission lines have no documented occurrences (DEK,
35 2008).

36 The dwarf lake iris is Federally- and State-listed as threatened, and has been known to occur in
37 Brown County, a county crossed by KPS-associated transmission lines (WDNR, 2008). Dwarf
38 lake iris is a very small iris with dark, deep blue flowers, although sometimes flowers can be lilac
39 or white (USFWS, 2009b). The flowers are about 1 to 1.5 inches (2.5 to 3.8 cm) wide and 1.5 to
40 2.5 inches (3.8 to 6.4 cm) tall (USFWS, 2009b). The iris's leaves can grow to 6 inches (15 cm)
41 long and are sword-like in shape, and grow in clusters (USFWS, 2009b). The iris prefers
42 habitats of shoreline, dunes, or cedar forest edge ecosystems, and grows in sandy soils or on
43 beaches with little to no other vegetation present (USFWS, 2009b). Surveys for dwarf lake iris

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1 on the KPS site or its associated transmission lines did not document any occurrences of the
2 plant species (DEK, 2008).

3 On July 9, 2007, the USFWS issued a *Federal Register* notice announcing the delisting of the
4 bald eagle from the Federal List of Endangered and Threatened Wildlife (72 FR 37346). Eagles
5 continue to be protected at the national level by the Bald and Golden Eagle Protection Act, as
6 well as the Migratory Bird Treaty Act, and at the State level as a Wisconsin-listed threatened
7 species. The bald eagle is a large bird, even among raptor species, and can reach a weight of
8 more than 13 pounds (6 kg). The eagle has a white head and tail, with brown body feathers.
9 Bald eagles eat fish, small mammals, birds, and occasionally carrion. Bald eagles are known to
10 occur throughout Wisconsin, and in every county associated with the KPS site or its associated
11 transmission lines. They are seen regularly along the Lake Michigan shoreline. Eagles have
12 been seen on the KPS site by employees and during the NRC staff audit; however, the KPS site
13 does not have any eagle nests (DEK, 2008).

14 The peregrine falcon was removed from the Federal listing in August 1999, but continues to be
15 listed as endangered at the State level in Wisconsin. Adult birds have a bluish-black head and
16 wings, are 14 to 19 inches (36 to 48 cm) tall, and have a 39- to 43-inch (99- to 109-cm)
17 wingspan (Cornell, 2003). Peregrine falcons nest on high cliffs near river systems and in some
18 cases, especially associated with breeding attempts, the falcon can nest on bridges and tall
19 buildings. The KPS site has had a breeding pair nesting on its reactor building since 2001, and
20 the pair has produced at least 14 fledglings (DEK, 2008). In an effort to protect the nesting pair
21 and their young, DEK regularly communicates with USFWS and WDNR (DEK, 2008).

22 State Protected Terrestrial Species

23 The Caspian tern, a State-listed endangered species, is potentially occurring on the KPS site
24 and its associated transmission lines (WDNR, 2004a; WNHP, 2006). The Caspian tern is the
25 largest known tern species in the world and is easily recognized by its red bill. The tern has grey
26 feathers on its wings, an all white underbelly, and black feathers on its head. In the spring of
27 2006, approximately 24 Caspian terns lived and were observed on the shoreline adjacent to the
28 KPS site (DEK, 2008).

29 The Wisconsin State-listed threatened osprey may potentially occur on the KPS site or its
30 associated transmission lines. The osprey is a fairly large bird of prey with a body length of
31 about 21 to 24 inches (53 to 61 cm) and a wingspan of 4.5 to 5.5 feet (1.4 to 1.7 m). Osprey
32 feed exclusively on live fish (USFWS, 2008b). Individuals are brown with a white belly and have
33 distinctive patches on their wings. The osprey has long, sharp talons, which are used for
34 gripping fish. Females are larger than males, which is true for most birds of prey. The osprey's
35 habitat includes rivers, lakes, and shallow water estuaries. Nesting often occurs on artificial
36 structures such as flat-topped wooden platforms, metrological towers, channel markers, and
37 radio towers, where such structures are near shallow waters that support plentiful fish. Osprey
38 pairs tend to be solitary nesters, and may colonize secure areas such as islands (USGS,
39 undated). In May of 2006, one osprey was sighted on the KPS site; however, no other ospreys
40 have been seen on the KPS site, or its associated transmission lines since.

41 **2.2.8 Socioeconomic Factors**

1 This section describes current socioeconomic factors that have the potential to be directly or
 2 indirectly affected by changes in operations at the KPS. The KPS and the people and
 3 communities surrounding it can be described as a dynamic socioeconomic system. The nuclear
 4 power plant requires people, goods, and services from local communities to operate the plant.
 5 The communities, in turn, provide the people, goods, and services to run the plant. KPS
 6 employees residing in the community receive income from the plant in the form of wages,
 7 salaries, and benefits, and spend this income on goods and services within the community
 8 thereby creating additional opportunities for employment and income. People and businesses in
 9 the community also receive income for the goods and services sold to KPS. Payments for these
 10 goods and services create additional employment and income opportunities in the community.
 11 The measure of a communities' ability to support the operational demands of KPS depends on
 12 the ability of the community to respond to changing socioeconomic conditions.

13 The socioeconomic region of influence (ROI) is defined by the areas where KPS employees
 14 and their families reside, spend their income, and use their benefits, thereby affecting the
 15 economic conditions of the region. The KPS ROI consists of a three-county area (Kewaunee,
 16 Manitowoc, and Brown counties in Wisconsin). The following sections describe the housing,
 17 public services, offsite land use, visual aesthetics and noise, population demography, and the
 18 economy in the ROI surrounding the KPS.

19 DEK employs a permanent workforce of approximately 705 workers (DEK, 2008).
 20 Approximately 95 percent live in Kewaunee County, Manitowoc County, and Brown County,
 21 Wisconsin (Table 2-4). Most of the remaining 5 percent of the workforce are divided among 9
 22 other counties in Wisconsin and a few employees living out of state with numbers ranging from
 23 1 to 11 employees per county. Given the residential locations of KPS employees, the most
 24 significant impacts of plant operations are likely to occur in Kewaunee, Manitowoc, and Brown
 25 counties. The focus of the socioeconomic impact analysis in this draft SEIS is based on the
 26 impacts of the KPS on these three counties.

27 **Table 2-4. Kewaunee Power Station Employee Residence by County (Wisconsin)**

County	Number of Employees	Percentage (%) of Total
Manitowoc	280	39.7
Brown	228	32.3
Kewaunee	159	22.6
Door	11	1.6
Outagamie	4	0.6
Sheboygan	4	0.6
Other	19	2.6
Total	705	100

Source: DEK 2008

28 Refueling outages at the KPS normally occur at 18-month intervals. During refueling outages,
 29 site employment increases by as many as 600 to 700 workers for approximately 30 days (DEK,

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1 2008). Most of these workers are assumed to be located in the same geographic areas as KPS
 2 employees.

3 2.2.8.1 *Housing*

4 Table 2-5 lists the total number of occupied and vacant housing units, vacancy rates, and
 5 median value in the three-county ROI. According to the 2000 Census, there were approximately
 6 133,000 housing units in the socioeconomic region, of which approximately 127,600 were
 7 occupied. The median value of owner-occupied housing units in the three Wisconsin counties
 8 ranged from \$90,900 in Manitowoc County to \$116,100 in Brown County. The vacancy rate was
 9 the lowest in Brown County (3.2 percent) and highest in Kewaunee County (7.3 percent).
 10 Kewaunee County has the smallest number of total and vacant housing units amongst the three
 11 counties (USCB, 2009a).

12 By 2007, the estimated number of housing units grew in all three counties by approximately 10
 13 percent of their combined total inventories. In Kewaunee County, the number of housing units
 14 grew to an estimated total of 9,013 units in 2007, an increase of approximately 800 units. In
 15 Manitowoc County the number of housing units grew by more than 2,000 units to an estimated
 16 total of 36,661 units or approximately 6 percent (USCB, 2009a).

17 **Table 2-5. Housing in Kewaunee, Manitowoc, and Brown Counties in Wisconsin**

	Kewaunee	Manitowoc	Brown	ROI
2000				
Total	8,221	34,651	90,199	133,071
Occupied housing units	7,623	32,721	87,295	127,639
Vacant units	598	1,930	2,904	5,432
Vacancy rate (percent)	7.3	5.6	3.2	4.1
Median value (dollars)	92,100	90,900	116,100	99,700
2005–2007, 3-Year Estimate				
Total	9,013	36,661	101,256	146,930
Occupied housing units	8,272	33,704	95,165	137,141
Vacant units	741	2,957	6,091	9,789
Vacancy rate (percent)	8.2	8.1	6.0	6.7
Median value (dollars)	134,100	118,300	155,400	135,933

Source: USCB 2009a.

1 2.2.8.2 *Public Services*

2 This section presents a discussion of public services including water supply, education, and
3 transportation.

4 Water Supply

5 Since 95 percent of workers at the KPS reside in Kewaunee, Manitowoc, and Brown counties,
6 Wisconsin, the discussion of public water supply systems is limited to these counties. In Table
7 2-6, information about municipal water suppliers in these counties, their permitted capacities
8 and maximum design yields, reported annual peak usage, and population served are presented.

9 Lake Michigan is the source of potable water for the cities of Two Rivers, Manitowoc, and Green
10 Bay and ground water provides potable water for smaller towns and rural residences in the
11 vicinity of the KPS site. Two ground water wells at KPS are used for cooling, stand-by cooling,
12 the plant equipment water system, and potable water. KPS pumps ground water for use as
13 potable water and is not connected to a municipal system. At the present time, the water supply
14 systems in Kewaunee, Manitowoc, and Brown counties are operating below their maximum
15 capacities. The following are brief descriptions of the water supply systems in the three
16 counties.

17 Kewaunee County's major public water systems serve the majority of residential, commercial,
18 and industrial users and are located in the cities of Kewaunee and Algoma, and the village of
19 Luxemburg. These three municipal water systems are supplied from groundwater through
20 community wells. County planners state that these systems are considered adequate for the
21 cities' and village's present and future growth. The village of Casco and ten towns within the
22 county, not serviced by public systems, have individual or shared wells that are owned and
23 maintained by the property owner(s). The city of Green Bay obtains drinking water supplies from
24 Lake Michigan by means of the Green Bay water pipeline. Two raw water pipelines cross
25 through the central portion of Kewaunee County to supply potable water to the city of Green Bay
26 and several of its suburbs. At this time, none of the communities in Kewaunee County has any
27 plans of utilizing this utility for their water needs (Bay-Lake Regional Planning Commission,
28 2007).

29 The cities of Manitowoc and Two Rivers are the two largest municipal water suppliers in
30 Manitowoc County (Table 2-6). Both cities obtain their municipal water from Lake Michigan. All
31 other water systems in the County rely on ground water as their source (Bay-Lake Regional
32 Planning Commission, 2005).

33 Local community infrastructures continue to be used and existing wells are used for backup
34 purposes. Ground water is the source of all drinking water and other water uses within the
35 remainder of Brown County (DEK, 2008).

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1 **Table 2-6. Public Water Supply Systems (thousand gallons per day)**

Water Supplier	Water Source	Average Daily Demand	System Capacity	Population Served
Kewaunee County				
Algoma Waterworks	GW	261	1,584	3,357
Kewaunee Waterworks	GW	362	2,592	2,887
Luxemburg Waterworks	GW	257	590	2,292
Manitowoc County				
Cleveland Waterworks	GW	75	1,500	1,410
Kiel Waterworks	GW	500	4,532	3,630
Manitowoc Waterworks	SW	8,000	31,000	34,500
Mishicot Waterworks	GW	1,404	1,440	1,422
Reedsville Waterworks	GW	100	500	1,200
Two Rivers Waterworks	SW	1,500	4,000	13,354
Brown County				
Allouez Waterworks	SW	1,100	4,000	14,443
Ashwaubenon Waterworks	SW	3,449	6,000	17,625
Bellevue Waterworks	SW	1,000	4,000	14,500
De Pere Water Department	SW	2,600	6,000	22,310
Green Bay Waterworks	SW	20,000	42,000	103,018
Hobart Waterworks Service Area #1	GW	864	1,400	1,600
Howard Waterworks	SW	1,860	4,200	14,543
Lawrence Utility District	SW	1,050	4,320	1,200
Wrightstown Waterworks	GW	220	1,000	2,578

2 GW = ground water; SW = surface water

3 Source: DEK 2008.

4 **Education**

5 The KPS is located in the Kewaunee School District, Kewaunee County, which had an
 6 enrollment of approximately 1,000 students in the 2008–2009 school year (DPI, 2009).
 7 Kewaunee County has three public school districts with over 1,900 enrolled students (DPI,
 8 2009). Manitowoc and Brown counties have six and eight public school districts, respectively
 9 (DPI, 2009). Total enrollment in Manitowoc and Brown counties' schools in the 2008–2009
 10 school year was approximately 12,000 and 42,000 students, respectively (DPI, 2009; IES,
 11 2009).

12 **Transportation**

13 Employees enter the KPS site gate after exiting State Highway 42 to the west. State Highway
 14 42 has a north-south orientation and runs near the Lake Michigan shoreline in Kewaunee
 15 County. KPS workers from Ahnapee and Pierce would likely travel south on State Highway 42;
 16 employees from Red River, Lincoln, Luxemburg, and Casco could travel along County Highway

1 C to the intersection with State Highway 42 and then continue south; those in Montpelier and
 2 West Kewaunee, Franklin, and Carlton would likely choose one of the east-west roads, travel
 3 east to the State Highway 42 intersection and then continue south. KPS workers commuting
 4 from Manitowoc County would also travel north on State Highway 42. County Highway BB is
 5 just south of the station and the state-maintained Nuclear Road terminates on State Highway 42
 6 near the plant entrance. State and county roads in this part of Wisconsin were laid out in grids
 7 on true north-south axes with accommodations for naturally occurring geographical boundaries.
 8 Thus, Nuclear Road, County Highway BB, and many other east-west roads leading to KPS are
 9 perpendicular to State Highway 42.

10 The annual average daily traffic volume along State Highway 42 in Kewaunee County, in 2006,
 11 ranged from 2,400 vehicles to 6,800 vehicles at the various intersections. The annual average
 12 daily traffic sampling location nearest the intersection of Nuclear Road and State Highway 42
 13 was 2,600 vehicles. In 2005, the annual average daily traffic volume along the State Highway 42
 14 in Manitowoc County ranged from 1,900 vehicles to 21,500 vehicles at the various intersections.
 15 The section of State Highway 42 where the 21,500 vehicles were recorded is the section where
 16 State Highway 42 and Interstate Highway 43 share the same road (just west of Manitowoc)
 17 (WDOT, 2009).

18 Table 2-7 lists commuting routes to KPS and average annual daily traffic (AADT) volume
 19 values. The AADT values represent traffic volumes for a 24-hour period factored by both day of
 20 week and month of year.

Table 2-7. Major Commuting Routes in the Vicinity of the Kewaunee Power Station in 2006 Average Annual Daily Traffic Counts

Roadway and Location	Average Annual Daily Traffic (AADT) ^a
State Highway 42 (between County Highway BB and Cherneyville Road)	2,600
State Highway 42 (between Cherneyville Road and Lakeshore Drive)	2,400
State Highway 42 (between State Highway 29 and Lakeshore Drive)	2,500
State Highway 42 (between Miller Street and State Highway 29)	5,400
State Highway 42 north of Miller Street	3,700–4,800
State Highway 29 west of Kewaunee	3,100–3,800
State Highway 42 (between Two Rivers and County Highway BB)	3,200

Source: WDOT 2009.

^a All AADTs represent traffic volume during the average 24-hour day during 2005 and 2006.

21 **2.2.8.3 Offsite Land Use**

22 Offsite land use conditions in Kewaunee and Manitowoc counties are described in this section
 23 because Kewaunee and Manitowoc are the only counties in which KPS employees represent
 24 more than 0.1 percent of the county population. Kewaunee County also receives Wisconsin

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1 Shared Revenues Utility Program payments from the State of Wisconsin because of KPS
2 presence in the County. In addition to shared revenue, Kewaunee and other counties in the
3 vicinity of KPS receive revenue from sales taxes and fees paid by DEK and its employees
4 residing in the region. Changes in the number of workers at the KPS and tax payments could
5 affect land use conditions in these counties.

6 The KPS is located in southeastern Kewaunee County. Manitowoc and Brown counties are
7 located south and west of Kewaunee County respectively. Kewaunee County has experienced
8 small increases in population and housing over the last 16 years (1990 to 2006). However, the
9 number of housing units in Kewaunee County grew faster than the population.

10 Kewaunee County occupies approximately 340 square miles (217,600 acres) (USCB, 2009c).
11 Almost 93 percent of the county's land is undeveloped. The majority (84 percent) of the
12 undeveloped acreage consists of croplands or pastures and woodlands. Croplands or pastures
13 comprise nearly 63 percent of the county's total land area, while woodlands cover 21 percent of
14 the total land area. Some of the larger woodland areas in the county include the Black Ash
15 Swamp in the town of Lincoln, Duvall Swamp in Red River, and Lipsky Swamp in West
16 Kewaunee (Bay-Lake Regional Planning Commission, 2007).

17 Almost 80 percent of the county's land is agricultural (USDA, 2009). Residential uses account
18 for the largest developed land-use, covering 2.6 percent of the County's total land area, while
19 transportation and agricultural structures each account for approximately 1.6 percent. The
20 largest concentrations of residential, commercial, and industrial land are found in and around
21 the cities of Algoma and Kewaunee, the village of Casco, and the town and village of
22 Luxemburg (Bay-Lake Regional Planning Commission, 2007).

23 KPS is located in the town of Carlton in Kewaunee County. The town limits of Carlton
24 encompass an area of 35.6 square miles. Carlton has experienced relatively little land-use
25 change since KPS began operations. Approximately 97 percent of the land is agricultural or
26 woodland and 3 percent is developed. Dairy farming is the primary economic activity.

27 Manitowoc County occupies approximately 592 square miles (378,900 acres) (USCB, 2009c).
28 Almost 66 percent of the county's land is farmed (USDA, 2009). Manitowoc County experienced
29 small increases in population and housing over the 16 years from 1990 to 2006, with the
30 number of housing units growing faster than the population. However, from 2000 to 2006, the
31 population in Manitowoc County declined by a small amount while the number of housing units
32 increased.

1 2.2.8.4 *Visual Aesthetics and Noise*

2 The KPS can be seen from the lake, but is partly shielded by vegetation along the lake. The
 3 predominant feature of the KPS site is the reactor building, which is approximately 180-feet tall
 4 (AEC, 1972). On the lake side of the reactor building is the turbine building, which is
 5 approximately 100-feet tall (AEC, 1972). Other features include the auxiliary building (adjoining
 6 the reactor building), administration building, and meteorological tower. The turbine building and
 7 reactor containment structures dominate the landscape of the site.

8 Noise from nuclear plant operations can be detected offsite. Sources of noise at KPS include
 9 the turbines and large pump motors. Given the industrial nature of the station, noise emissions
 10 from the station are generally nothing more than an intermittent minor nuisance. However, noise
 11 levels may sometimes exceed the 55 dBA level that the EPA uses as a threshold level to protect
 12 against excess noise during outdoor activities (EPA, 1974). However, according to the EPA this
 13 threshold does “not constitute a standard, specification, or regulation,” but was intended to
 14 provide a basis for state and local governments establishing noise standards.

15 2.2.8.5 *Demography*

16 According to the 2000 Census, approximately 86,224 people lived within 20 miles of KPS, which
 17 equates to a population density of 132 persons per square mile (DEK, 2008). This density
 18 translates to GEIS Category 4, least sparse (greater than or equal to 120 persons per square
 19 mile within 20 miles). Approximately 723,900 people live within 50 miles of KPS (DEK, 2008).
 20 This equates to a population density of 202 persons per square mile. Applying the GEIS
 21 proximity measures, KPS is classified as proximity Category 4 (greater than or equal to 190
 22 persons per square mile within 50 miles). Therefore, according to the sparseness and proximity
 23 matrix presented in the GEIS, rankings of sparseness Category 4 and proximity Category 4
 24 result in the conclusion that KPS is located in a high population area.

25 Table 2-8 shows population projections and growth rates from 1970 to 2050 in Kewaunee,
 26 Manitowoc, and Brown counties, Wisconsin. The growth rate in Kewaunee County showed an
 27 increase of 6.9 percent for the period of 1990 to 2000. County populations are expected to
 28 continue to grow in Kewaunee, Manitowoc, and Brown counties through 2050.

29 **Table 2-8. Population and Percent Growth in Kewaunee, Manitowoc, and Brown Counties,**
 30 **Wisconsin, from 1970 to 2000 and projected for 2008 to 2050**

Year	Kewaunee		Manitowoc		Brown	
	Population	Percent Growth ^(a)	Population	Percent Growth ^(a)	Population	Percent Growth ^(a)
1970	18,961	—	82,294	—	158,244	—
1980	19,539	3.0	82,918	0.8	175,280	10.8
1990	18,878	-3.4	80,421	-3.0	194,594	11.0
2000	20,187	6.9	82,887	3.1	226,778	16.5
2008	20,388	1.0	80,641	-2.7	245,018	8.0
2010	21,841	8.2	85,834	3.6	254,040	12.0

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2020	23,587	8.0	89,035	3.7	282,409	11.2
2030	25,085	6.4	91,622	2.9	306,931	8.7
2040	26,748	6.6	94,618	3.3	334,018	8.8
2050	28,370	6.1	97,512	3.1	360,463	7.9

— = No data available.

^(a)Percent growth rate is calculated over the previous decade.

Sources: Population data for 1970 through estimated population data for 2008 (USCB, 2009b); population projections for 2010–2030 by State of Wisconsin Demographics Services Center, Division of Intergovernmental Relations, Department of Administration (5/30/2008); population projections for 2040 and 2050 (calculated).

1 Demographic Profile

2 The 2000 and 2005–2007 American Community Survey 3-Year Estimates demographic profiles
3 of the three-county region of influence population are presented in Table 2-9 and Table 2-10. In
4 2000, minority individuals (both race and ethnicity) comprised 8.5 percent of the total three-
5 county population. The minority population was composed largely of Hispanic or Latino and
6 Asian residents.

7 **Table 2-9. Demographic Profile of the Population in the Kewaunee Power Station Three-** 8 **County Socioeconomic Region of Influence (ROI) in 2000**

	Kewaunee	Manitowoc	Brown	ROI
Total Population	20,187	82,887	226,778	329,852
Race (percent of total population, Not-Hispanic or Latino)				
White	98.2	95.0	89.6	91.5
Black or African American	0.1	0.3	1.1	0.9
American Indian and Alaska Native	0.3	0.4	2.1	1.6
Asian	0.1	2.0	2.2	2.0
Native Hawaiian and Other Pacific Islander	0.0	0.0	0.0	0.0
Some other race	0.0	0.0	0.0	0.0
Two or more races	0.5	0.7	1.0	0.9
Ethnicity				
Hispanic or Latino	153	1,343	8,698	10,194
Percent of total population	0.8	1.6	3.8	3.1
Minority Population (including Hispanic or Latino ethnicity)				
Total minority population	365	4,131	23,535	28,031
Percent minority	1.8	5.0	10.4	8.5

9 Source: USCB, 2009b

10 According to the U.S. Census Bureau's (USCB's) 2005–2007 American Community Survey
11 3-Year Estimates, minority populations in the three-county region were estimated to have
12 increased by over 8,300 persons and comprised 10.6 percent of the total three county
13 population (see Table 2-10). Most of this increase was due to an estimated increase in the
14 Hispanic or Latino population (over 5,000 persons) of over 52 percent from 2000. This was the
15 largest percentage increase of any minority population and a 1.4 percent increase in the

1 Hispanic or Latino population when compared to the total increase in the three-county
 2 population. The next largest increase in minority population was in the Black or African
 3 American population, an increase of over 1,600 persons from 2000. However, this resulted in a
 4 0.5 increase in population as a percentage of the total increase in the three-county population.

5 **Table 2-10. Demographic Profile of the Population in the Kewaunee Power Station Three-**
 6 **County Socioeconomic Region of Influence in 2005-2007, 3-Year Estimate**

	Kewaunee	Manitowoc	Brown	ROI
Total Population	20,532	81,009	240,801	342,342
Race (percent of total population, Not-Hispanic or Latino)				
White	97.0	94.0	87.2	89.4
Black or African American	0.0	0.6	1.7	1.3
American Indian and Alaska Native	0.2	0.3	1.9	1.4
Asian	0.2	1.9	2.3	2.1
Native Hawaiian and Other Pacific Islander	0.2	0.0	0.1	0.1
Other	0.0	0.0	0.1	0.1
Two or more races	0.8	0.9	1.2	1.1
Ethnicity				
Hispanic or Latino	314	1,880	13,347	15,541
Percent of total population	1.5	2.3	5.5	4.5
Minority Population (including Hispanic or Latino ethnicity)				
Total minority population	624	4,895	30,826	36,345
Percent minority	3.0	6.0	12.8	10.6

7 Source: USCB, 2009b

8 Transient Population

9 Within 50 miles (80 km) of the KPS, colleges and recreational opportunities attract daily and
 10 seasonal visitors who create demand for temporary housing and services. In 2009, there were
 11 approximately 11,794 students attending colleges and universities within 50 miles (80 km) of the
 12 KPS (IES, 2009).

13 In 2000 in Kewaunee County, 45.2 percent of all housing units were considered temporary
 14 housing for seasonal, recreational, or occasional use. By comparison, seasonal housing
 15 accounted for 26.8 percent, 14.3 percent, and 60.1 percent of total housing units in Manitowoc
 16 and Brown counties and Wisconsin, respectively (USCB, 2009a). Table 2-11 provides
 17 information on seasonal housing for the 12 counties located all or partly within 50 miles of the
 18 KPS.

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1 **Table 2-11. Seasonal Housing in Counties Located within 50 Miles of the Kewaunee**
 2 **Power Station**

County ^a	Housing units	Vacant housing units: For seasonal, recreational, or occasional use	Percent
Wisconsin	236,600	142,313	60.1
Brown	2,904	414	14.3
Calumet	848	287	33.8
Door	7,759	6,970	89.8
Fond du Lac	2,340	573	24.5
Kewaunee	598	270	45.2
Manitowoc	1,930	518	26.8
Marinette	8,675	7,586	87.4
Oconto	5,833	4,837	82.9
Outagamie	2,084	237	11.4
Shawano	2,502	1,793	71.7
Sheboygan	2,402	804	33.5
Winnebago	3,564	1,032	29.0
County Total	41,439	25,321	45.9 (avg.)

Source: USCB 2009a

^a Counties within 50 miles of the KPS that are totally or partially located within the 50-mile radius.
 avg. = percent average for counties within the KPS 50-mile radius and excludes state percentage.

3 Migrant Farm Workers

4 Migrant farm workers are individuals whose employment requires travel to harvest agricultural
 5 crops. These workers may or may not have a permanent residence. Some migrant workers
 6 follow the harvesting of crops, particularly fruit, throughout rural areas of the United States.
 7 Others may be permanent residents near the KPS who travel from farm to farm harvesting
 8 crops.

9 Migrant workers may be members of minority or low-income populations. Because they travel
 10 and can spend a significant amount of time in an area without being actual residents, migrant
 11 workers may be unavailable for counting by census takers. If uncounted, these workers would
 12 be “underrepresented” in USCB minority and low-income population counts.

13 Information on migrant farm and temporary labor was collected in the 2007 Census of
 14 Agriculture. Table 2-12 provides information on migrant farm workers and temporary farm labor
 15 (less than 150 days) within 50 miles of the KPS. According to the 2007 Census of Agriculture,
 16 approximately 8,000 farm workers were hired to work for less than 150 days and were
 17 employed on 2,300 farms within 50 miles of the KPS. The county with the largest number of
 18 temporary farm workers (1,108 workers on 298 farms) was Fond du Lac County, Wisconsin
 19 (USDA, 2009).

20 In the 2002 Census of Agriculture, farm operators were asked for the first time whether or not
 21 any of them hired migrant workers, defined as a farm worker whose employment required travel

1 that prevented the migrant worker from returning to their permanent place of residence the
 2 same day. A total of 131 farms in the 50-mile radius of the KPS reported hiring migrant workers
 3 in the 2007 Census of Agriculture. Brown County, reported the most farms (20 farms) with hired
 4 migrant workers, followed by Fond du Lac County and Outagamie County with 16 farms (USDA,
 5 2009).

6 According to the 2007 Census of Agriculture estimates, 675 temporary farm laborers (those
 7 working fewer than 150 days per year) were employed on 148 farms in Kewaunee County, and
 8 976 and 823 temporary farm workers were employed on 256 and 213 farms in Manitowoc and
 9 Brown counties, respectively (USDA, 2009).

10 **Table 2-12. Migrant Farm Workers and Temporary Farm Labor in Counties Located within**
 11 **50 Miles of the Kewaunee Power Station**

County ^a	Number of farms with hired farm labor ^b	Number of farms hiring workers for less than 150 days ^b	Number of farm workers working for less than 150 days ^b	Number of farms reporting migrant farm labor ^b
Wisconsin	17,889	13,169	45,921	636
Brown	318	213	823	20
Calumet	244	163	471	12
Door	201	167	564	6
Fond du Lac	451	298	1,108	16
Kewaunee	250	148	675	11
Manitowoc	353	256	976	12
Marinette	143	107	476	9
Oconto	251	171	606	7
Outagamie	350	230	755	16
Shawano	417	246	872	8
Sheboygan	290	201	664	5
Winnebago	214	144	404	9
County Total	3,482	2,344	8,394	131

Source: 2007 Census of Agriculture—County Data (USDA, 2009)

^a Counties within 50 miles of the KPS that are totally or partially located within the 50-mile radius

^b Table 7. Hired Farm Labor - Workers and Payroll: 2007

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1 2.2.8.6 *Economy*

2 This section contains a discussion of the economy, including employment and income,
3 unemployment, and taxes.

4 Employment and Income

5 Between 2000 and the U.S. Census Bureau's 2005–2007 American Community Survey 3-Year
6 Estimates, the civilian labor force in Kewaunee County increased 5.7 percent from 10,984 to
7 11,609. During the same time period, the civilian labor force in Manitowoc County grew by 1.6
8 percent. By 2007, the civilian labor force in Brown County increased by 6.1 percent
9 (USCB, 2009).

10 According to the U.S. Census Bureau's 2005–2007 American Community Survey 3-Year
11 Estimates, manufacturing represented the largest industrial sector of employment in the three-
12 county region followed by educational services, health care and social assistance, and retail
13 trade industry. A list of some of the major employers in Kewaunee County is provided in Table
14 2-13.

15 **Table 2-13. Major Employers in Kewaunee County in 2005**

Employer	Service or Product	Number of Employees
Aurora Medical Center of Oshkosh	General medical & surgical hospitals	500–999
Wisconsin Label Corp.	Commercial flexographic printing	500–999
Algoma Hardwoods Inc.	Wood window & door manufacturing	250–499
Kewaunee Nuclear Power Plant	Nuclear electric power generation	250–499
Luxemburg-Casco Public Schools	Elementary & secondary schools	250–499
Kewaunee Fabrications LLC	Miscellaneous gen. purpose machinery mfg.	250–499
Kewaunee School District	Elementary & secondary schools	100–249
County of Kewaunee	Highway, street, & bridge construction	100–249
N E W Plastics Corp.	Plastics bottle manufacturing	100–249
The Vollrath Co. LLC	Kitchen utensil, pot, & pan manufacturing	100–249

Source: DWD, 2006

16 Estimated income information for the KPS ROI is presented in Table 2-14. According to the
17 USCB's 2005–2007 American Community Survey 3-Year Estimates, Kewaunee and Brown
18 counties each had median household incomes above the State average. Brown County had the
19 highest median household income among the three counties. Per capita incomes in Kewaunee
20 County and Manitowoc County were both below per capita income estimates for Brown County
21 and the State. In Kewaunee and Manitowoc counties an estimated 5.8 and 8.6 percent of the
22 population were living below the official poverty level, respectively, while the percentage for
23 Brown County and the State of Wisconsin as a whole was over 10 percent. The percentage of
24 families living below the poverty level in Kewaunee County and Manitowoc County (4.6 and 5.5
25 percent, respectively) was lower than the percentage of families in Brown County and the State
26 of Wisconsin as a whole (both over 7 percent) (USCB, 2009).

1 **Table 2-14. Estimated Income Information for the Kewaunee Power Station Region of**
 2 **Influence, 2005–2007 3-Year Estimates**

	Kewaunee	Manitowoc	Brown	Wisconsin
Median household income (dollars)	51,734	47,075	51,624	50,309
Per capita income (dollars)	23,771	23,592	25,741	25,742
Percent of families living below the poverty level	4.6	5.5	7.6	7.1
Percent of individuals living below the poverty level	5.8	8.6	10.4	10.8

3 Source: USCB, 2009

4 Unemployment

5 According to the U.S. Census Bureau's 2005–2007 American Community Survey 3-Year
 6 Estimates, the unemployment rate in Kewaunee and Manitowoc counties was 4.5 and 5.5
 7 percent, respectively, which was lower than the unemployment rate of 5.8 percent for the State
 8 of Wisconsin (USCB, 2009). The unemployment rate in Brown County was 6.2 percent, which
 9 was higher than the state average (USCB, 2009).

10 Taxes

11 Utilities and large electricity generators in Wisconsin are generally exempt from paying local
 12 property taxes. Instead, "gross revenue" taxes are collected from the utilities, which are then
 13 combined with other revenue collected statewide to become part of the state's general purpose
 14 revenue fund. The general purpose revenue fund is disbursed in the form of aid payments to
 15 local governments. In general, utility aid payments are distributed to the county and municipality
 16 based on utility valuation or location.

17 Utility aid payments consist of six components: the ad valorem payment, spent nuclear fuel
 18 storage payment, the minimum payment, the per capita limit, megawatt-based payment and
 19 incentive payments. Descriptions of the components applicable to KPS are provided below.

20 Ad Valorem Payment

21 This component is based on the "net book value" of "qualifying property" for "eligible utilities".
 22 The total value of "qualifying property" in a municipality may not exceed \$125 million per utility
 23 company or, if the property is owned by two or more utilities, \$125 million for that specific
 24 property.

- 25 • "Net book value" is the original cost of the property minus depreciation. For deregulated
 26 companies, depreciation is generally reported on a straight-line basis.
- 27 • "Qualifying property" includes (a) production plants that were in operation on January 1,
 28 2004, and not subsequently rebuilt or "repowered," (b) substations, and (c) general
 29 structures. The land on which such property is located is excluded. Electric utility
 30 production plant consists of generating station structures and improvements and
 31 associated boilers, reactors, reservoirs, dams, waterways, fuel holders; engines, prime
 32 movers, and generators. Electric utility substations are facilities that connect the local
 33 distribution lines to the interstate electric transmission system. Gas utility substations are

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1 facilities that connect the local distribution lines to interstate gas transmission pipelines.
2 For any utility, general structures included office buildings, garages, maintenance
3 facilities, and related structures.

- 4 • “Eligible utilities” include: (1) private companies that produce, transmit, or distribute
5 electricity or gas in more than one municipality; (2) electric cooperatives; (3) municipal
6 utilities (for the portion of their property located outside the municipality that owns the
7 utility) (4) municipal electric association projects (multi-municipal entities that own
8 electric plants and/or purchase and transmit electricity to their members); and (5)
9 qualified wholesale electric companies (entities that sell 95 percent or more of their
10 power at wholesale and have a total generating capacity of 50 megawatts (MW) or
11 more).

12 When calculating payments, the net book value in a municipality may not be less than the net
13 book value as of December 31, 1989, minus the value of property removed since that date. This
14 is called the “value guarantee.”

15 Spent nuclear fuel storage

16 A payment of \$50,000 is made to any municipality and county in which spent nuclear fuel is
17 stored on December 31 of the prior year. If the nuclear fuel storage facility is located within one
18 mile of another municipality or county, the municipality or county where the fuel is stored is paid
19 \$40,000 and the nearby municipality or county is paid \$10,000.

20 Minimum payment

21 This component applies only to electric generating plants with a rated capacity of 200 MW or
22 more that were in operation on January 1, 2004, and not subsequently rebuilt or “repowered”.
23 The minimum payment to a municipality or county with such a plant may not be less than
24 \$75,000.

25 Per capita limit

26 The total payment from the ad valorem and minimum payments may not exceed \$300 per
27 capita for municipalities and \$100 per capita for counties. Payments under the spent nuclear
28 fuel storage component are exempt from this limit.

29 Megawatt-based payment

30 Through 2008, this component only applies to electric generating plants that began operation or
31 were “repowered” after December 31, 2003. Beginning in 2009, this component may apply to
32 KPS in lieu of the ad valorem payment. The payment is \$2,000 per MW of name-plate
33 generating capacity. For a plant in a town, one-third (\$666.67) is paid to the town and two-thirds
34 (\$1,333.33) is paid to the county. For a plant in a village or city, two-thirds (\$1,333.33) is paid to
35 the village or city and one-third (\$666.67) is paid to the county.

1 Pending Utility Tax Changes

2 Beginning in 2009, the Wisconsin Department of Revenue changed the methodology for
3 computing the utility aid payment. For production plants that were in operation on January 1,
4 2004, and not subsequently rebuilt or “repowered,” the payment is the greater of (a) the amount
5 calculated under the current net book value based payment, or (b) the amount that would be
6 paid under the \$2,000 per MW payment plus incentive payments for plants that use a renewable
7 energy source. Once a payment is made under alternative (b), all future payments will be
8 calculated under alternative (b) (WDOR, 2007).

9 In addition, the provision under which the net book value in a municipality may not be less than
10 the net book value as of December 31, 1989, minus the value of property removed since that
11 date, the “value guarantee,” was repealed effective with payments in 2009. Also, in 2009, the
12 per capita limitation on payments increased over previous years for municipalities and counties
13 (WDOR, 2007).

14 Taxes Paid by DEK

15 In lieu of property tax on its electrical generating plant and other facilities, DEK pays the State of
16 Wisconsin a lump sum gross revenue tax. There is no direct correlation between the amount of
17 taxes paid to the State of Wisconsin and the distribution of funds to local taxing jurisdictions.
18 The allocation of tax revenue attributable to KPS to local taxing jurisdictions is not recorded.

19 Wisconsin state law requires that utility aid funds be paid to the municipalities and counties
20 where utility property is located. The utility aid payments to the town of Carlton and Kewaunee
21 County from the state could be attributed to the presence of KPS in these jurisdictions. Tables
22 2-15 through 2-19 present information about the town of Carlton’s and Kewaunee County’s total
23 tax revenues and the utility aid payments to the town of Carlton and Kewaunee County from the
24 State of Wisconsin (for all utility property located in the town of Carlton).

25 As presented in Table 2-16, the utility aid payments represent approximately 58.0 to
26 69.2 percent of the town of Carlton’s total tax revenues. The vast majority of the payments are
27 attributed to KPS. In 2004 and 2005, the town of Carlton collected no general property tax from
28 its residents (DEK, 2008). Additionally, as shown in Table 2-17, the utility aid payments to
29 Kewaunee County represent approximately 2.3 to 3.8 percent of Kewaunee County’s total tax
30 revenue.

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1 **Table 2-15. Wisconsin Shared Revenue Utility Payments to the Town of Carlton for Utility**
 2 **Property in the Town of Carlton, 2004 to 2008**

Item	2004	2005	2006	2007	2008
Utility Property: Net Book Value:					
Wisconsin Power & Light	48,276,451	44,689,234	6	6	6
Wisconsin Public Service	70,717,380	73,240,209	0	240,250	154,309
Dominion Energy Kewaunee	0	0	75,773,083	36,556,659	37,503,448
American Transmission	1,310,499	1,281,173	1,872,469	2,209,085	2,043,656
Total	120,304,330	119,210,616	77,643,558	39,006,000	39,701,413
Value Guarantee	1,093,714	0	17,062,594	55,702,152	55,006,739
Total Value	121,398,044	119,210,616	94,708,152	94,708,152	94,708,152
Payment:					
Payment Rate	0.003	0.003	0.003	0.003	0.003
Payment – Rate X Total Value	364,194.13	357,631.85	284,124.46	284,124.46	284,124.46
Population	1,032	1,037	1,031	1,034	1,061
Payment Limit – Per Capita	300.00	300.00	300.00	300.00	300.00
Maximum Payment	309,600.00	311,100.00	309,300.00	310,200.00	318,300.00
Value-Based payment	309,600.00	311,100.00	284,124.46	284,124.46	284,124.46
Spent Nuclear Fuel payment	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
Total Utility Payment	359,600.00	361,100.00	334,124.46	334,124.46	334,124.46

Source: DEK, 2008

Note: The shared revenue payment is funded from general state revenues; it is not paid by the utilities in the town. It is a payment for the presence of the utilities in the town and county.

1 **Table 2-16. Wisconsin Shared Revenue Utility Payments to Kewaunee County for Utility**
 2 **Property in the Town of Carlton, 2004 to 2008**

Item	2004	2005	2006	2007 (estimated)	2008 (estimated)
Utility Property: Net Book Value:					
Wisconsin Power & Light	48,276,451	44,689,234	6	6	6
Wisconsin Public Service	70,717,380	73,240,209	0	240,250	154,309
Dominion Energy Kewaunee	0	0	75,773,083	36,556,659	37,503,448
American Transmission	1,310,499	1,281,173	1,872,469	2,209,085	2,043,656
Total	120,304,330	119,210,616	77,643,558	39,006,000	39,701,413
Value Guarantee	1,093,714	0	17,062,594	55,702,152	55,006,739
Total Value	121,398,044	119,210,616	94,708,152	94,708,152	94,708,152
Payment:					
Payment Rate	0.006	0.006	0.006	0.006	0.006
Payment – Rate X Total Value	728,388.26	715,263.70	568,248.91	568,248.91	568,248.91
Population	20,648	21,082	12,157	21,198	21,358
Payment Limit – Per Capita	100.00	100.00	100.00	100.00	100.00
Maximum Payment	2,064,800.00	2,108,200.00	2,115,700.00	2,119,800.00	2,135,800.00
Value-Based payment	728,388.26	715,263.70	568,248.91	568,248.91	568,248.91
Spent Nuclear Fuel payment	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
Total Utility Payment	778,388.26	765,263.70	618,248.91	618,248.91	618,248.91

Source: DEK, 2008

Note: The shared revenue payment is funded from general state revenues; it is not paid by the utilities in the town. It is a payment for the presence of the utilities in the town and county.

3

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1 **Table 2-17. Wisconsin Shared Revenue Utility Payments to the Town of Carlton and**
 2 **Kewaunee County for Utility Property in the Town of Carlton, Projected for 2009**

Item	Town of Carlton	Kewaunee County	Combined Total
Utility Property: Net Book Value:			
Wisconsin Public Service	148,137	148,137	148,137
American Transmission	1,961,910	1,961,910	1,961,910
Total	2,110,047	2,110,047	2,110,047
Payment Rate			
Value-Based Payment	6,330.14	12,660.28	18,990.42
Megawatt-Based Payment:			
\$ per MW of Capacity	666.67	1,333.33	2,000.00
MW Capacity	535	535	535
Megawatt – Based Payment	356,666.67	713,333.32	1,070,000.00
Maximum Payment:			
Population	1,061	21,494	
Payment Limit – Per capita	425.00	125.00	
Maximum Payment	450,925.00	2,686,750.00	3,137,675.00
Utility Property – Value-Based Payment	6,330.14	12,660.28	18,990.42
Utility Property – Megawatt-Based Payment	356,666.67	713,333.32	1,070,000.00
Spent Nuclear Fuel Payment	50,000.00	50,000.00	50,000.00
Total Utility Aid Payment	412,996.81	775,993.60	1,138,990.42

Source: DEK, 2008

Note: The shared revenue payment is funded from general state revenues; it is not paid by the utilities in the town. It is a payment for the presence of the utilities in the town and county.

3

1 **Table 2-18. Town of Carlton – Wisconsin Shared Revenue Utility Payments and Total**
 2 **Town Revenues, 2004 to 2008**

Year	2004	2005	2006	2007	2008
Total Revenues	522,200	522,100	515,200	576,400	NA
Wisconsin Shared Revenue Utility Payments	359,600	361,100	334,124	334,124	334,124
Percent of Total Revenues	68.9	69.2	64.9	58.0	NA

Source: DEK, 2008; WDOR, 2009.

3

4 **Table 2-19. Kewaunee County – Wisconsin Shared Revenue Utility Payments and Total**
 5 **Town Revenues, 2004 to 2008**

Year	2004	2005	2006	2007	2008
Total Revenues	20,376,900	22,597,300	21,683,600	26,351,500	NA
Wisconsin Shared Revenue Utility Payments	778,388	765,264	618,249	618,249	618,249
Percent of Total Revenues	3.8	3.4	2.9	2.3	NA

Source: DEK, 2008; WDOR, 2009.

6 **2.2.9 Historic and Archaeological Resources**

7 This section discusses the cultural background and the known historic and archaeological
 8 resources at the KPS site and in the surrounding area.

9 **2.2.9.1 Cultural Background**

10 KPS is located on the west central shore of Lake Michigan in Kewaunee County, Wisconsin.
 11 The landscape of Wisconsin is dominated by glacial and postglacial geological deposits. The
 12 Pleistocene Age glaciers reached their greatest extent 14,000 to 16,000 years ago, and the last
 13 glacial advance (the Two Rivers, or Valderan) dates to about 12,400 years ago. Approximately
 14 12,000 years ago the glaciers retreated and exposed most of the current area of Wisconsin.

15 The region around the KPS site contains prehistoric and historic Native American and Euro-
 16 American cultural resources. Twenty properties in Manitowoc County and eleven properties in
 17 Kewaunee County are listed in the National Register of Historic Places (NRHP). None of these
 18 properties fall within a 6-mile radius of KPS (NPS 2009a, 2009b).

19 Prehistoric Periods

20 The climate during the Paleo-Indian period was much cooler and wetter than today. The
 21 distribution of Paleo-Indian artifacts in Wisconsin correlates with the last stages of glacial activity

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1 and fluctuating lake levels. Paleo-Indians exploited postglacial environments and organized in
2 small mobile hunting groups and appear to have been more numerous in southern Wisconsin
3 than in the north where glacial conditions persisted longer (R. Mason, 1997).
4 Paleo-Indian populations were highly mobile. Most sites would have been short-term
5 occupations (campsites). Paleo-Indian peoples hunted large, now extinct game, such as
6 mastodon, mammoth, and caribou that lived on the lush vegetation that colonized postglacial
7 soils (R. Mason, 1997). By the late Paleo-Indian period, the levels of the Great Lakes may have
8 been significantly lower than present. Paleo-Indian sites of this period could be submerged
9 several hundred feet below the current surface (R. Mason, 1997). Later Paleo-Indian sites show
10 evidence of woodworking tools reflecting the increasing forestation of the previously glaciated
11 land. Late Paleo-Indian sites are widespread and continue to reflect small mobile populations.
12 Instead of large game, species hunted during the later period included deer, caribou, bison,
13 turtle, beaver, and other small mammals (R. Mason, 1997).

14 During the Archaic Period, subsistence hunting and gathering underwent changes to adapt to
15 resource availability. As glaciers retreated northward and larger animals disappeared from the
16 region, humans adapted to modern plants and smaller game animals. Between 10,000 and
17 7,500 years ago, Archaic populations consisting of small groups of hunters and gatherers living
18 in caves and rock shelters along rivers, around lakes and wetlands, replaced the older Paleo-
19 Indian culture.

20 Archaic peoples may have been direct descendants of Paleo-Indians or may represent a
21 migration of people from the south. These hunter-gatherers subsisted on fish, wild plants, nuts,
22 acorns, and modern game animals such as elk and deer. Archaeological evidence indicates that
23 settlement was sparse with small, mobile groups relying on diverse hunting and gathering
24 strategies. At least one extensive Archaic local Wisconsin quarry site is known; however, stone
25 tool materials from neighboring Illinois are also found at Archaic sites (Stoltman, 1997). By
26 about 4,000 to 6,000 B.C., Archaic sites were more widely distributed throughout Wisconsin.
27 Drier, warmer conditions with a rise in herbaceous species characterized this period. Archaic
28 tool assemblages expanded to include fishing gear, ground stone plant processing tools, axes,
29 and copper tools (Stoltman, 1997). Copper artifacts (such as harpoons, axes, adzes, chisels,
30 knives, and drills) are widely found in eastern Wisconsin and in Manitowoc County (Stoltman,
31 1997).

32 The Red Ochre Complex, an elaborate ceremonial burial complex distributed widely across the
33 Midwest and the Great Lakes areas, serves to mark the transition between the Archaic and the
34 Woodland periods. Information about the complex is largely limited to burial sites, therefore the
35 connections to the Archaic and Woodland period remains uncertain (Stevenson et al., 1997).
36 Use of copper for ornaments increased; evidence of fishing and wild rice harvesting exists.
37 Toward the end of this period, mounds and Woodland pottery are found at these sites.

38 Approximately 2,500 years ago, the presence of pottery marks the beginning of the Woodland
39 period in Wisconsin. In Wisconsin, the Archaic culture persists throughout the early Woodland
40 period. The Woodland period is also defined by the introduction of horticulture to augment
41 subsistence hunting and gathering. In the Great Lakes region, evidence of domestication of
42 local plants appears, as well as the introduction of exotic species. Squash is the earliest known
43 agricultural crop (R. Mason, 1981). A reliance on agriculture led to the establishment of more

1 permanent settlements during this period. Use of bows and arrows and pottery and construction
2 of effigy mounds all began during of the Woodland period.

3 The middle Woodland occupation (roughly 1,500 to 2,200 years ago) has distinctive
4 characteristics that include construction of conical burial mounds and evidence of widespread
5 interaction throughout central and eastern North America. The characteristics of this network,
6 called the Hopewell Interaction Sphere, include elaborate ceremonialism, extensive trade of
7 exotic manufactured items and raw materials, and large mound construction.

8 Late Woodland sites (occupied 700 to 1,600 years ago) show a decline in Hopewellian
9 ceremonialism but continue the tradition of mound construction, primarily in the form of animal
10 and human shapes, in the southern half of Wisconsin. Burials are associated with some, but not
11 all, mounds (Stevenson et al., 1997). Cultivation of corn became increasingly prominent, and
12 villages became more permanent (Stevenson et al., 1997). Late Woodland populations
13 continued to increase and archaeological evidence from settlements shows a greater
14 dependence on agriculture (R. Mason, 1981).

15 An exception to the typical Woodland occupation is the intrusion of a few Middle Mississippian
16 sites in Wisconsin about 1,000 years ago. These sites consist of permanent towns and
17 ceremonial sites in Iowa, Minnesota, Missouri, and Illinois, particularly the site of Cahokia.
18 Hierarchical structure, extensive trade networks, a focus on larger centralized villages, and
19 intensive agriculture characterized these societies. Several sites in south-central Wisconsin
20 represent a northern extension of Mississippian culture. Aztalan, a palisade village containing
21 four platform mounds and a series of dwellings, is the best known of these sites in Wisconsin
22 (Goldstein and Freeman, 1997). The relationship of such sites with the surrounding Woodland
23 sites is unclear, and the influence of the Mississippian culture on Woodland culture in Wisconsin
24 appears to have been transitory (Green, 1997).

25 The transition from Woodland to later cultures is poorly understood. About 1,000 years ago,
26 overlapping the late Woodland and Mississippian period, sites referred to as the Oneota culture,
27 recognized by distinctive pottery styles, appear in the archaeological record. Permanent
28 villages, some fortified, were established; subsistence was based on corn, beans, squash,
29 aquatic resources, and a variety of wild plants and game. Hunting and gathering, probably on a
30 seasonal basis, supplemented the basic agricultural economy (Overstreet, 1997). Following the
31 collapse of Mississippian influence, Oneota communities returned to the abandoned areas, and
32 by about 700 years ago, they were the predominant culture in most of southern Wisconsin
33 (Overstreet, 1997).

34 During the late Oneota culture, villages were concentrated in several areas, such as the Fox
35 River valley in eastern Wisconsin. Subsistence patterns remained relatively constant throughout
36 Oneota history until the arrival of Europeans (circa 1600 to 1650). Oneota settlements in
37 eastern Wisconsin were abandoned by the time of French contact. Causes for this rapid
38 depopulation could include disease, warfare, or out-migration (Overstreet, 1997). The Ho-Chunk
39 (formerly Winnebago) Indians are commonly believed to be descendants of Oneota populations,
40 but the archaeological evidence is inconclusive.

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1 Historic Period

2 At the time of the first European contact (1600 to 1650), eastern Wisconsin was occupied by
3 several American Indian groups (Ho-Chunk (Winnebago), Potawatomi, Menominee, and
4 Chippewa). American Indian communities in the east were forced west due to ecological shifts
5 (Cronon, 1983), societal collapse, and disease. Encroaching European settlement created
6 waves of population shifts as these tribal groups pushed north and westward (Bragdon, 2001).
7 Wisconsin tribal groups, responding to these pressures, shifted their areas of use to around
8 Wisconsin, Michigan, and other areas of the Midwest.

9 The first European known to have visited the area was Jean Nicolet, a French explorer, who
10 reached the Green Bay region in 1634 (AEC, 1972). Green Bay was subsequently established
11 as the first French fur trading settlement, and a number of other trading posts were established
12 throughout the late 1600s and 1700s. Father Marquette said his First Mass on All Saints Day,
13 November 1, 1674, in Kewaunee County (Kewaunee County, 2009). French influence continued
14 until the end of the French and Indian War. As the French withdrew from the western Great
15 Lakes, items of British manufacture replaced French trade goods in Native American
16 communities (C. Mason, 1997). Throughout the historic period, American Indian economies
17 were supplanted or supplemented by an emphasis on hunting for the fur trade. European trade
18 goods increasingly replaced traditional tools and utensils.

19 The United States acquired ownership of the northern Midwest at the close of the American
20 Revolution, but de facto control remained with the British until the War of 1812 (AEC, 1972).
21 Wisconsin was sparsely settled by Europeans prior to becoming a U.S. territory. Lead mining
22 drew the first wave of Euro-American immigrants to southwestern Wisconsin in the 1820s. In
23 1834, Wisconsin was surveyed and opened to Euro-American settlers. The fur trade, which had
24 been a lucrative enterprise for the French, declined rapidly in the 1830s. During this time, the
25 region was heavily forested. Settlement began in earnest when the lumber industry was started
26 and the streams were dammed for water power. The vast forests of pine and larchwood led to
27 shipbuilding. In 1848, Wisconsin became a State. Toward the end of the 19th century, farm
28 settlement in the region followed the lumber industry (AEC, 1972).

29 The Potawatomi tribe lived in the area that is presently Door, Kewaunee, and Manitowoc
30 counties for hundreds of years before Europeans began settling in Wisconsin. The Potawatomi
31 are Algonquin speakers and are Neshnabek, a Potawatomi word that refers to "original people"
32 (Forest County Potawatomi, 2009). A major village, Ma-kah-da-we-kah-mich-(cock), also known
33 as Black Earth, was located 3.5 miles west of the plant site, on what is now the East Twin River
34 (DEK, 2008). It was there that members of the tribe would plant crops of corn, beans, pumpkins,
35 and squash. Each spring, the Potawatomi would establish a camp in Sandy Bay Creek, located
36 on the northern edge of the KPS property (DEK, 2008). It was at this camp where the
37 Potawatomi would fish during the annual spawning runs, primarily for suckers (Bach, 1933).
38 This area was used for hunting and gathering purposes until 1862, when the tribe was forced
39 from their land by the U.S. government for non-payment of taxes (AVD, 2007). The burial
40 ground for the tribe was also located here. (KCHS, 2002)

41 Kewaunee County was created in 1850s from Manitowoc County, and was divided into three
42 towns, Sandy Bay, Wolf River, and Kewaunee (Kewaunee County undated). The southernmost
43 town, Sandy Bay, was named for the little indentation in the shore of Lake Michigan. The town

1 originally consisted of the present-day limits of Carlton and Franklin (Kewaunee County
2 undated). During the mid to late 1800s, Sandy Bay was a thriving village, with a productive
3 sawmill (using a dam erected on Fischer Creek), a general store, cheese factory, post office,
4 and hotel (KCHS, 2002). The large pier at Sandy Bay served as the center for shipping in the
5 area, where lumber, bark (for tanning), and farmers' crops were shipped to Milwaukee and
6 Chicago. St. John's Lutheran Church and cemetery and the Sandy Bay School were also part of
7 the Sandy Bay Community. St. John's was founded in 1869 and disbanded in 1947. The church
8 was located on Route 42, but no longer exists. The cemetery is a Wisconsin Historical Resource
9 and is currently owned and maintained by the Town of Carlton. Sandy Bay School was located
10 across Route 42 from the church, and was in use until the 1960s. The schoolhouse was torn
11 down in the 1960s to make way for the construction of KPS. By 1891, the settlement had all but
12 disappeared. The only remnants from the community are the cemetery and a number of rotting
13 pilings from the pier, which are visible from the shore by the mouth of Sandy Bay Creek (DEK
14 2008).

15 *2.2.9.2 Historic and Archaeological Resources at the Kewaunee Power Station Site*

16 Most of the land at KPS was used for agricultural purposes. During the 1960s, land was
17 acquired from 12 families to build KPS. The only remnants onsite from the farms are stretches
18 of old barbed wire scattered around the site, part of the back end of an old threshing machine, a
19 farm bridge north of the plant, and a bridge of unknown origin southwest of the plant (DEK,
20 2008). As noted earlier, the Sandy Bay school house was also located onsite, but was torn
21 down due to the construction of KPS.

22 During the early to mid-1900s, Joe Krofta owned land approximately one-quarter mile south of
23 the KPS plant. He planted a grove of trees in the area, and in 1931, built a small cabin. When
24 KPS went into operation, the previous owners established the Kewaunee School Forest, which
25 was used as an outdoor classroom for the county's schools (DEK, 2008). During the 1980s, the
26 lake level rose to historic high levels resulting in severe erosion. The cabin was about to
27 collapse into Lake Michigan, and the plant's owner at the time salvaged the front facade of the
28 cabin and moved it to its current location. In 1987, the forest was renamed Joe Krofta Memorial
29 Forest (DEK, 2008).

30 In 2007, DEK contracted with AVD Archaeological Services, Inc. (AVD) to conduct a Phase 1
31 Archaeological Survey and literature review for the KPS site. Land disturbed during construction
32 of KPS was not surveyed. A majority of the remaining land is leased agricultural cropland. A
33 search of the Wisconsin records found only 141 historic and archaeological sites in Kewaunee
34 County compared with more than 500 sites each for bordering Manitowoc, Brown, and Door
35 counties (AVD, 2007). In addition, there are no eligible or listed NRHP properties located on the
36 KPS site.

37 **2.3 RELATED FEDERAL AND STATE ACTIVITIES**

38 The NRC staff reviewed the possibility that activities of other Federal agencies might impact the
39 renewal of the operating license for the KPS. Any such activity could result in cumulative
40 environmental impacts and the possible need for a Federal agency to become a cooperating
41 agency in the preparation of the KPS SEIS.

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1 The NRC has determined that there are no Federal projects that would make it desirable for
2 another Federal agency to become a cooperating agency in the preparation of the SEIS. There
3 are no federal lands, facilities, national wildlife refuges, forests, and parks within 50 miles of the
4 KPS. However, Two Creeks Buried Forest State Natural Area, a unit of the Ice Age National
5 Scientific Reserve, is located approximately one mile south of the KPS property. The Reserve is
6 a separate affiliated area of the National Park Service.

7 NRC is required under Section 102(2)(c) of the National Environmental Policy Act of 1969 to
8 consult with and obtain the comments of any Federal agency that has jurisdiction by law or
9 special expertise with respect to any environmental impact involved. NRC has consulted with
10 the USFWS, Advisory Council on Historic Preservation, Wisconsin Historical Society, Wisconsin
11 Coastal Management Program, WDNR, Menominee Indian Tribe of Wisconsin, and 23 other
12 Native American Tribes listed in Section 1.8 and Appendix E. Federal Agency consultation
13 correspondence and comments on the SEIS are presented in Appendix D.

14 2.4 REFERENCES

15 10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for
16 Protection Against Radiation."

17 10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic Licensing of
18 Production and Utilization Facilities."

19 10 CFR Part 61. *Code of Federal Regulations*, Title 10, *Energy*, Part 61, "Licensing
20 Requirements for Land Disposal of Radioactive Waste."

21 U.S. Atomic Energy Commission (AEC). 1972. Final Environmental Statement Related to the
22 Operation of Kewaunee Nuclear Power Plant. Wisconsin Public Service Corporation. Docket
23 No. 50-305. Directorate of Licensing. Washington, D.C. December 1972. ADAMS Accession
24 No. ML082820122.

25 AVD Archaeological Services, Inc (AVD). 2007. Phase I Archaeological Survey at the
26 Kewaunee Power Station in Kewaunee County, Wisconsin. Prepared for Dominion Energy
27 Kewaunee, Kewaunee, Wisconsin. [Non-public document, withheld per 36 CFR 800.11(c)]

28 Bach, W.H. 1933. "60 Years ago – Some Reminiscences by W.H. Bach, and Old Time
29 Resident." Available URL:
30 [http://www.wisconsinhistory.org/wlha/articleView.asp?pg=1&id=7853&hdl=&np=Kewaunee+En
31 terprise&adv=yes&ln=&fn=&q=&y1=&y2=&ci=&co=&mhd=&shd=](http://www.wisconsinhistory.org/wlha/articleView.asp?pg=1&id=7853&hdl=&np=Kewaunee+Enterprise&adv=yes&ln=&fn=&q=&y1=&y2=&ci=&co=&mhd=&shd=) (accessed July 2009).
32 [Copyright protected]

33 Bay-Lake Regional Planning Commission. 2005. "Bay-Lake Regional 2030 Regional
34 Comprehensive Plan." November 2005. Available URL:
35 [http://www.baylakerpc.org/REGIONALPLAN/Final/Bay-
36 Lake%20Regional%202030%20Comprehensive%20Plan.pdf](http://www.baylakerpc.org/REGIONALPLAN/Final/Bay-Lake%20Regional%202030%20Comprehensive%20Plan.pdf) (accessed July 2009). ADAMS
37 Accession No. ML093250004.

38 Bay-Lake Regional Planning Commission. 2007. "Kewaunee County 20-Year Comprehensive
39 Plan." November 2005. Available URL:
40 [http://www.baylakerpc.org/Documents/Kewaunee County/Kewaunee County Comp Plan Nov
41 ember 2007.pdf](http://www.baylakerpc.org/Documents/Kewaunee%20County/Kewaunee%20County%20Comp%20Plan%20November%202007.pdf) (accessed July 2009). ADAMS Accession No. ML093250005.

- 1 Bragdon, K. J. 2001. The Columbia Guide to American Indians of the Northeast. New York:
2 Columbia University Press. [Copyright protected]
- 3 Brandt, S. 2004. Effects of Diporeia Declines on Fish Diet, Growth and Food Web Dynamics in
4 Southeast Lake Michigan. Great Lakes Environmental Research Laboratory, National Oceanic
5 and Atmospheric Administration. Available URL:
6 http://www.glerl.noaa.gov/res/Task_rpts/1998/edybrandt09-3.html (accessed November 4,
7 2008). ADAMS Accession No. ML093250006
- 8 Brent, R., J. Schofield, and K. Miller. 2001. Results of the Lake Michigan Mass Balance Study:
9 Atrazine Data Report. U.S. EPA Great Lakes National Program Office, EPA 905R-01-010.
10 Available URL: http://www.epa.gov/glnpo/lmmb/results/atra_final.pdf (accessed May 18, 2009).
11 ADAMS Accession No. ML093250007.
- 12 Cornell Lab of Ornithology (Cornell). 2003. "Peregrine Falcon." Available URL:
13 <http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/PeregrineFalcondtl.html> (accessed June 6,
14 2008). ADAMS Accession No. ML073300303.
- 15 Crawford, S. S. 2001. Salmonine Introductions to the Laurentian Great Lakes: An Historical
16 Review and Evaluation of Ecological Effects. Executive Summary. Canadian Special Publication
17 of Fisheries and Aquatic Sciences. Available URL:
18 [http://www.uoguelph.ca/~scrawfor/research/research_greatlakes/research_greatlakes_fisheries/
19 research_greatlakes_fisheries_issues/research_greatlakes_fisheries_issues_salmon_monogra
20 ph.shtml](http://www.uoguelph.ca/~scrawfor/research/research_greatlakes/research_greatlakes_fisheries/research_greatlakes_fisheries_issues/research_greatlakes_fisheries_issues_salmon_monograph.shtml) (accessed July 15, 2009). ADAMS Accession No. ML093250009.
- 21 Cronon, W. 1983. Changes in the Land: Indians, Colonists, and the Ecology of New England.
22 New York: Hill and Wang. [Copyright protected]
- 23 Crowder, L.B. 1980. Alewife, Rainbow Smelt, and Native Fishes in Lake Michigan: Competition
24 or Predation? *Environmental Biology of Fishes*, 5(3): 225-233.
- 25 Dominion Energy Kewaunee, Inc. (DEK). 1968. WDNR Well Installation Forms. Wisconsin
26 Department of Natural Resources. ADAMS Accession No. ML091970509.
- 27 Dominion Energy Kewaunee, Inc. (DEK). 2005. 2004 Annual Radioactive Effluent Release
28 Report. Kewaunee, Wisconsin. ADAMS Accession No. ML051230416.
- 29 Dominion Energy Kewaunee, Inc. (DEK). 2006. 2005 Annual Radioactive Effluent Release
30 Report. Kewaunee, Wisconsin. ADAMS Accession No. ML061240156.
- 31 Dominion Energy Kewaunee, Inc. (DEK). 2007. 2006 Annual Radioactive Effluent Release
32 Report. Kewaunee, Wisconsin. ADAMS Accession No. ML071220274.
- 33 Dominion Energy Kewaunee, Inc. (DEK). 2007a. DNR Drinking Water System: High Capacity
34 Wells. ADAMS Accession No. ML091970509.
- 35 Dominion Energy Kewaunee, Inc. (DEK). 2007b. Kewaunee Power Station Updated Safety
36 Analysis Report, Revision 20. ADAMS Accession No. ML071150379.
- 37 Dominion Energy Kewaunee, Inc. (DEK). 2008. Applicant's Environmental Report – Operating
38 License Renewal Stage. Appendix E of Application for Renewed Operating License, Kewaunee
39 Power Station. Docket No. 50-305. August 2008. ADAMS Accession No. ML082341039.

Affected Environment

- 1 Dominion Energy Kewaunee, Inc. (DEK). 2008a. 2007 Annual Radioactive Effluent Release
2 Report. Kewaunee, Wisconsin. ADAMS Accession No. ML081230068.
- 3 Dominion Energy Kewaunee, Inc. (DEK). 2008b. 2007 Annual Radioactive Effluent Release
4 Report Offsite Dose Calculation Manual. Kewaunee, Wisconsin. ADAMS Accession No.
5 ML082190067.
- 6 Dominion Energy Kewaunee, Inc. (DEK). 2008c. Application for Renewed Operating License,
7 Kewaunee Power Station. Docket No. 50-305. August 2008. ADAMS Accession Nos.
8 ML082341020, ML082341038, ML082420854.
- 9 Dominion Energy Kewaunee, Inc. (DEK). 2008d. KPS System Description: Circulating Water
10 System (CW). March 2008. ADAMS Accession No. ML091970509.
- 11 Dominion Energy Kewaunee, Inc. (DEK). 2009. 2008 Annual Radioactive Effluent Release
12 Report. Kewaunee, Wisconsin. ADAMS Accession No. ML081230068.
- 13 Dominion Energy Kewaunee, Inc. (DEK). 2009a. Kewaunee Power Station Potable Water Use
14 Documentation. ADAMS Accession No. ML091970509.
- 15 Dominion Energy Kewaunee, Inc. (DEK). 2009b. Kewaunee Power Station Radiological
16 Environmental Monitoring Manual (REMM). May 2009. ADAMS Accession No. ML091970515.
- 17 Dominion Energy Kewaunee, Inc. (DEK). 2009c. Response to Request to Docket Information
18 Related to the Environmental Site Audit for Kewaunee Power Station. July 6, 2009. ADAMS
19 Accession No. ML091970512.
- 20 Dominion Energy Kewaunee, Inc. (DEK). 2009d. Response To Request to Docket Information
21 Related To The Environmental Site Audit for Kewaunee Power Station. Enclosure A –
22 Meteorology and Air Compliance. ADAMS Accession No. ML09190514.
- 23 Dominion Energy Kewaunee, Inc. (DEK). 2009e. Response to Request to Docket Information
24 Related to the Environmental Site Audit for Kewaunee Power Station – Enclosure E
25 Nonradiological Waste. Richmond, VA. ADAMS Accession No. ML091970529.
- 26 Dominion Energy Kewaunee, Inc.(DEK). 2009f. Stormwater Pollution Prevention Plan (SWPPP)
27 for the Kewaunee Power Station. April 2009. ADAMS Accession No. ML091970509.
- 28 EA Engineering, Science, and Technology, Inc. (EA Engineering). 2007. Impingement Mortality
29 and Entrainment Characterization Report, Kewaunee Power Station, March 2006 – February
30 2007. Prepared for Dominion Resources Services, Inc., Glen Allen, Virginia. ADAMS Accession
31 No. ML083520612.
- 32 Environmental Protection Agency (EPA). 1974. "Information on Levels of Environmental Noise
33 Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." Report
34 550/9-74-004, Washington, D.C. Available URL:
35 <http://www.nonoise.org/library/levels74/levels74.htm> (accessed March 2, 2009). (See also "EPA
36 Identifies Noise Levels Affecting Health and Welfare." September 21, 2007. Available URL:
37 <http://www.epa.gov/history/topics/noise/01.htm>). ADAMS Accession No. ML093250012.
- 38 Environmental Protection Agency (EPA). 1992. "Great Lakes Fact Sheet No. 1: Physical
39 Features and Population." Available URL: <http://www.epa.gov/glnpo/atlas/gl-fact1.html>
40 (accessed October 1, 2008). ADAMS Accession No. ML093250013.

- 1 Environmental Protection Agency (EPA). 2007a. "Hazardous Waste Generators Regulations."
2 May. Available URL: <http://www.epa.gov/osw/hazard/downloads/tool.pdf> (accessed October 14,
3 2008). ADAMS Accession No. ML082880301.
- 4 Environmental Protection Agency (EPA). 2007b. "Wastes – Laws and Regulations." Available
5 URL: <http://www.epa.gov/osw/laws-regs/index.htm> (accessed August 20, 2009). ADAMS
6 Accession No. ML082880301.
- 7 Environmental Protection Agency (EPA). 2008. Approval and Promulgation of Implementation
8 Plans and Designation of Areas for Air Quality Planning Purposes; Wisconsin; Redesignation of
9 Kewaunee County to Attainment of Ozone; Final Rule. Federal Register, Vol. 73, No. 99, pp.
10 29436-29444.
- 11 Environmental Protection Agency (EPA). 2008a. "The Great Lakes: An Environmental Atlas and
12 Resource Book. Factsheet 1." Jointly produced by the Government of Canada and the U.S.
13 Environmental Protection Agency. Available URL: <http://www.epa.gov/glnpo/atlas/gl-fact1.html>
14 (accessed July 2009). ADAMS Accession No. ML093250014.
- 15 Environmental Protection Agency (EPA). 2008b. "The Great Lakes: An Environmental Atlas and
16 Resource Book. The Great Lakes Today: Concerns." Jointly produced by the Government of
17 Canada and the U.S. Environmental Protection Agency. Available URL:
18 <http://www.epa.gov/glnpo/atlas/glat-ch4.html> (accessed July 2009). ADAMS Accession No.
19 ML093250015.
- 20 Environmental Protection Agency (EPA). 2008c. "Invasive Species: Asian Carp and the Great
21 Lakes." Available URL: <http://www.epa.gov/glnpo/invasive/asiancarp/> (accessed November 4,
22 2008). ADAMS Accession No. ML093250016.
- 23 Environmental Protection Agency (EPA). 2008d. "Lake Michigan Lake Wide Management Plan
24 (LaMP) 2008." Available URL: http://www.epa.gov/greatlakes/lamp/lm_2008/lm_2008.pdf
25 (accessed May 18, 2009). ADAMS Accession No. ML093250017.
- 26 Environmental Protection Agency (EPA). 2008e. "Lower Fox River and Green Bay Area of
27 Concern." Available URL: <http://www.epa.gov/glnpo/aoc/greenbay.html> (accessed May 18,
28 2009). ADAMS No. ML093250018.
- 29 Environmental Protection Agency (EPA). 2008f. "Pollution Prevention Information
30 Clearinghouse (PPIC)." Available URL: <http://www.epa.gov/oppt/ppic/> (accessed August 20,
31 2009). ADAMS Accession No. ML082880301.
- 32 Environmental Protection Agency (EPA). 2009. "EPA Green Book Nonattainment Areas for
33 Criteria Pollutants." Available URL: <http://www.epa.gov/air/oaqps/greenbk/index.html> (accessed
34 May, 2009). ADAMS No. ML093250019.
- 35 Environmental Protection Agency and Environment Canada (EPA and Environment Canada).
36 1997. "The Great Lakes Binational Toxics Strategy." Available URL:
37 http://binational.net/bns/2007/2007GLBTS_en.pdf (accessed July 20, 2009). ADAMS Accession
38 No. ML093250020.
- 39 Environmental Protection Agency and Environment Canada (EPA and Environment Canada).
40 2007. "Great Lakes Binational Toxics Strategy: 2007 Annual Progress Report." Available URL:

Affected Environment

- 1 http://binational.net/bns/strategy_en.pdf (accessed July 20, 2009). ADAMS Accession No.
2 ML093250021.
- 3 Forest County Potawatomi. 2009. "Forest County Potawatomi History." Forest County
4 Potawatomi, Crandon, Wisconsin. Available URL:
5 <http://www.fcpotawatomi.com/index.php/Treaties/history-overview.html> [Copyright protected]
- 6 Fuller, P., E. Maynard, and D. Raikow. 2007. "Alosa pseudoharengus." USGS Nonindigenous
7 Aquatic Species Database. Available URL:
8 <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=490> (accessed January 6, 2009).
9 ADAMS Accession No. ML093250022.
- 10 Great Lakes Commission (GLC). 2000. "Assessment of the Lake Michigan Monitoring Inventory:
11 A Report on the Lake Michigan Tributary Monitoring Project." Available URL:
12 http://www.glc.org/monitoring/lakemich/pdf/full_report.PDF (accessed October 1, 2008). ADAMS
13 Accession No. ML093250029.
- 14 Great Lakes Fishery Commission (GLFC). 1997. Joint Strategic Plan for Management of Great
15 Lakes Fisheries. Miscellaneous Publication 2007-01. GLFC: Ann Arbor, Michigan. Available
16 URL: <http://www.glfsc.org/fishmgmt/jsp97.pdf> (accessed July 13, 2009). ADAMS Accession No.
17 ML093250030.
- 18 Great Lakes Fishery Commission (GLFC). 2009. "Great Lakes Fishery Commission." Available
19 URL: <http://www.glfsc.org/> (accessed July 13, 2009). ADAMS Accession No. ML093250031.
- 20 Goldstein, L., and J. Freeman. 1997. "Aztalan - A Middle Mississippian Village." The Wisconsin
21 Archaeologist, Vol. 78, Numbers 1 and 2, pp. 223-248. [Copyright protected]
- 22 Green, W. 1997. "The Middle Mississippian Peoples." Wisconsin Archaeology, Chapter 8. The
23 Wisconsin Archaeological Society, The Wisconsin Archaeologist, Vol.78, Numbers 1 and 2, pp.
24 202-222. [Copyright protected]
- 25 Institute of Educational Science (IES). 2009. U.S. Department of Education, National Center for
26 Educational Statistics. "College Opportunities Online Locator." Zip Code 54216. Data release
27 date March 6, 2009. Available URL: <http://nces.ed.gov/ipeds/cool/RefineSearch.aspx> (accessed
28 July 2009). ADAMS Accession No. ML093250032.
- 29 International Joint Commission (IJC). 2006. Thirteenth Biennial Report on Great Lakes Water
30 Quality. Available URL: [http://ijc.org:8080/glro/glro-web/resources/biennial-
31 reports/BRGLWQ_13.pdf](http://ijc.org:8080/glro/glro-web/resources/biennial-reports/BRGLWQ_13.pdf) (accessed July 13, 2009). ADAMS Accession No. ML093250033.
- 32 Kewaunee County Historical Society (KCHS). 2002. Background for Historical Markers.
33 Compiled information by Donna Urban. March 2002. [Copyright protected]
- 34 Kewaunee County 2009. "Kewaunee County Genealogy and History." Available URL:
35 <http://www.rootsweb.ancestry.com/~wikewaun/> (accessed July 2009). [Copyright protected]
- 36 Lehman, J.T. 1991. Causes and Consequences of Cladoceran Dynamics in Lake Michigan:
37 Implications of Species Invasion by Bythotrephes. J. Great Lakes Res., Vol. 17, pp. 437-445.
- 38 Liebig, J., and A. Benson. 2007. Bythotrephes longimanus. Nonindigenous Aquatic Species
39 Database, Gainesville, Florida. Available URL:
40 <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=162> (accessed July 13, 2009).
41 ADAMS Accession No. ML093250034.

- 1 Madenjian, C.P., G.L. Fahnenstiel, T.H. Johengen, T.F. Nalepa, H.A. Vanderploeg, G.W.
2 Fleischer, P.J. Schneeberger, D.M. Benjamin, E.B. Smith, J.R. Bence, E.S. Rutherford, D.S.
3 Lavis, D.M. Robertson, D.J. Jude, and M.P. Ebener. 2002. Dynamics of the Lake Michigan Food
4 Web, 1970-2000. Canadian Journal of Fisheries and Aquatic Sciences, Vol. 59, pp. 736-753.
- 5 Makarewicz, J.C., T. Lewis, and P. Bertram. 1994. Epilimnetic Phytoplankton and Zooplankton
6 Biomass and Species Composition in Lake Michigan, 1983 to 1992. U.S. Environmental
7 Protection Agency, Great Lakes National Program, Chicago, Illinois. Available URL:
8 <http://www.epa.gov/glnpo/monitoring/plankton/mich83-92/index.html> (accessed July 13, 2009).
9 ADAMS Accession No. ML093250035.
- 10 Mason, C. I. 1997. The Historic Period in Wisconsin Archaeology, Native Peoples. The
11 Wisconsin Archaeologist, Vol. 78, Numbers 1 and 2, pp. 293-319. [Copyright protected]
- 12 Mason, R. J. 1997. The Paleo-Indian Tradition. The Wisconsin Archaeologist, Vol. 78, Numbers
13 1 and 2, pp. 78-i 10. [Copyright protected]
- 14 Mason, R. J. 1981. Great Lakes Archaeology. New York: Academic Press, Inc. [Copyright
15 protected]
- 16 McCarty, H., K. Miller, R. Brent, J. Schofield, and R. Rossmann. 2004. Results of the Lake
17 Michigan Mass Balance Study: Mercury Data Report. U.S. EPA Great Lakes National Program
18 Office, EPA 905 R-01-012. February 2004.
- 19 McCarty, H., J. Schofield, K. Miller, and R. Brent. 2004a. Results of the Lake Michigan Mass
20 Balance Study: Polychlorinated Biphenyls and trans-Nonachlor Data Report. U.S. EPA Great
21 Lakes National Program Office, EPA 905 R-01-011. Available URL:
22 <http://www.epa.gov/glnpo/lmmb/results/pcb/lmmbpcb.pdf> (accessed May 18, 2009). ADAMS
23 Accession No. ML093250036.
- 24 National Climatic Data Center (NCDC). 2009. Historical climate data, 1971–2000 NCDC
25 normals, Precipitation Summary, 474195 Kewaunee Station, Wisconsin. ADAMS Accession No.
26 ML091960148.
- 27 National Climatic Data Center (NCDC). 2009a. Historical climate data, 1971–2000 NCDC
28 normals, Temperature Summary, 474195 Kewaunee Station, Wisconsin. ADAMS Accession
29 No. ML091960128.
- 30 National Climatic Data Center (NCDC). 2009b. Flood events in Wisconsin, 1950–2009.
31 Available URL: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms> (accessed July,
32 2009). ADAMS Accession No. ML091960114.
- 33 National Climatic Data Center (NCDC). 2009c. Tornado activities in Kewaunee County,
34 Wisconsin. Available URL: <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>
35 (accessed July, 2009). ADAMS Accession No. ML091960104
- 36 Nalco Environmental Sciences (NES). 1976a. Kewaunee Nuclear Power Plant 316(a)
37 Demonstration, Type 1: Absence of Prior Appreciable Harm. ADAMS Accession No.
38 ML08520612.

Affected Environment

- 1 Nalco Environmental Sciences (NES). 1976b. Kewaunee Nuclear Power Plant 316(b)
2 Demonstration: Environmental Effects of Existing Cooling Water Intake Structures. ADAMS
3 Accession No. ML083520612.
- 4 National Park Service (NPS). 2009a. "National Register of Historic Places Information System,
5 Kewaunee County, Wisconsin." Available URL: www.nr.nps.gov (accessed August 3, 2009).
- 6 National Park Service (NPS). 2009b. "National Register of Historic Places Information System,
7 Manitowoc County, Wisconsin." Available URL: www.nr.nps.gov (accessed August 5, 2009).
- 8 Overstreet, D. F. 1997. Oneota Prehistory and History. The Wisconsin Archaeologist, Vol. 78,
9 Numbers 1 and 2, pp. 250-296. [Copyright protected]
- 10 Platt, J. 2009. "Quagga Terror: Alien Mussels in U.S. Waters Cause Problems for Other
11 Species." Scientific American Online. March 16, 2009. Available URL:
12 <http://www.scientificamerican.com/blog/60-second-science/post.cfm?id=quagga-terror-alien->
13 [mussels-in-us-w-2009-03-16](http://www.scientificamerican.com/blog/60-second-science/post.cfm?id=quagga-terror-alien-mussels-in-us-w-2009-03-16) (accessed July 15, 2009). ADAMS Accession No. ML093250037.
- 14 State of Wisconsin, Department of Workforce Development (DWD). 2006. "Kewaunee County
15 Workforce Profile." December 2006. Available URL:
16 http://www.dwd.state.wi.us/oea/county_profiles/archived/2006/kewaunee_profile_2006.pdf
17 (accessed July 2009). ADAMS Accession No. ML093250011.
- 18 Stevenson, K. P., R. F. Boszhardt, C. R. Moffat, P. H. Salkin, T. C. Pleger, J. L. Theler, and C.
19 M. Arzigian. 1997. The Woodland Tradition. The Wisconsin Archaeologist, Vol. 78, Numbers 1
20 and 2, pp. 140-201. [Copyright protected]
- 21 Stoltman, J. B. 1997. The Archaic Tradition. The Wisconsin Archaeologist, Vol. 78, Numbers 1
22 and 2, pp. 112-139. [Copyright protected]
- 23 STS Consultants, Ltd (STS). 2007. Report of Well Installation Services. Dominion Energy
24 Kewaunee Power Station. August 2007. ADAMS Accession No. ML091970515.
- 25 U.S. Census Bureau (USCB). 2009. "American Community Survey of Kewaunee County,
26 Manitowoc County, and Brown County, Wisconsin, Data Profile Highlights. 2005-2007 American
27 Community Survey 3-Year Estimates." Available URL: <http://factfinder.census.gov> (accessed
28 July 2009).
- 29 U.S. Census Bureau (USCB). 2009a. "American FactFinder, Census 2000 and 2005-2007, 3-
30 Year Estimate, American Community Survey, QuickFacts on Kewaunee, Manitowoc, and Brown
31 Counties. Housing Characteristics for 2000 and 2005-2007, 3-Year Estimate." Available URL:
32 <http://factfinder.census.gov> and <http://quickfacts.census.gov> (accessed July 2009).
- 33 U.S. Census Bureau (USCB). 2009b. "Decennial Census 1900 to 1990 and 2000 Data and
34 American FactFinder, American Community Survey of Kewaunee County, Manitowoc County,
35 and Brown County, Wisconsin, Data Profile Highlights. 2005-2007 American Community
36 Survey 3-Year Estimates." Available URL: <http://factfinder.census.gov> (accessed July 2009).
- 37 U.S. Census Bureau (USCB). 2009c. "State and County QuickFacts for Kewaunee County and
38 Manitowoc County, Wisconsin." Available URL: <http://quickfacts.census.gov> (accessed July
39 2009).
- 40 U.S. Department of Agriculture (USDA). 2009. "2007 Census of Agriculture. Iowa, Kansas,
41 Missouri, Nebraska." Released February 4, 2009. Available URL:

- 1 http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/index.asp
2 (accessed April 17, 2009). ADAMS Accession No. ML093250038.
- 3 U.S. Fish and Wildlife Service (USFWS). 2008. "County Distribution of Wisconsin's Federally
4 Threatened, Endangered, Proposed, and Candidate Species." November 2008. Available URL:
5 <http://www.fws.gov/Midwest/Endangered/lists/wisc08cty.pdf> (accessed January 6, 2009).
6 ADAMS No. ML093250023.
- 7 US Fish and Wildlife Service (USFWS). 2008a. Letter to the NRC regarding the Renewal
8 Application Review of Kewaunee Power Station, Kewaunee County, Wisconsin. October 28,
9 2008. ADAMS Accession No. ML 083390643.
- 10 U.S. Fish and Wildlife Service (USFWS). 2008b. "Osprey: *Pandion haliaetus*." Available URL:
11 <http://www.fws.gov/chesapeakebav/osprey.html> (accessed May 15, 2009). ADAMS No.
12 ML082880486.
- 13 U.S. Fish and Wildlife Service (USFWS). 2009. "Hines Emerald Dragonfly. Factsheet." Available
14 URL: http://www.fws.gov/Midwest/endangered/insects/hed/hins_fct.html (accessed August 9,
15 2009). ADAMS Accession No. ML093250024.
- 16 U.S. Fish and Wildlife Service (USFWS). 2009a. "Piping Plover. Atlantic Coast Population."
17 Available URL: <http://www.fws.gov/northeast/pipingplover/> (accessed August 9, 2009). ADAMS
18 Accession No. ML093250025.
- 19 U.S. Fish and Wildlife Service (USFWS). 2009b. "U.S. Fish and Wildlife Service. Threatened
20 and Endangered Species. Dwarf lake iris. Factsheet." Available URL:
21 <http://www.fws.gov/Midwest/Endangered/plants/pdf/dwarf-lake-iris.pdf> (accessed August 9,
22 2009). ADAMS Accession No. ML093250026.
- 23 U.S. Fish and Wildlife Service (USFWS). 2009c. "U.S. Fish and Wildlife Service. Threatened
24 and Endangered Species. Karner Blue Butterfly. Factsheet." Available URL:
25 <http://www.fws.gov/Midwest/endangered/insects/kbb/kbbFactSheet.pdf> (accessed August 9,
26 2009). ADAMS Accession No. ML093250027.
- 27 U.S. Fish and Wildlife Service (USFWS). 2009d. "U.S. Fish and Wildlife Service. Threatened
28 and Endangered Species. Pitcher Thistle. Factsheet." Available URL:
29 <http://www.fws.gov/Midwest/Endangered/plants/pdf/Pitchersthistle.pdf> (accessed August 9,
30 2009). ADAMS Accession No. ML093250028.
- 31 U.S. Geological Survey (USGS). Undated. "Biological and Ecotoxicological Characteristics of
32 Terrestrial Vertebrate Species Residing in Estuaries – Osprey." ADAMS Accession No.
33 ML091350285.
- 34 U.S. Geological Survey (USGS). 2008. "Sea Lamprey." Available URL:
35 [http://www.glsc.usgs.gov/main.php?content=research_lamprey&title=Invasive%20Fish0&menu=
36 research_invasive_fish](http://www.glsc.usgs.gov/main.php?content=research_lamprey&title=Invasive%20Fish0&menu=research_invasive_fish) (accessed November 4, 2008). ADAMS Accession No. ML093250040.
- 37 University of Wisconsin Sea Grant Institute (UWSGI). 2002. "Fish of the Great Lakes: Brown
38 Trout." Available URL: <http://www.seagrant.wisc.edu/greatlakesfish/browntROUT.html> (accessed
39 November 4, 2008). ADAMS Accession No. ML093250041.

Affected Environment

- 1 University of Wisconsin Sea Grant Institute (UWSGI). 2002a. "Fish of the Great Lakes: Carp."
2 Available URL: <http://www.seagrant.wisc.edu/greatlakesfish/carp.html> (accessed November 4,
3 2008). ADAMS Accession No. ML093250042.
- 4 University of Wisconsin Sea Grant Institute (UWSGI). 2002b. "Fish of the Great Lakes: Fish of
5 Lake Michigan." Available URL:
6 <http://www.seagrant.wisc.edu/greatlakesfish/LakeMichFishIndex.html> (accessed November 4,
7 2008). ADAMS Accession No. ML093250043.
- 8 University of Wisconsin Sea Grant Institute (UWSGI). 2002c. "Fish of the Great Lakes: Rainbow
9 Smelt." Available URL: <http://www.seagrant.wisc.edu/greatlakesfish/rainbow-smelt.html>
10 (accessed November 4, 2008). ADAMS Accession No. ML093250044.
- 11 Wells, L. 1970. Effects of Alewife Predation on Zooplankton Populations in Lake Michigan.
12 *Limnology and Oceanography*, Vol. 15, 4:565-574.
- 13 Wisconsin Department of Public Instruction (DPI). 2009. "Public School Enrollment Data 2009:
14 Public Enrollment by District by School by Gender." Available URL:
15 <http://dpi.wi.gov/lbstat/xls/pecog09.xls> (accessed July 2009). ADAMS Accession No.
16 ML093250010.
- 17 Wisconsin Department of Natural Resources (WDNR). 2004. "Rainbow Smelt (*Osmerus*
18 *mordax*)." Available URL: http://dnr.wi.gov/invasives/fact/rainbow_smelt.htm (accessed
19 November 7, 2008). ADAMS Accession No. ML093250045.
- 20 Wisconsin Department of Natural Resources (WDNR). 2004a. "Wisconsin Endangered and
21 Threatened Species Laws & List." February 2004. Available URL:
22 http://dnr.wi.gov/ORG/LAND/ER/wlist/WI_ET_Laws_List.pdf (accessed January 6, 2009).
23 ADAMS Accession No. ML093250046.
- 24 Wisconsin Department of Natural Resources (WDNR). 2005. State of Wisconsin Department of
25 Natural Resources Permit to Discharge Under the Wisconsin Pollutant Discharge Elimination
26 System, Permit No. WI-0001571-07-0, Kewaunee Power Station, July 2005. ADAMS Accession
27 No. ML083520612.
- 28 Wisconsin Department of Natural Resources (WDNR). 2008. "Natural Heritage Inventory
29 County Maps: Brown County." Available URL:
30 http://dnr.wi.gov/org/land/er/nhi/CountyMaps/pdfs/Brown_County.pdf (accessed January 6,
31 2009). ADAMS Accession No. ML093250047.
- 32 Wisconsin Department of Natural Resources (WDNR). 2008a. "Natural Heritage Inventory
33 County Maps: Kewaunee County." Available URL:
34 http://dnr.wi.gov/org/land/er/nhi/CountyMaps/pdfs/Kewaunee_County.pdf (accessed January 6,
35 2009). ADAMS Accession No. ML093250048.
- 36 Wisconsin Department of Natural Resources (WDNR). 2008b. "Natural Heritage Inventory
37 County Maps: Manitowoc County." Available URL:
38 http://dnr.wi.gov/org/land/er/nhi/CountyMaps/pdfs/Manitowoc_County.pdf (accessed January 6,
39 2009). ADAMS Accession No. ML093250049.
- 40 Wisconsin Department of Natural Resources (WDNR). 2008c. "Natural Heritage Inventory
41 County Maps: Outagamie County." Available URL:

- 1 http://dnr.wi.gov/org/land/er/nhi/CountyMaps/pdfs/Outagamie_County.pdf (accessed January 6,
2 2009). ADAMS Accession No. ML09325050.
- 3 Wisconsin Department of Natural Resources (WDNR). 2009. "Choose Wisely: A Health Guide
4 for Eating Fish in Wisconsin." Available URL:
5 <http://dnr.wi.gov/fish/consumption/FishAdvweb09lo.pdf> (accessed July 13, 2009). ADAMS
6 Accession No. ML093250051.
- 7 Wisconsin Department of Natural Resources (WDNR). 2009a. "Invasive Species. Animals."
8 Available URL: <http://dnr.wi.gov/invasives/animals.asp> (accessed August 9, 2009). ADAMS
9 Accession No. ML093250052.
- 10 Wisconsin Department of Natural Resources (WDNR). 2009b. "Invasive Species. Plants."
11 Available URL: <http://dnr.wi.gov/invasives/plants.asp> (accessed August 9, 2009). ADAMS
12 Accession No. ML093250053.
- 13 Wisconsin Department of Natural Resources (WDNR). 2009c. "Natural Communities of
14 Wisconsin." Available URL: <http://www.dnr.wi.gov/org/land/er/communities/> (accessed August 9,
15 2009). ADAMS Accession No. ML093250054.
- 16 Wisconsin Department of Natural Resources (WDNR). 2009d. "Wisconsin Ecological
17 Landscape Handbook. Grassland Communities." Available URL:
18 <http://www.dnr.wi.gov/landscapes/pdfs/Grass.pdf> (accessed August 9, 2009). ADAMS
19 Accession No. ML093250055.
- 20 Wisconsin Department of Natural Resources (WDNR). 2009e. "Wisconsin Ecological
21 Landscape Handbook. Wetland Communities." Available URL:
22 <http://www.dnr.wi.gov/landscapes/pdfs/Wet.pdf> (accessed August 9, 2009). ADAMS Accession
23 No. ML093250056.
- 24 Wisconsin Department of Natural Resources (WDNR). 2009f. "Wisconsin's Major Aquifers."
25 Available URL: <http://www.dnr.state.wi.us/org/caer/ce/eeek/teacher/groundwaterguide/P1213.pdf>
26 (accessed August 2009). ADAMS Accession No. ML093250057.
- 27 Wisconsin Department of Revenue (WDOR). 2007. "Shared Revenue Utility Payments."
28 Available URL: <http://www.revenue.wi.gov/> (accessed on July 2009).
- 29 Wisconsin Department of Revenue (WDOR). 2009. "County and Municipal Revenues and
30 Expenditures – 2004 through 2007." Available URL: <http://www.revenue.wi.gov/report/r.html>
31 (accessed July 2009). ADAMS Accession No. ML093250058.
- 32 Wisconsin Department of Transportation (WDOT). 2009. "Travel Information – Traffic Count
33 Maps by County." Available URL: <http://www.dot.wisconsin.gov/travel/counts/index.htm>
34 (accessed July 2009). ADAMS Accession No. ML093250059.
- 35 Wisconsin Natural Heritage Program (WNHP). 2006. "Wisconsin Natural Heritage Working List."
36 December 2006. Available URL: http://dnr.wi.gov/ORG/LAND/ER/wlist/Working_List_2006.pdf
37 (accessed January 6, 2009).

3.0 ENVIRONMENTAL IMPACTS OF REFURBISHMENT

Facility owners or operators may need to undertake or, for economic or safety reasons, may choose to perform refurbishment activities in anticipation of license renewal or during the license renewal term. The major refurbishment class of activities characterized in the Generic Environmental Impact Statement (GEIS) (NRC 1996, 1999) is intended to encompass actions which typically take place only once in the life of a nuclear plant, if at all. Examples of these activities include, but are not limited to, replacement of boiling water reactor recirculation piping and pressurized water reactor steam generators. As noted in the GEIS, refurbishment activities could result in environmental impacts beyond those that occur during normal plant operations. Refurbishment activities may affect a variety of environmental issues as listed in Table 3-1.

Environmental Impacts of Refurbishment

1 **Table 3-1. Issues Related to Refurbishment.** *Kewaunee Power Station (KPS) does not have*
 2 *any plans for refurbishment activities.*

Issues	Category
Surface Water Quality, Hydrology, and Use	
Impacts of refurbishment on surface water quality	1
Impacts of refurbishment on surface water use	1
Aquatic Ecology	
Refurbishment	1
Terrestrial Resources	
Refurbishment impacts	2
Threatened or Endangered Species	
Threatened or endangered species	2
Ground Water Use and Quality	
Impacts of refurbishment on ground water use and quality	1
Air Quality	
Air quality during refurbishment (nonattainment and maintenance areas)	2
Land Use	
Onsite land use	1
Human Health	
Radiation exposures to the public during refurbishment	1
Occupational radiation exposures during refurbishment	1
Socioeconomics	
Public services: public safety, social services, and tourism and recreation	1
Aesthetic impacts (refurbishment)	1
Housing impacts	2
Public services: education (refurbishment)	2
Public services: public utilities	2
Public services: transportation	2
Offsite land use (refurbishment)	2
Historic and Archaeological resources	2
Environmental Justice	
Environmental justice	Uncategorized

3 Dominion Energy Kewaunee, Inc. (DEK) submitted to the U.S. Nuclear Regulatory Commission
 4 (NRC) an environmental report (ER) as part of its license renewal application for the Kewaunee
 5 Power Station (KPS) in August 2008. DEK addressed refurbishment activities in the ER (DEK,
 6 2008a), which is Attachment E of the license renewal application (DEK, 2008b). DEK states in
 7 the ER that the refurbishing assessment for KPS was done according to the regulations in

1 10 CFR Parts 51 and 54 and complementary information in the GEIS, NUREG-1437 (NRC
2 1996, 1999).

3 The requirements for the assessment of refurbishing in a license renewal of operating nuclear
4 power plants include the preparation of an integrated plant assessment (IPA) under
5 10 CFR 54.21. The IPA must identify and list systems, structures, and components subject to an
6 aging management review. Items that are subject to aging and might require refurbishment
7 include, for example, the reactor vessel, piping, supports, and pump casings, as well as those
8 that are not subject to periodic replacement.

9 In the case of KPS, the IPA did not identify the need for major refurbishment or replacement
10 actions to maintain the functionality of important systems, structures, and components during
11 the KPS license renewal period. Also, the IPA did not identify the need for modifications to any
12 of the KPS facilities associated with the license renewal.

13 The NRC staff reviewed the information presented in the KPS ER, support documentation, and
14 gathered during the site audits and interviews. During the review, the NRC staff did not identify
15 any new and significant information that would affect the conclusion presented in the ER.
16 Therefore, based on the review, the NRC staff concluded that no refurbishing activities are
17 necessary in anticipation of the license renewal or during the license renewal term. The NRC
18 staff does not expect that the environmental impacts caused by KPS during the renewal term
19 will be beyond those that occur during the normal plant operations.

20 **3.1 REFERENCES**

21 10 CFR 51. *Code of Federal Regulations*, Title 10 *Energy*, Part 51 “Environmental Protection
22 Regulations for Domestic Licensing and Related Regulatory Functions.”

23 10 CFR 54. *Code of Federal Regulations*, Title 10 *Energy*, Part 54, “Requirements for Renewal
24 of Operating Licenses for Nuclear Power Plants.”

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

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

31 Dominion Energy Kewaunee, Inc. (DEK). 2008a: “Applicant’s Environmental Report – Operating
32 License Renewal Stage. Appendix E of Application for Renewed Operating License, Kewaunee
33 Power Station.” Docket No. 50-305. August 2008. Agencywide Documents Access and
34 Management System (ADAMS) Accession No. ML082341039.

35 Dominion Energy Kewaunee, Inc. (DEK) 2008b: “Application for Renewed Operating License,
36 Kewaunee Power Station.” Docket No. 50-305. August 2008. ADAMS Accession Nos.
37 ML082341020, ML082341038, ML082420854.

4.0 ENVIRONMENTAL IMPACTS OF OPERATION

This chapter addresses potential environmental impacts related to the period of extended operation of Kewaunee Power Station (KPS). These impacts are grouped and presented according to resource. Generic issues (Category 1) rely on the analysis provided in the generic environmental impact statement (GEIS), prepared by the U.S Nuclear Regulatory Commission (NRC 1996, 1999) and are discussed briefly. Site-specific issues (Category 2) have been analyzed for KPS and assigned a significance level of SMALL, MODERATE, or LARGE, accordingly. Some remaining issues are not applicable to KPS because of site characteristics or plant features. Section 1.4 of this report explains the criteria for Category 1 and Category 2 issues, and defines the impact designations of SMALL, MODERATE, and LARGE.

4.1 LAND USE

Table 4.1 lists the Category 1 issues (from 10 CFR Part 51, Subpart A, Appendix B, Table B-1) which are applicable to onsite land use and power line right of way (ROW) impacts during the renewal term. As stated in the GEIS, the impacts associated with these Category 1 issues were determined to be SMALL, and plant-specific mitigation measures would not be sufficiently beneficial to be warranted.

NRC reviewed and evaluated the applicant's environmental report (ER), Dominion Energy Kewaunee, Inc. (DEK, 2008), scoping comments, other available information, and visited the KPS in search of new and significant information that would change the conclusions presented in the GEIS. No new and significant information was identified during this review and evaluation. Therefore, it is expected that there would be no impacts related to these Category 1 issues during the renewal term beyond those discussed in the GEIS.

Table 4-1. Land Use Issues. Section 2.2.1 of this draft supplemental environmental impact statement (SEIS) describes the land use around KPS.

Issues	GEIS Section	Category
Onsite land use	4.5.3	1
Power line ROW	4.5.3	1

4.2 AIR QUALITY

The air quality issue applicable to KPS is listed in Table 4-2. No Category 2 issues have been identified for air quality. The NRC staff did not identify any new and significant information during the review of the applicant's ER (DEK, 2008), the site audit, or during the scoping process. No major facility construction or refurbishments are planned to occur during the license renewal period. Therefore, there are no impacts related to this issue beyond those discussed in the GEIS. For these issues, the GEIS concluded that the impacts are SMALL.

Environmental Impacts of Operation

1 **Table 4-2. Air Quality Issue.** Section 2.2.2 of this document provides a description of air quality
 2 at Kewaunee Power Station.

Issue	GEIS Section	Category
Air quality effects of transmission lines	4.5.2	1

3 **4.3 GENERIC GROUNDWATER ISSUES**

4 There were no Category 1 groundwater impacts identified for the KPS license renewal term and
 5 no Category 2 issues were found applicable to the continued operation of the facility. KPS
 6 withdraws less than 100 gallons per minute of groundwater, and its once-through cooling
 7 system does not utilize cooling towers or cooling ponds, therefore, none of the NRC specified
 8 Category 2 issues for groundwater issues are applicable to KPS.

9 **4.4 GENERIC SURFACE WATER ISSUES**

10 The following sections discuss the surface water quality issues applicable to KPS. The issues
 11 are also listed in Table 4-3. NRC did not identify any new and significant information during the
 12 environmental review for the KPS license renewal, the site visit, or the scoping process.
 13 Therefore, no impacts are related to these issues beyond those discussed in the GEIS. For
 14 these issues, the GEIS concludes that the impacts are SMALL and additional site-specific
 15 mitigation measures are not likely to be warranted.

16 **Table 4-3. Category 1 Surface Water Issues.** Applicable to the operation of the KPS cooling
 17 system during the renewal term.

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
Surface Water Quality, Hydrology, and Use	
Altered current patterns at intake and discharge structures	4.2.1.2.1
Temperature effects on sediment transport capacity	4.2.1.2.3
Scouring caused by discharged cooling water	4.2.1.2.3
Discharge of chlorine or other biocides	4.2.1.2.4
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4
Discharge of other metals in wastewater	4.2.1.2.4
Water use conflicts – plants with once-through cooling systems	4.2.1.3

18

19 **4.4.1 Water Use Conflicts**

20 There were no Category 2 surface water issues identified for the KPS license renewal term.

21 **4.5 AQUATIC RESOURCES**

22 The Category 1 and Category 2 issues related to aquatic resources applicable to KPS are
 23 discussed below and listed in Table 4-4.

1 **Table 4-4. Aquatic Resources Issues.** Section 2.1.6 of this document describes KPS's cooling
 2 water system and Section 2.2.5 of this document describes the aquatic resources.

Issues	GEIS Sections	Category
For All Plants		
Accumulation of contaminants in sediments or biota	4.2.1.2.4	1
Entrainment of phytoplankton and zooplankton	4.2.2.1.1	1
Cold shock	4.2.2.1.5	1
Thermal plume barrier to migrating fish	4.2.2.1.6	1
Distribution of aquatic organisms	4.2.2.1.6	1
Premature emergence of aquatic insects	4.2.2.1.7	1
Gas supersaturation (gas bubble disease)	4.2.2.1.8	1
Low dissolved oxygen in the discharge	4.2.2.1.9	1
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10	1
Stimulation of nuisance organisms	4.2.2.1.11	1
For Plants with Once-Through Cooling Pond Heat Dissipation Systems		
Entrainment of fish and shellfish in early life stages	4.1.2	2
Impingement of fish and shellfish	4.1.3	2
Heat shock	4.1.4	2

3 **4.5.1 Generic Aquatic Ecology Issues**

4 The NRC staff did not identify any new or significant information during the review of the
 5 applicant's ER (DEK, 2008), the staff's site audit, the scoping process, or the evaluation of other
 6 available information. Therefore, the NRC staff found no impacts related to the generic,
 7 Category 1 issues beyond those discussed in the GEIS. For these issues, the GEIS concluded
 8 that the impacts are SMALL, and additional site-specific mitigation measures are not likely to be
 9 sufficiently beneficial to be warranted.

10 **4.5.2 Entrainment of Fish and Shellfish in Early Life Stages**

11 Entrainment occurs when aquatic organisms (usually eggs, larvae, and other small organisms)
 12 are drawn into the cooling water system and are subjected to thermal, physical, and chemical
 13 stress. For nuclear power plants with once-through cooling systems, the NRC considers the
 14 entrainment of fish and shellfish in early life stages into cooling water systems to be a Category
 15 2 issue, which requires a site-specific assessment during the license renewal application review
 16 process. KPS operates a once-through heat dissipation system that withdraws water from and
 17 discharges it back to Lake Michigan. A detailed description of the KPS cooling system is
 18 presented in Section 2.1.6 of this draft SEIS. Flow rates and discharge volumes are given in
 19 Section 4.2.5 of this draft SEIS.

20 For the site-specific assessment of the KPS cooling system, the NRC staff reviewed the
 21 applicant's ER (DEK, 2008) and related documents, including the Clean Water Act (CWA)
 22 Section 316(a) Demonstration (NES, 1976), CWA Section 316(b) Demonstration (NES, 1976),
 23 the KPS Impingement Mortality and Entrainment Characterization Report and the Kewaunee

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1 Power Station WPDES WI-0001571-07, "Cooling Water Intake Structure Information Submittal"
2 (Dominion, 2008), and visited the KPS site. The NRC staff also reviewed the applicant's State of
3 Wisconsin WPDES Permit No. WI-0001571-07-0, issued on July 18, 2005, and in force until
4 June 30, 2010 (WDNR 2005; 2005a).

5 Section 316(b) of the CWA requires that the location, design, construction, and capacity of the
6 cooling water intake structures reflect the best technology available (BTA) in order to minimize
7 adverse environmental impacts, specifically impingement and entrainment, to protect fish,
8 shellfish, and other forms of aquatic life (33 USC 1326). Phase II of Section 316(b)'s
9 implementing regulations applies to large existing electric generating plants, such as KPS, that
10 withdraw more than 50 million gallons of water per day (gpd; 6.7 million cubic feet per day (cfd)).
11 The Environmental Protection Agency (EPA) implemented Phase II on July 9, 2004
12 (69 FR 41575). The new Phase II performance standards were designed to significantly reduce
13 impingement mortality due to water withdrawals associated with cooling water intake structures
14 used for power production and were to be implemented through the NPDES permitting process.
15 The rule would require licensees to demonstrate compliance with Phase II performance
16 standards upon renewal of their NPDES permit.

17 However, the EPA suspended the Phase II rule on July 9, 2007 (72 FR 37107), in response to
18 the Second Circuit Court of Appeals decision in *Riverkeeper, Inc. v. EPA*, 475 F.3d 83 (2d Cir.
19 2009). As a result, the EPA directed NPDES permit writers for Phase II facilities to develop
20 technology-based permit conditions on a case-by-case basis using all reasonably available and
21 relevant data and best professional judgment (BPJ) regarding the BTA. Some of the changes
22 that the licensees may be required to implement by the EPA could include altering their intake
23 structure, redesigning the cooling system, modifying station operation, or taking other mitigative
24 measures.

25 Before suspension of the Phase II rule, DEK submitted a Proposal for Information Collection
26 (PIC) to the Wisconsin Department of Natural Resources (WDNR) in October 2005 to
27 demonstrate KPS's compliance with the Phase II requirements. The PIC included options for
28 achieving compliance with the rule and proposals for biological studies. The WDNR provided
29 comments modifying the PIC, and DEK began collecting data in accordance with the modified
30 PIC in March 2006. As a result of the July 9, 2007, suspension of the Phase II rule, KPS was no
31 longer required to comply with the modified PIC; however, the WDNR modified the requirements
32 contained in the KPS WPDES permit so that the one-year impingement and entrainment field
33 study detailed in the modified PIC remained a requirement (WDNR, 2007). On January 4, 2008,
34 DEK submitted a letter to the WDNR (Dominion, 2008) containing the one-year impingement
35 and entrainment field study from March 2006 through February 2007 prepared by EA
36 Engineering Science and Technology, Inc. (EAE, 2007).

37 Prior to this study, as a condition of the original WPDES permit for KPS, Nalco Environmental
38 Sciences (NES) performed a one-year entrainment and impingement study (NES 1976) for
39 Wisconsin Public Service Corporation (WPSC) from April 1, 1975, through March 31, 1976. The
40 results of this study were summarized in a 316(b) Demonstration. At that time, WDNR did not
41 require any additional modifications of the cooling system or mitigation for compliance with the
42 KPS WPDES permit as a result of the study.

1 4.5.2.1 *Nalco Environmental Sciences, 1975-1976*

2 The original KPS WPDES Permit required a one-year study on the environmental impacts of the
 3 cooling water intake structure, which NES (1976) conducted from April 1, 1975 through
 4 March 31, 1976; the results were summarized in a 316(b) Demonstration. NES gathered
 5 entrainment samples from the forebay once per week from April through August 1975 and twice
 6 per month from September 1975 through March 1976. Two zero-mesh (335 µm) plankton nets
 7 with digital flow monitors were used to gather entrainment samples three times (12:00 a.m., 8
 8 a.m., and 4 p.m.) during each 24-hour period of sampling. Two replicates were collected for
 9 each net at each time period. Collected fish eggs, larvae, and debris were then sorted, counted,
 10 and recorded. Larvae were measured to the nearest 0.1 mm (0.004 in.) and identified by
 11 species, as possible. Some juveniles were collected, though NES combined juveniles and
 12 larvae for purposes of analysis. Intake and discharge temperatures, water flow, and turbidity
 13 were also collected at the time of each sample. Impingement sampling methods for this study
 14 are discussed in Section 4.5.3 (NES, 1976).

15 Alewife was the most prevalent species of eggs collected from entrainment sampling, followed
 16 by rainbow smelt and white or longnose sucker (the study groups these together by family,
 17 Catostomidae) (See Table 4-5). Alewife eggs were collected in June, July, and August, while
 18 catostomid and rainbow smelt eggs were only collected in April and May. A total of 3,224 fish
 19 eggs were collected during the study with a peak collection of 1777 eggs in July. NES (1976)
 20 estimated that a total of 52.6 million eggs were entrained through the KPS cooling system
 21 during the study year with peak numbers in July and August and a combined estimated total of
 22 43.9 million eggs (NES, 1976).

23 **Table 4-5. Entrainment by Species, April 1975 through March 1976**

Common Name	Taxa	Total Number Collected	Percentage of Total
Eggs			
Alewife	<i>Alosa pseudoharengus</i>	2208	68.5
Rainbow smelt	<i>Osmerus mordax</i>	976	30.3
White or longnose sucker	Catostomidae spp.	26	0.8
Unidentified taxa		14	0.4
Total		3224	100
Larvae and Juveniles			
Rainbow smelt	<i>Osmerus mordax</i>	411	89.7
Alewife	<i>Alosa pseudoharengus</i>	20	4.4
Carp	<i>Cyprinus carpio</i>	12	2.6
Burbot	<i>Lota lota</i>	6	1.3
Whitefish	<i>Coregonidae</i> spp.	5	1.1
Slimy sculpin	<i>Cottus cognatus</i>	3	0.7
White or longnose sucker	Catostomidae spp.	1	0.2
Total		458	100

Source: adapted from NES 1976

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1 Rainbow smelt was the most prevalent species of larvae and juveniles collected from
2 entrainment sampling, and accounted for almost 90 percent of the total collected. Alewife and
3 catostomid larvae and juveniles were also identified in the samples. Additionally, carp (*Cyprinus*
4 *carpio*), burbot (*Lota lota*), whitefish (*Coregonidae* spp.), and slimy sculpin (*Cottus cognatus*)
5 were present, none of which were identified in egg samples. NES (1976) estimated that KPS
6 entrained a total of 13.6 million larvae and juveniles through the KPS cooling system during the
7 study year with the majority entrained during summer months (6.4 million), followed by autumn
8 (5.2 million), and then spring (2.0 million).

9 When all life stages are considered (eggs, larvae, and juveniles), alewife accounted for
10 61 percent and rainbow smelt accounted for 38 percent of the total entrained. The study
11 estimates that the number of alewife and rainbow smelt eggs lost to entrainment over the study
12 year would be comparable to the potential production of 4,286 alewife females and 200 smelt
13 females (NES 1976). The estimated loss of larval and juvenile individuals for each species
14 would be equivalent to the larval production of 105,400 alewife, 4,630 smelt, 323 slimy sculpin,
15 1 burbot, 10 whitefish, and 1 Catostomid female (NES, 1976). The loss of carp juveniles was
16 noted to be small compared to the large number of larvae produced by an average carp female,
17 though no equivalent was provided. Froese and Pauly (2009) estimate that a 19-inch (47-cm)
18 carp female can produce 300,000 eggs; therefore the loss of carp larvae and juveniles due to
19 entrainment is equivalent to the egg production of less than one adult female. NES (1976)
20 considered these losses to be small for all species.

21 The NES (1976) study shows that the alewife population is adversely affected the most from
22 entrainment. As discussed in Section 2.2.5 of this draft SEIS, the alewife is invasive to the Great
23 Lakes and was first introduced to Lake Michigan in 1949. From the mid-1950s through 1960s,
24 the rapid decrease in abundance of certain native fish that the alewife preyed on led to large-
25 scale die-offs of alewives in the 1950s and 1960s (Crawford, 2001). In response, Wisconsin
26 Department of Natural Resources (WDNR) began a salmonid stocking program in 1965 to
27 control the overabundant alewife population (Madenjian et al., 2005). Though the number of
28 entrained alewife seems high, this study took place within the time period that the previously
29 overabundant population of alewife was showing decline due to salmonid predation. Therefore,
30 the effect of entrainment on the total population of alewife may not have been significant. The
31 National Marine Fisheries Service does not have annual commercial landing statistics available
32 for 1976, the year that the impingement and entrainment study took place (NOAA, 2007). The
33 closest years available for the state of Wisconsin are 1961 (2,113,200 lbs or 958,531 kg) and
34 1985 (23,366,000 lbs or 10,598,639 kg) (NOAA, 2007). Because the decline of alewife in Lake
35 Michigan occurred between the 1960s and 1980s, NRC will assume the average between 1961
36 and 1985 as an estimate for 1976, which is 12,739,600 lbs (5,778,585 kg). Adult alewives might
37 typically weigh 8 to 9 ounces (227 to 255 g) on average (Bigelow and Schroeder, 1953).
38 Therefore, the 1976 estimated landings would account for an estimated 23,980,423 adult
39 alewives. In comparison, the equivalent loss of production of 109,686 females from entrainment
40 of eggs, larvae, and juveniles is small.

41 4.5.2.2 EA Engineering, Science, and Technology, Inc., 2006–2007

42 After the EPA suspended the CWA 316(b) Phase II rule (discussed above), the WDNR modified
43 the requirements of the KPS WPDES permit to include a one-year impingement and
44 entrainment study. EAE performed this study from March 2006 through February 2007. EAE

1 gathered entrainment samples from the discharge canal once per week from March through
 2 August 2006, once in September 2006 due to a planned plant outage, and twice per month from
 3 October 2006 through February 2007. One zero-mesh (335 µm) plankton net equipped with a
 4 mechanical flow meter was used to gather entrainment samples four times (generally at 4:00
 5 a.m., 10 a.m., 4 p.m., and 10 p.m.) during each 24-hour period of sampling. Two replicates were
 6 collected for each sampling time. Collected fish eggs, larvae, and debris were then sorted,
 7 counted, and recorded. Unlike the NES (1976) study, EAE (2007) based their findings on
 8 density of entrainment rather than total number of organisms of each taxon collected.
 9 Additionally, eggs were only counted and identified as fertilized or unfertilized, but were not
 10 identified by species. Up to 20 larvae of each taxon and life-stage were measured to the nearest
 11 0.004 inches (0.1mm). Impingement sampling methods for this study are discussed in Section
 12 4.5.3 (EAE, 2007).

13 The amphipod crustacean genus *Gammarus* accounted for the vast majority (93 percent) of
 14 entrained organisms based on annual density. Burbot, alewife, and common carp were the most
 15 abundant fish species; however, these three species collectively accounted for only 1.08
 16 percent of the estimated total number of organisms entrained. A total of 15 fish species were
 17 identified in the entrainment samples. Density data as well as station cooling water flow data
 18 were used to estimate the total number of organisms entrained during the study year for each
 19 species (see Table 4-6) (EAE, 2007).

20 **Table 4-6. Estimated Entrainment by Species, March 2006 through February 2007**

Common Name	Taxa	Total Estimated Number (x 10 ⁶)	Percentage of Total
Eggs			
Unidentified taxa		25.28	1.63
Total		25.28	1.63
Larvae			
Burbot	<i>Lota lota</i>	7.82	0.50
Carp	<i>Cyprinus carpio</i>	5.40	0.35
Alewife	<i>Alosa pseudoharengus</i>	3.52	0.23
Carp and minnow family	Cyprinidae spp.	2.80	0.18
Clupeid family	Clupeidae spp.	1.96	0.13
Rainbow smelt	<i>Osmerus mordax</i>	1.25	0.08
Whitefish family	Coregoninae spp.	0.80	0.05
Sickleback family	Gasterosteidae spp.	0.66	0.04
Perch family	Percidae spp.	0.55	0.03
Unidentified taxa		0.39	0.02
Round goby	<i>Neogobius melanostomus</i>	0.14	0.01
Sucker spp.	Catostomus spp.	0.12	<0.01
Ninespine Stickleback	<i>Pungitius pungitius</i>	0.07	<0.01
White sucker	<i>Catostomus commersoni</i>	0.05	<0.01
Deepwater sculpin	<i>Myoxocephalus thompsoni</i>	0.04	<0.01
Juveniles			

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Rainbow smelt	<i>Osmerus mordax</i>	3.22	0.21
Alewife	<i>Alosa pseudoharengus</i>	0.29	0.02
Ninespine Stickleback	<i>Pungitius pungitius</i>	0.20	0.01
Deepwater sculpin	<i>Myoxocephalus thompsoni</i>	0.07	<0.01
Total		29.35	1.88
Invertebrates			
Scud spp.	Gammarus spp.	1494.22	96.23
Opossum shrimp	<i>Mysis relicta</i>	3.22	0.21
Bloody-red mysid	<i>Hemimysis anomala</i>	0.74	0.05
Total		1498.18	96.49

Source: adapted from EAE, 2007

1 Total estimated numbers entrained for each species of fish were generally small when
 2 compared to the potential production of reproducing females. Female burbot can produce
 3 between 500,000 and 1,500,000 eggs (USFWS, 2003). Using the average egg production of
 4 1,000,000 eggs per female, the total estimated number of entrained burbot larvae is equivalent
 5 to the egg production of about eight females. Female carp can produce up to 300,000 eggs
 6 (Froese and Pauly, 2009). Therefore, the total estimated number of entrained carp larvae is
 7 equivalent to the egg production of 18 females. Female alewife can produce 60,000 to 100,000
 8 eggs (Fay et al., 1983). Using the average egg production of 80,000 eggs per female, the total
 9 estimated number of entrained alewife larvae is equivalent to the production of 44 females.

10 Because not all eggs are spawned, not all spawned eggs are fertilized, few fertilized eggs
 11 survive to become larvae in the wild, and mortality rates can be high within the larval stages, the
 12 estimated equivalent number of reproducing females for each species will likely be greater than
 13 the numbers calculated above. Though the specific mortality rate of alewives from egg to larval
 14 stage is unavailable, Edsall in 1970, (Fay et al., 1983) reported an alewife egg hatching rate of
 15 38 percent at an optimal incubation temperature of 64 °F (18 °C) in Lake Michigan. Using this
 16 hatching rate and the average production of 80,000 eggs per female (Fay et al., 1983), the total
 17 estimated number of entrained alewife larvae is equivalent to the production of 116 females.
 18 The NRC staff calculated the percent of the Lake Michigan alewife population that 116 females
 19 represents by using a 2007 estimate (Madenjian et al., 2008) of a lake-wide biomass of
 20 alewives (11,674 metric tons; 25,736,764.5 lbs) and the average weight of an adult alewife,
 21 which might typically be 8 to 9 ounces (227 to 255 g) (Bigelow and Schroeder, 1953). The staff
 22 found that alewife larval entrainment, calculated to be equivalent to the egg production of 116
 23 females, would represent only 0.0002 percent of the Lake Michigan population. Specific
 24 mortality rates for burbot and carp were unavailable; however, the equivalent loss of
 25 reproducing females from larval entrainment would likely remain small in comparison to the
 26 lake-wide population of each species.

27 When results of the 1975–1976 NES (1976) study are compared to the 2006–2007 EAE (2007)
 28 study, some notable differences appear. Rainbow smelt were more abundant in 1975–1976
 29 samples than in 2006–2007 samples. Table 4-7 contains the total estimated numbers of
 30 entrained individuals for those species that appear in both studies. The total estimated number
 31 of eggs entrained was also much higher in the 1975–1976 study. Alewife, carp, burbot, and
 32 whitefish were more abundant in the 2006–2007 samples. EAE (2007) notes that these

1 differences primarily reflect the changing population dynamics and species' abundances in Lake
 2 Michigan during the 30-year interval between studies. Section 2.2.5 of this draft SEIS describes
 3 the changing aquatic communities within Lake Michigan as a result of numerous invasive
 4 species introductions, which supports this conclusion.

5 Sampling differences may have occurred due to location of sampling; NES (1976) sampled in
 6 the forebay at the intake, while EAE (2007) sampled in the discharge canal. However, the total
 7 absence of certain species from the 1975–1976 study is unlikely if these species were within the
 8 vicinity of KPS at the time of the study. Burbot, ninespine stickleback, round goby, and white
 9 sucker, all of which appeared in the 2006–2007 study but not in the 1975–1976 study, spawn in
 10 relatively shallow water, which means that their larvae would have a greater likelihood of being
 11 entrained if these species were in the vicinity of KPS. Bunnell et al., 2007 reports a recovery of
 12 burbot numbers beginning in the 1980s, after the species had suffered a decline in the 1970s
 13 following the introduction of alewife, which may account for the appearance of this species in
 14 the 2006–2007 study, but not the 1975–1976 study. The ninespine stickleback population
 15 density in Lake Michigan was low from 1973–1995, increased dramatically in 1996–1997, and
 16 has remained variable since this time, which may account for the increased number of
 17 individuals recorded in the 2006–2007 study (Bunnell et al., 2007; EAE, 2007). Though species
 18 composition differs between the studies, both studies collected species representing the major
 19 trophic levels of fish: predator species, forage species, and bottom-dwellers; therefore the
 20 results of these studies do not indicate that the aquatic community within the vicinity of KPS has
 21 become destabilized. Additionally, neither study indicates that any one species is being affected
 22 enough to cause decline or destabilization of the species population in Lake Michigan.

23 **Table 4-7. Estimated Total Numbers of Entrained Fish.** *Total estimated numbers are*
 24 *compared between the 1975–1976 study (NES, 1976) and 2006–2007 (EAE, 2007) study for*
 25 *those species that appeared in both studies.*

Species and/or Life Stage	Total Estimated Number (x 10 ⁶) 1975–1976	Total Estimated Number (x 10 ⁶) 2006–2007
Fish eggs	52.672	25.28
Rainbow smelt juveniles	9.715	3.22
Rainbow smelt larvae	2.764	1.32
Alewife juveniles	0.393	0.29
Alewife larvae	0.271	3.52
Carp larvae	0.237	5.40
Burbot larvae	0.076	7.82
Slimy sculpin larvae	0.085	0.00
Whitefish larvae	0.076	0.80

Source: adapted from EAE, 2007

26 Based on the information presented in this section, the NRC staff determined that the potential
 27 impacts of entrainment of fish and shellfish by the KPS cooling system during the 20-year
 28 renewal period would be SMALL. The staff identified potential mitigation measures, including
 29 use of finer mesh screens, operating under reduced intake flow, and scheduling outages during
 30 historic periods of high fish density. However, the staff concludes that none of the mitigation

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1 measures considered would eliminate adverse entrainment impacts and would not reduce the
2 significance level below SMALL. The NRC does not have the authority to mandate these
3 measures; it is the responsibility of the WDNR to impose any restrictions or modifications to the
4 cooling system to reduce the impact of entrainment under the WPDES permitting process. The
5 staff did not identify any cost benefit studies applicable to these mitigation measures.

6 4.5.3 Impingement

7 Impingement occurs when aquatic organisms are pinned against intake screens or other parts
8 of the cooling water system intake structure. For plants with once-through cooling systems, the
9 impingement of fish and shellfish on screens associated with plant cooling systems is
10 considered a Category 2 issue, which requires a site-specific assessment during the license
11 renewal application review process. The NRC staff considered the information and documents
12 described previously in Section 4.5.2 to perform a site-specific assessment of impingement
13 resulting from the KPS cooling system. Impacts of existing cooling water systems, including
14 impacts of impingement, are regulated under the provisions of the CWA as described in Section
15 4.5.2. Section 4.5.2 also includes a discussion of Section 316(b) requirements, which are also
16 relevant to impingement. A detailed description of the KPS cooling system is presented in
17 Section 2.1.6. Flow rates and discharge volumes are given in Section 4.2.5.

18 4.5.3.1 *Nalco Environmental Sciences, 1975–1976*

19 As previously described in Section 4.5.2, NES (1976) conducted a one-year impingement and
20 entrainment study from April 1, 1975 through March 31, 1976. NES sampled adult and juvenile
21 fish impinged on the traveling screens from two to seven days per week during the study period.
22 Impinged fish were washed into a discharge sluice and collected in a basket to be identified,
23 measured, and weighed. Once the total number of alewives or smelt exceeded 50, only 10
24 percent of the remaining alewives or smelt were removed to be weighed and measured, and
25 these individuals served as a subsample from which to estimate the total number of alewives or
26 rainbow smelt impinged (NES, 1976).

27 A total of 31 species of fish were collected in entrainment samples during the study year (See
28 Table 4-8). No Federally- or State-listed species were collected. Alewife accounted for the vast
29 majority (83.2 percent) of the total individual fish impinged. Rainbow smelt, slimy sculpin, and
30 longnose dace were also prevalent. A total of 215,108 fish were impinged with June having the
31 highest number of fish (57,871) and March having the lowest number of fish (931). Alewives
32 were collected in greatest numbers in the spring and summer, and few alewives were collected
33 in winter, which corresponds to their seasonal patterns of migrating into shallower waters in the
34 spring and inhabiting deeper portions of the lake in winter. NES (1976) estimated that only
35 0.0003 percent of the total estimated biomass of alewife in Lake Michigan was impinged at KPS
36 during the study year, which represents 0.02 percent of the total commercial catch in Wisconsin.
37 Also, alewife die-offs were common during the late-1970s, which may account for the large
38 number of alewives collected in impingement samples. The final SEIS for Point Beach Nuclear
39 Station (NRC, 2005), which is located about 5 mi (8km) south of KPS, notes that a majority of
40 “impinged alewives were assumed to be dead or dying individuals associated with the annual
41 spring die-off.” Rainbow smelt was the second most abundant species collected in impingement
42 samples and was most common in October and November. Impinged smelt only accounted for
43 0.003 percent of the total estimated biomass of smelt in Lake Michigan and 0.3 percent of the

1 total commercial catch in Wisconsin. Similarly, impinged slimy sculpin accounted for only 0.002
 2 percent of the total estimated biomass of the species in Lake Michigan. All other species of fish
 3 impinged during the study year accounted for less than 0.002 percent of the total estimated
 4 biomass of that species. (NES, 1976).

5 **Table 4-8. Impinged Fish by Species, April 1975 through March 1976**

Common Name	Taxa	Total Number	Percentage of Total
Alewife	<i>Alosa pseudoharengus</i>	178,883	83.2
Rainbow smelt	<i>Osmerus mordax</i>	19,206	8.9
Slimy sculpin	<i>Cottus cognatus</i>	8,640	4.0
Longnose dace	<i>Rhinichthys cataractae</i>	4,389	2.0
Lake chub	<i>Couesius plumbeus</i>	1,584	0.7
Sucker group ^a	<i>Catostomus catostomus</i> , <i>C. commersonii</i> , and <i>Moxostoma macrolepidotum</i>	1,000	0.5
Trout group ^b	<i>Oncorhynchus mykiss</i> , <i>Salmo trutta</i> , <i>Salvelinus fontinalis</i> , and <i>Salvelinus namaycush</i>	344	0.2
Gizzard shad	<i>Dorosoma cepedianum</i>	311	0.1
Carp	<i>Cyprinus carpio</i>	259	0.1
Yellow perch	<i>Perca flavescens</i>	245	0.1
Bullhead group ^c	<i>Ameiurus natalis</i> and <i>A. nebulosus</i>	111	<0.1
Ninespine stickleback	<i>Pungitius pungitius</i>	55	<0.1
Troutperch	<i>Percopsis omiscomaycus</i>	39	<0.1
Whitefish group ^d	<i>Coregonus clupeaformis</i> and <i>Prosopium cylindraceum</i>	13	<0.1
Pumpkinseed	<i>Lepomis gibbosus</i>	9	<0.1
Burbot	<i>Lota lota</i>	7	<0.1
Common shiner	<i>Notropis cornutus</i>	4	<0.1
Salmon group ^e	<i>Oncorhynchus tshawytscha</i> and <i>O. kisutch</i>	3	<0.1
Lamprey	<i>Petromyzontidae spp.</i>	2	<0.1
Northern pike	<i>Esox lucius</i>	2	<0.1
Bloater	<i>Coregonus hoyi</i>	1	<0.1
Blacknose dace	<i>Rhinichthys atratulus</i>	1	<0.1
Total		215108	100

^aSucker group consists of white sucker, longnose sucker, and shorthead redhorse.

^bTrout group consists of rainbow trout, brown trout, brook trout, and lake trout.

^cBullhead group consists of yellow bullhead and brown bullhead.

^dWhitefish group consists of lake whitefish and round whitefish.

^eSalmon group consists of Chinook salmon and coho salmon.

Source: adapted from NES, 1976

6 4.5.3.2 EA Engineering, Science and Technology, Inc., 2006–2007

7 As previously described in Section 4.5.2, EAE (2007), conducted a one-year impingement and
 8 entrainment study from March 2006 through February 2007. Impingement samples were

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1 collected once per week from March through August 2006 and twice per month October 2006
2 through February 2007. No samples were collected in September 2006 due to a planned plant
3 outage. Impingement samples were gathered in a collection basket downstream of the traveling
4 screens over 24-hour periods from 9 a.m. to 9 a.m. As in the 1975–1976 NES (1976) study, fish
5 were then removed, identified, weighed, and counted. Up to 50 individual fish per species per
6 24-hour period were individually measured and weighed, and the excess individuals were
7 counted and collectively weighed. (EAE, 2007)

8 A total of 34 species of fish were collected in entrainment samples during the study year. Over
9 90 percent of all impinged fish were collected in June and July. No Federally- or State-listed
10 species were collected. Alewife accounted for the vast majority (99.7 percent) of the total
11 individuals impinged (EAE, 2007). Alewife collection peaked in June and July 2006 and again,
12 to a lesser extent, in October and November 2006 (EAE, 2007). The NRC staff estimated the
13 percent of Lake Michigan alewives that were impinged in the KPS cooling system during the
14 study year. EAE, 2007 recorded 690,402 individual alewives with a combined biomass of
15 2,666,686.5 grams (5879 lbs) in impingement samples over the study year. Using the total
16 number of collected alewife, the biomass of collected alewife, and the total estimated number of
17 alewife impinged over the study year (5,592,692 individuals), the NRC staff extrapolated the
18 total estimated biomass of alewife impinged over the study year to be 21,601,844 grams
19 (47,624 lbs). Madenjian et al., (2008) estimates the 2007 lake-wide biomass of alewife was
20 11,674 metric tons (25,736,764.5 lbs). Therefore, impinged alewife represented 0.002 percent
21 of the total estimated alewife biomass in Lake Michigan in 2007.

22 Ninespine stickleback, rainbow smelt, yellow perch, mottled sculpin, and spottail shiner were
23 collected in excess of 100 individual fish over the study year, and less than 100 individual fish of
24 all other species were collected (See Table 4-9) (EAE, 2007). Similar to the estimates above,
25 the NRC staff used Madenjian et al.'s (2008) lake-wide biomass estimates, EAE 2007 total
26 estimated number of individual fish impinged over the study year, and an extrapolated total
27 estimated biomass based on the combined collected biomass during the study. The NRC staff
28 found that ninespine stickleback, rainbow smelt, yellow perch, mottled sculpin, and spottail
29 shiner each accounted for less than 0.001 percent of the total estimated biomass of their
30 species in Lake Michigan.

1 **Table 4-9. Impinged Fish by Species, February 2006 through January 2007**

Common Name	Taxa	Total Collected	% of Total Collected	Total Estimated	% of Total Estimated
Alewife	<i>Alosa pseudoharengus</i>	690,402	99.741	5,592,692	99.624
Ninespine stickleback	<i>Pungitius pungitius</i>	572	0.083	4473	0.080
Rainbow smelt	<i>Osmerus mordax</i>	300	0.043	3279	0.058
Yellow perch	<i>Perca flavescens</i>	164	0.024	3080	0.055
Mottled sculpin	<i>Cottus bairdii</i>	145	0.021	2148	0.038
Spottail shiner	<i>Notropis hudsonius</i>	125	0.018	1615	0.029
Northern clearwater crayfish	<i>Orconectes propinquus</i>	123	0.018	1104	0.020
Longnose sucker	<i>Catostomus catostomus</i>	62	0.009	590	0.011
Threespine stickleback	<i>Gasterosteus aculeatus</i>	55	0.008	525	0.009
White sucker	<i>Catostomus commersonii</i>	52	0.008	597	0.011
Longnose dace	<i>Rhinichthys cataractae</i>	50	0.007	714	0.013
Gizzard shad	<i>Dorosoma cepedianum</i>	41	0.006	1216	0.022
Burbot	<i>Lota lota</i>	27	0.004	384	0.007
Slimy sculpin	<i>Cottus cognatus</i>	18	0.003	277	0.005
Round goby	<i>Neogobius melanostomus</i>	12	0.002	117	0.002
Channel catfish	<i>Ictalurus punctatus</i>	8	0.001	219	0.004
Lake trout	<i>Salvelinus namaycush</i>	7	0.001	49	<0.001
Round whitefish	<i>Prosopium cylindraceum</i>	7	0.001	169	0.003
Black bullhead	<i>Ameiurus melas</i>	3	<0.001	90	0.002
Carp	<i>Cyprinus carpio</i>	3	<0.001	70	0.001
Smallmouth bass	<i>Micropterus dolomieu</i>	3	<0.001	43	<0.001
Brown trout	<i>Salmo trutta</i>	2	<0.001	35	<0.001
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	2	<0.001	36	<0.001
Lake whitefish	<i>Coregonus clupeaformis</i>	2	<0.001	38	<0.001
Bloater	<i>Coregonus hoyi</i>	1	<0.001	28	<0.001
Bluegill	<i>Lepomis macrochirus</i>	1	<0.001	28	<0.001

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Common Name	Taxa	Total Collected	% of Total Collected	Total Estimated	% of Total Estimated
Sucker group	Catostominae spp.	1	<0.001	22	<0.001
Sculpin group	Cottidae spp.	1	<0.001	38	<0.001
Creek chub	<i>Semotilus atromaculatus</i>	1	<0.001	29	<0.001
Pumpkinseed	<i>Lepomis gibbosus</i>	1	<0.001	29	<0.001
Rock bass	<i>Ambloplites rupestris</i>	1	<0.001	26	<0.001
Shorthead redhorse	<i>Moxostoma macrolepidotum</i>	1	<0.001	7	<0.001
Silver lamprey	<i>Ichthyomyzon unicuspis</i>	1	<0.001	10	<0.001
White perch	<i>Morone americana</i>	1	<0.001	22	<0.001
Total		692,195	100	5,613,799	100

Source: adapted from EAE, 2007

1 When results of the 1975–1976 NES (1976) study are compared to the 2006–2007 EAE (2007)
 2 study, some notable differences appear. Alewife and rainbow smelt were among the most
 3 prevalent species impinged during both study years though the total number of alewife collected
 4 in the 2006–2007 study (690,402 individuals) was significantly higher than the total number
 5 collected in the 1975–1976 study (178,883 individuals). Impinged alewives in 2006–2007
 6 accounted for a slightly higher percentage of the total estimated biomass in Lake Michigan.
 7 However, both study years collected only a very small percentage of the total estimated
 8 biomass of alewives.

9 Generally, the same family groups were present in both studies, though species composition
 10 and abundance vary. Lake chub, rainbow trout, brook trout, yellow bullhead, brown bullhead,
 11 troutperch, common shiner, coho salmon, lamprey, northern pike, and blacknose dace were
 12 present in the NES (1976) study, but did not appear in EAE 2007 impingement samples.
 13 Conversely, mottled sculpin, spottail shiner, northern Clearwater crayfish, threespine
 14 stickleback, round goby, channel catfish, black bullhead, smallmouth bass, bluegill,
 15 Catostominae spp., Cottidae spp., creek chub, rock bass, silver lamprey, and white perch were
 16 present in the EAE 2007 study, but did not appear in NES (1976) impingement samples. Slimy
 17 sculpin and longnose dace were the third (4.0 percent) and fourth (2.0 percent) most prevalent
 18 species, respectively, in the NES (1976) study, while the two species only accounted for 0.003
 19 and 0.007 percent, respectively, of total collected individuals in EAE 2007 impingement
 20 samples. EAE (2007) attributes the majority of these differences to the changes in the Lake
 21 Michigan aquatic community between study years.

22 Bunnell et al. (2007) report a record class of yellow perch in 2005, which may explain the
 23 increase in this species numbers between the 1975–1976 study and the 2006–2007 study. As
 24 discussed in Section 4.5.2, Bunnell et al. (2007) also reports a recovery of burbot numbers
 25 beginning in the 1980s, after the species had suffered a decline in the 1970s following the
 26 introduction of alewife. Though ninespine stickleback accounted for less than 0.01 percent in
 27 both studies, about ten times as many individuals were collected in the 2006–2007 study.
 28 Threespine stickleback was not present in the 1975–1976 study, but appeared in the 2006–

1 2007 study. These two species' densities were low from 1973–1995, increased dramatically in
2 1996–1997, and have remained variable since that time, which may account for the increased
3 number of individuals recorded in the 2006–2007 study (Bunnell et al., 2007; EAE, 2007).
4 Rainbow smelt, which represented 8.9 percent of impinged individuals in the 1975–1976 study,
5 has shown decline since 1994, though the cause for this decline is unclear (Bunnell et al. 2007;
6 EAE 2007). Rainbow smelt were present, but in much reduced numbers in the 2006–2007
7 study.

8 Section 2.2.5 of this draft SEIS describes the changing aquatic communities within Lake
9 Michigan as a result of numerous invasive species introductions, which supports these
10 conclusions. Because impinged fish represented such a small percentage of total estimated
11 numbers in Lake Michigan, results of neither the NES (1976) study nor the EAE, 2007) study
12 suggest that the impacts of the KPS cooling system on the aquatic community in the vicinity of
13 KPS is negatively affecting any fish species or destabilizing the aquatic community as a whole.

14 Based on the information presented in this section, the NRC staff determined that the potential
15 impacts of impingement of fish and shellfish by the KPS cooling system during the 20-year
16 renewal period would be SMALL. The NRC staff identified potential mitigation measures,
17 including closed cycle cooling, and derating the facility and scheduling plant outages during
18 historic peak impingement periods. However, the staff concludes that none of the mitigation
19 measures considered would eliminate adverse entrainment impacts and would not reduce the
20 significance level below SMALL. The NRC does not have the authority to mandate these
21 measures. It is the WDNR's jurisdiction to impose any restrictions or modifications to the cooling
22 system to reduce the impact of impingement under the WPDES permitting process. The staff
23 did not identify any cost benefit studies applicable to these mitigation measures.

24 **4.5.4 Heat Shock**

25 The NRC defines heat shock as acute thermal stress caused by exposure to a sudden elevation
26 of water temperature that adversely affects the metabolism and behavior of fish and can lead to
27 death. Heat shock is most likely to occur when an offline unit returns to service or when a
28 station has a discharge canal effectively trapping fish in the flow of heated discharge from the
29 plant. For plants with once-through cooling systems, the effects of heat shock are listed as a
30 Category 2 issue and require a plant-specific assessment before license renewal. The NRC
31 staff considered the information and documents described previously in Section 4.5.2 to perform
32 a site-specific assessment of heat shock resulting from the KPS cooling system. The KPS
33 cooling system is described in Section 2.1.6. Flow rates and discharge volumes are given in
34 Section 4.2.5.

35 Section 316(a) of the CWA establishes a process by which a discharger can demonstrate that
36 the established thermal discharge limitations are more stringent than necessary to protect
37 balanced, indigenous populations of fish and wildlife and obtain facility-specific thermal
38 discharge limits (33 USC 1326). In May 1976, NES (1976) provided WDNR with a Section
39 316(a) demonstration that addressed compliance with the thermal effluent limitations in the
40 WPDES permit and environmental impacts of KPS's thermal discharge. This demonstration
41 supported a petition for relief from Wisconsin Administrative Code thermal standards and a

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1 State statute that required all plants on Lake Michigan with cooling water-related thermal
2 discharges to transition to a recirculating system by 1981 (DEK, 2008).

3 For the demonstration, NES reviewed monthly reports of temperature, flow, chemical and
4 biological data for the KPS thermal plume under average, ideal, and worst case conditions. NES
5 (1976a) used thermal plume surveys conducted by Industrial BIO-TEST Laboratories, Inc.
6 between June 1974 and July 1975 to assess thermal plume characteristics at KPS. NES
7 determined that the data was highly variable and could not be used to adequately characterize
8 ambient conditions to yield a reliable plume model. However, NES used the thermal plume data
9 to determine a discharge zone for KPS. The discharge zone was based on the EPA's
10 September 1974 Draft Guidelines for a 316(a) Demonstration and included the maximum
11 surface area and maximum bottom area of the 2 °C (34 °F) isotherm. The discharge zone was
12 determined to have an area of 985.3 acres (398.7 hectare (ha)) at the surface and 94.5 acres
13 (38.2 ha) at the bottom. NES (1976a) estimated the extent of the thermally-affected zones for
14 extreme conditions in summer and winter. In the summer, an ambient lake temperature of
15 21.1 °C (70 °F) and a plant discharge temperature of 30 °C (86 °F) were used to predict the
16 area of the thermal plume with zero lake current and with a lake current of 0.8 feet per second
17 (fps); 0.2 meters per second (m/s)). In the winter, an ambient lake temperature of 0 °C (32 °F)
18 and a plant discharge temperature of 15.5 °C (59.9 °F) were used to predict the area of the
19 thermal plume with zero lake current and a lake current of 1.2 fps (0.37 m/s). Table 4-10 and 4-
20 11 summarize these thermal plume estimates.

21 Lake Michigan has a surface area of 22,300 mi² (14.27 million ac; 5.78 million ha) (WDNR,
22 2009a), and so, based on these thermal plume estimates, any thermal effects on aquatic
23 species originating from the KPS cooling system would be very localized for those species with
24 a lake-wide distribution. Additionally, KPS's discharge is located on the shoreline, just south of
25 the forebay. Because water is discharged directly to Lake Michigan rather than returning to the
26 lake via a discharge canal, fish are less likely to become entrapped in areas of elevated
27 temperatures. The final SEIS for Point Beach Nuclear Station (NRC, 2005), which is located
28 about 5 miles (8 km) south of KPS, also concluded that thermal effects on aquatic species
29 would be localized because the plant is located on a relatively featureless portion of Lake
30 Michigan with sandy substrate and rapid plume dissipation, no bays or points nearby to act as
31 fish nurseries or other attracting features, and no substantial unique spawning grounds in the
32 vicinity of the plant.

1 **Table 4-10. KPS Thermal Plume Characteristics in Summer Under Extreme Conditions**

Isotherm Temperature(a)	Distance in ft (m)	Width in ft (m)	Area in ac (ha)
No current			
29.0 °C (84.2 °F)	111.4 (34.0)	79.5 (24.2)	0.17 (0.07)
28.0 °C (82.4 °F)	147.7 (45.0)	92.4 (28.2)	0.27 (0.11)
27.0 °C (80.6 °F)	204.9 (62.5)	112.7 (34.4)	0.46 (0.19)
26.0 °C (78.8 °F)	302.1 (92.1)	147.2 (44.9)	0.88 (0.36)
25.0 °C (77.0 °F)	486.9 (148.4)	212.7 (64.8)	2.04 (0.83)
24.0 °C (75.2 °F)	904.9 (275.8)	361.0 (110.0)	6.45 (2.61)
23.0 °C (73.4 °F)	2194.1 (668.8)	818.3 (249.4)	35.45 (14.35)
22.0 °C (71.6 °F)	4939.5 (1505.6)	1792.2 (546.3)	174.80 (70.74)
0.8 fps (0.2 m/s) current			
29.0 °C (84.2 °F)	101.4 (30.9)	66.0 (20.1)	0.13 (0.05)
28.0 °C (82.4 °F)	174.3 (53.1)	84.8 (25.8)	0.29 (0.12)
27.0 °C (80.6 °F)	279.3 (85.1)	111.8 (34.1)	0.62 (0.25)
26.0 °C (78.8 °F)	411.7 (125.5)	145.8 (44.4)	1.19 (0.48)
25.0 °C (77.0 °F)	663.5 (202.2)	210.5 (64.2)	2.76 (1.12)
24.0 °C (75.2 °F)	1233.2 (375.9)	356.8 (108.8)	8.69 (3.52)
23.0 °C (73.4 °F)	2989.6 (911.2)	808.1 (246.3)	47.70 (19.30)
22.0 °C (71.6 °F)	6727.2 (2050.5)	1768.4 (539.0)	234.90 (95.06)

^(a) The discharge temperature is 30 °C (86 °F), and the ambient summer temperature is assumed to be 21.1 °C (70 °F).

Source: Adapted from NES 1976

2

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1 **Table 4-11. KPS Thermal Plume Characteristics in Winter under Extreme Conditions.**

Isotherm Temperature(a)	Distance in ft (m)	Width in ft (m)	Area in ac (ha)
No current			
15.0 °C (59.0 °F)	101.5 (30.9)	77.1 (23.5)	0.15 (0.06)
10.0 °C (50.0 °F)	331.2 (100.9)	119.7 (36.5)	0.78 (0.32)
5.0 °C (41.0 °F)	1411.0 (430.1)	486.4 (148.3)	13.55 (5.48)
4.0 °C (39.2 °F)	2101.9 (366.3)	751.2 (229.0)	31.18 (12.62)
3.0 °C (37.4 °F)	3337.1 (1017.1)	1224.7 (373.3)	80.70 (32.66)
2.0 °C (35.6 °F)	4994.8 (1522.4)	1860.2 (567.0)	183.46 (74.24)
1.0 °C (33.8 °F)	9920.4 (3023.7)	3748.4 (1142.5)	734.26 (297.14)
1.2 fps (0.37 m/s) current			
15.0 °C (59.0 °F)	132.7 (40.4)	51.7 (15.8)	0.14 (0.06)
10.0 °C (50.0 °F)	671.8 (204.8)	99.3 (30.3)	1.32 (0.53)
5.0 °C (41.0 °F)	2274.3 (693.2)	462.3 (140.9)	20.76 (8.40)
4.0 °C (39.2 °F)	3176.2 (968.1)	629.7 (191.9)	39.49 (15.98)
3.0 °C (37.4 °F)	4800.2 (1463.1)	1147.3 (349.7)	108.74 (44.01)
2.0 °C (35.6 °F)	7183.0 (2189.4)	1589.2 (484.4)	225.39 (91.21)
1.0 °C (33.8 °F)	14257.0 (4345.5)	2900.9 (884.2)	816.63 (330.48)

(a) The discharge temperature is 15.5 °C (59.9 °F), and the ambient winter temperature is assumed to be 0 °C (32 °F).

Source: Adapted from NES 1976

2 NES (1976a) also considered biological studies conducted by Industrial BIO-TEST Laboratories,
 3 Inc., from 1971 through 1975, to determine any impacts that the KPS thermal discharge may
 4 have on the fish community. A comparison of pre-operational and operational data showed no
 5 noticeable changes in the aquatic community as a result of thermal changes near the KPS
 6 discharge. No major changes in species composition, seasonal abundance, spatial distribution,
 7 or use of affected area were observed. Densities of major macroinvertebrate taxa remained
 8 similar between preoperational and operational studies, and no changes to the benthic
 9 community were detected as a result of KPS thermal discharge. The demonstration concluded
 10 that “the thermal component of the [KPS] discharge has not disturbed the balanced indigenous
 11 communities of fish, shellfish, and wildlife in Lake Michigan” (NES, 1976).

12 On September 13, 1976, the WDNR granted alternative effluent limitations for KPS and
 13 exempted the thermal component of the Wisconsin Administration Code (DEK, 2008). As a
 14 result of this exemption, the current WPDES permit for KPS does not contain thermal effluent
 15 limitations. Under Dominion’s license, Appendix B of the Environmental Protection Plan,
 16 Dominion is required to report fish kills as an “unusual or important event.” To date, Dominion
 17 has not reported any fish kills related to thermal effluent discharge from the KPS cooling
 18 system.

19 The WDNR is currently in the process of revising Chapter NR 102 of the Wisconsin
 20 Administrative Code to include water quality standards for thermal discharges. The new

1 Subchapter II would be entitled “Water Quality Standards for Temperature” and would include
2 water quality criteria as well as ambient temperatures for certain fish and aquatic species. As
3 part of this rule proposal, the WDNR would also establish procedures for calculating thermal
4 limitations for WPDES-permitted discharges. The rule package was most recently revised in
5 May 2009 (WDNR, 2009b). If this rule package is passed, KPS may be subject to thermal
6 discharge limitations in the future, such as an upper limit on the temperatures of discharged
7 waters. In this case, KPS would have to monitor intake and discharge temperatures and report
8 them to WDNR on an annual or semi-annual basis. These limitations would most likely be
9 addressed at the time of the WPDES permit renewal, or a timeline specified in the final rule. The
10 current WPDES permit expires June 30, 2010. The NRC does not have authority to regulate
11 thermal conditions, and therefore, relies on the State to set appropriate guidelines for thermal
12 discharge through the WPDES permitting process.

13 The NRC staff has reviewed available information, including the applicant’s ER (DEK, 2008), the
14 current WPDES permit (WDNR, 2005a), the CWA Section 316(a) Demonstration (NES, 1976),
15 and other applicable sources of information on heat shock. Plant operating conditions have not
16 changed significantly since the original 316(a) Demonstration. Therefore, it can be reasonably
17 concluded that the extent and distribution of KPS’s thermal plume has remained relatively
18 unchanged. The NRC staff evaluated the potential impacts to aquatic resources due to heat
19 shock during continued operation and determined that thermal impacts are likely to be limited
20 because of the design and location of the KPS discharge structure. Furthermore, the NRC staff
21 concludes that the potential impacts to fish and shellfish due to heat shock during the renewal
22 term are SMALL. The NRC staff identified potential mitigation measures, including closed cycle
23 cooling, helper cooling towers, derating the plant, and operating under reduced intake flows.
24 The staff did not identify any cost benefit studies applicable to these mitigation measures.
25 However, the NRC does not have the authority to mandate these measures; it is the WDNR’s
26 jurisdiction to impose any restrictions or modifications to the cooling system to reduce the
27 impact of heat shock under the WPDES permitting process.

28 **4.5.5 Total Impacts on Aquatic Resources**

29 Impingement, entrainment and heat shock all act on the same populations of aquatic resources.
30 The purpose of this section is to provide perspective on the total impact of cooling system
31 operation on fish and other aquatic resources. The WDNR, not the NRC, is responsible for
32 issuing and enforcing WPDES permits. Because the NRC level of impact associated with
33 impingement and entrainment is SMALL and the level of impact associated with thermal impacts
34 is SMALL, the NRC staff believes that the total impact from all of these sources together on
35 aquatic resources would also be SMALL through the period of license renewal.

36 **4.6 TERRESTRIAL RESOURCES**

37 The issues related to terrestrial resources applicable to KPS site are discussed below and listed
38 in Table 4-12. There are no Category 2 issues related to terrestrial resources for license
39 renewal. The NRC staff did not identify any new and significant information during the review of
40 the DEK ER (DEK, 2008), the site audit, the scoping process, or the evaluation of other
41 available information. Therefore, the NRC staff concludes that there would be no impacts
42 related to these issues beyond those discussed in the GEIS (NRC, 1996). The GEIS concludes

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1 that the impacts are SMALL, and additional site-specific mitigation measures are not likely to be
2 sufficiently beneficial to implement.

3 **Table 4-12. Terrestrial Resources Issues.** *Section 2.2.6 of this draft SEIS provides a*
4 *description of the terrestrial resources at KPS and in the surrounding area.*

Issues	GEIS Section	Category
Power line ROW management (cutting herbicide application)	4.5.6.1	1
Bird collisions with power lines	4.5.6.1	1
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3	1
Floodplains and wetland on power line right of way	4.5.7	1

5 **4.7 THREATENED AND ENDANGERED SPECIES**

6 **Table 4-13. Threatened or Endangered Species.** *Section 2.2.7 of this document describes the*
7 *threatened or endangered species on or near KPS.*

Issue	GEIS Section	Category
Threatened or endangered species	4.1	2

8 This site-specific, or Category 2 issue, requires consultation with the appropriate agencies to
9 determine whether or not threatened or endangered species are present and whether or not
10 they would be adversely affected by continued operation of KPS during the license renewal
11 term. The characteristics and habitats of threatened and endangered species in the vicinity of
12 the KPS site are discussed in Sections 2.2.6 and 2.2.7 of this draft SEIS.

13 The NRC contacted the USFWS on September 20, 2008, regarding threatened and endangered
14 species at the KPS site (NRC, 2008). A description of the site and the in-scope transmission
15 lines and a preliminary assessment of the Federally-listed threatened and endangered species
16 potentially occurring on or near the KPS site were provided in this letter. The USFWS provided
17 its response on October 28, 2008, indicating that the Hine's emerald dragonfly (*Somatochlora*
18 *hineana*) and the piping plover (*Charadrius melodus*) have the potential to occur in the vicinity of
19 KPS (USFWS, 2008a).

20 **4.7.1 Aquatic Species**

21 The NRC staff has reviewed information provided by the applicant and information publicly
22 available and has contacted the Greenbay Field Office of USFWS (NRC, 2008). Currently, no
23 threatened or endangered aquatic species are known to occur within Lake Michigan on or in the
24 vicinity of the KPS site or within any streams crossed by in-scope transmission line ROWs.
25 Therefore, license renewal of KPS would have no effect on any Federally- or State-listed
26 aquatic species, and mitigation measures need not be considered.

1 4.7.2 Terrestrial Species

2 Sections 2.2.6 and 2.2.7 of this draft SEIS discuss the characteristics and habitat of threatened
3 and endangered species in the vicinity of the KPS site.

4 The NRC staff contacted the USFWS and the WDNR to request information that could assist in
5 assessing the environmental impacts associated with license renewal. On October 28, 2008, the
6 FWS indicated that no known Federally-listed threatened or endangered species occur within
7 the project area; therefore, the proposed project would not likely adversely affect any Federally-
8 listed species (USFWS, 2008).

9 There are five Federally-listed threatened or endangered terrestrial species that potentially
10 occur on the KPS site, although these species have not been documented on the site: the
11 piping plover (*Charadrius melodus*), the Hine's emerald dragonfly (*Somatochlora hineana*), the
12 Karner blue butterfly (*Lycaeides melissa samuelis*), the dune or Pitcher's thistle (*Cirsium*
13 *pitcheri*), and the dwarf lake iris (*Iris lacustris*). The bald eagle (*Haliaeetus leucocephalus*) and
14 the peregrine falcon (*Falco peregrinus*) were formerly Federally-listed as threatened and may
15 also be found in the vicinity of the KPS site. Four State-listed species were identified as species
16 for consideration of the proposed license renewal of KPS, including the Caspian tern (*Sterna*
17 *caspia*), the osprey (*Pandion haliaetus*), and the formerly listed bald eagle and peregrine falcon.
18 Section 2.2.7 of this report describes these species in greater detail (USFWS, 2008a; DEK,
19 2008).

20 The NRC staff encourages DEK, as well as American Transmission Company (ATC), who own
21 the transmission lines, to report the existence of any Federally- or State-listed endangered or
22 threatened species within or near the transmission line ROWs to the WDNR and USFWS, or
23 both, if any such species are identified during the license renewal term. In particular, if any
24 evidence of injury to, or mortality of, migratory birds, piping plovers, or any other threatened or
25 endangered species is observed within the corridor during the license renewal period, the NRC
26 staff encourages DEK and ATC to promptly report this to the appropriate wildlife management
27 agencies. Also, if a Caspian tern (or common tern, also State-listed) population revisits the
28 shore of either the KPS site or the surrounding areas, the NRC staff encourages DEK to monitor
29 the situation and the species. Finally, the NRC staff encourages DEK and ATC to continue
30 providing information concerning the peregrine falcon nesting pair and any fledglings that nest
31 on the reactor building or occur in the transmission line ROW's to the FWS and the State of
32 Wisconsin.

33 Because no threatened or endangered species are known to occur on or in the vicinity of the
34 KPS site, operation of the site and its associated transmission lines are not expected to
35 adversely affect any threatened or endangered species during the license renewal term.
36 Therefore, the NRC staff concludes that adverse impacts to threatened or endangered species
37 during the period of extend operation would be SMALL. The NRC staff finds several mitigation
38 measures currently in place at the KPS site, and with its associated transmission lines, the NRC
39 staff finds them to be adequate. They include: nest construction and placement for the peregrine
40 falcon, environmental review checklists, environmental evaluation forms, and best management
41 practices.

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1 **4.8 HUMAN HEALTH**

2 The human health issues applicable to KPS are discussed below and listed in Table 4-14 for
3 Category 1, Category 2, and uncategorized issues.

4 **Table 4-14. Human Health Issues.** *Table B-1 of Appendix B to Subpart A of 10 CFR Part 51*
5 *contains more information on these issues.*

Issues	GEIS Section	Category
Microbiological organisms (occupational health)	4.3.6	1
Noise	4.3.7	1
Radiation exposures to public (license renewal term)	4.6.1, 4.6.2	1
Occupational 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

6 **4.8.1 Generic Human Health Issues**

7 The NRC staff did not identify any new and significant information regarding generic human
8 health issues during its review of the Environmental Report, the site audit, or the scoping
9 process. Therefore, there are no impacts related to these issues beyond those discussed in the
10 GEIS. For these issues, the GEIS concluded that the impacts are SMALL, and additional site-
11 specific mitigation measures are not likely to be sufficiently beneficial to be warranted. The
12 information presented below is a discussion of selected radiological programs conducted at
13 KPS which monitor the impacts of radioactive effluents on the environment and members of the
14 public.

15 **4.8.1.1 Radiological Environmental Monitoring**

16 KPS conducts a Radiological Environmental Monitoring Program (REMP) in the environs
17 around their site to assess the radiological impact, if any, to its employees, the public, and the
18 environment. KPS issues an annual environmental monitoring report which contains a
19 discussion of the environmental data, and includes graphs which trend the data from prior
20 years. The objectives of the REMP are to include the following:

- 21 • Measure and evaluate the levels of radiation and radioactive material in the environs
22 around the KPS site to assess the radiological impacts, if any, of plant operation on the
23 environment.
- 24 • Supplement the results of the radiological effluent monitoring program by verifying that
25 the measurable concentrations of radioactive material and levels of radiation are not
26 higher than expected based on the measurement of radioactive effluents and modeling
27 for the applicable exposure pathways.
- 28 • Provide data on the radiation dose to the public by direct or indirect pathways of
29 exposure.

- 1 • Demonstrate compliance with applicable Federal regulatory requirements.

2 The KPS REMP collects samples of environmental media in the environs around the site for
3 analysis to measure the amount of radioactivity, if any, in the samples. The media samples are
4 representative of the radiation exposure pathways to the public from all plant radioactive
5 effluents. The REMP measures the aquatic, terrestrial, and atmospheric environment for
6 radioactivity, as well as ambient gamma radiation. Ambient gamma radiation pathways include
7 radiation from buildings, plant structures, and airborne material that may be released from the
8 plant. In addition, the REMP also measures background radiation (i.e., cosmic sources, global
9 fallout, and naturally occurring radioactive material, including radon). Thermoluminescent
10 dosimeters are used to measure direct radiation. The atmospheric environmental monitoring
11 consists of sampling the air for particulates and radioiodine. Terrestrial environmental
12 monitoring consists of analyzing samples of milk and food products. The aquatic environmental
13 monitoring consists of analyzing samples of surface water, drinking water ground water, fish,
14 and sediment from Lake Michigan. There is also an onsite ground water protection program
15 designed to monitor the onsite plant environment for indication of leaks from plant systems and
16 pipes carrying radioactive liquid.

17 The NRC staff reviewed the KPS radioactive environmental monitoring reports from 2004
18 through 2008 to look for any significant impacts to the environment or any unusual trends in the
19 data (DEK 2005, 2006, 2007, 2008a, 2009). The NRC staff's review of the KPS REMP reports
20 showed no unusual trends in the data and showed no measurable impact from the operations at
21 KPS on the environment.

22 The Wisconsin Department of Health Services (WDHS) conducts a yearly independent
23 comprehensive environmental radioactivity survey program around the two nuclear power plant
24 sites, KPS and Point Beach Nuclear Plant (PBNP), in Wisconsin. The program collects various
25 types of samples of environmental media, similar to that obtained by KPS, from the environs
26 around the KPS site. The sampling program includes samples of air, precipitation, ambient
27 gamma radiation, surface water, fish, shoreline sediment, soil, milk, well water, and vegetation.

28 The NRC staff reviewed the WDHS 2007 environmental survey program report for the KPS and
29 PBNP sites. The state reported that it observed radioactivity levels associated with natural
30 background and fallout from atmospheric weapons testing. No radioactivity attributable to the
31 operation of the KPS and PBNP was observed (WDHS, 2008).

32 Based on the review of the radiological environmental monitoring data from KPS and the
33 WDHS, the NRC staff concludes that there are no measurable radiological impacts from the
34 operations at KPS on the environment.

35 4.8.1.2 *Radioactive Effluent and Dose Information*

36 The NRC staff reviewed KPS historical data on radioactive releases and the calculated dose to
37 a hypothetical maximally exposed individual to verify that the doses are within the dose limits
38 specified in 10 CFR Part 20 and are as low as reasonably achievable (ALARA) per the dose
39 design objectives in Appendix I to 10 CFR Part 50.

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1 Dose estimates for members of the public are calculated based on liquid and gaseous effluent
2 release data and atmospheric and aquatic transport models. The KPS 2008 annual radioactive
3 effluent release report (DEK, 2009) contains a detailed presentation of radioactive discharges
4 and the resultant calculated doses. The following summarizes the calculated hypothetical
5 maximum dose to an individual located at the KPS site boundary from radioactive liquid and
6 gaseous effluents released during 2008:

- 7 • The maximum whole-body dose to an offsite member of the public from liquid effluents
8 was 1.04 E-03 milliroentgen equivalent man (mrem) (1.04 E-05 millisievert (mSv),
9 which is below the 3 mrem (0.03 mSv) dose criterion in Appendix I to 10 CFR Part 50.
- 10 • The maximum organ (gastro-intestinal tract) dose to an offsite member of the public
11 from liquid effluents was 4.19 E-03 mrem (4.19 E-05 mSv), which is below the 10
12 mrem (0.1 mSv) dose criterion in Appendix I to 10 CFR Part 50.
- 13 • The maximum air dose at the site boundary from gamma radiation in gaseous effluents
14 was 4.21 E-06 mrad (4.21 E-08 mGy) which is below the 10 mrad (0.1 mGy) dose
15 criterion in Appendix I to 10 CFR Part 50.
- 16 • The maximum air dose at the site boundary from beta radiation in gaseous effluents
17 was 1.07 E-05 mrad (1.07 E-07 mGy), which is below the 20 mrad (0.2 mGy) dose
18 criterion in Appendix I to 10 CFR Part 50.
- 19 • The maximum organ (liver) dose to an offsite member of the public from radioactive
20 iodine and radioactive particulate material in gaseous effluents was 5.55 E-04 mrem
21 (5.55 E-06 mSv), which is below the 15 mrem (0.15 mSv) dose criterion in Appendix I
22 to 10 CFR Part 50.

23 Based on the NRC staff review and assessment of the KPS radioactive waste system
24 performance in controlling radioactive effluents and the resultant doses to members of the
25 public in conformance with the ALARA criteria, the NRC staff found that the 2008 radiological
26 effluent data for KPS are consistent, with reasonable variation attributable to operating
27 conditions and outages and with the 5-year historical radiological effluent releases and resultant
28 doses. These results demonstrate that KPS is operating in compliance with Federal radiation
29 protection standards contained in 10 CFR Part 20 and Appendix I to 10 CFR Part 50.

30 The applicant has no plans to conduct refurbishment activities during the license renewal term,
31 thus, no change to radiological conditions is expected. Continued compliance with regulatory
32 requirements is expected during the license renewal term. Thus, the radiological impacts are not
33 expected to change during the license renewal term and there are no impacts beyond those
34 discussed in the GEIS. Therefore, the NRC staff concludes that the radiological impacts to
35 human health from the continued operation of KPS during the license renewal term would be
36 SMALL.

37 **4.8.2 Electromagnetic Fields – Acute Shock**

38 Based on the GEIS, the NRC found that electric shock resulting from direct access to energized
39 conductors or from induced charges in metallic structures has not been a problem at most
40 operating plants and generally is not expected to be a problem during the period of extended

1 operation. However, a site-specific review is required to determine the significance of the
2 electric shock potential along the portions of the transmission lines within the scope of the SEIS.

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

14 As a result of the Wisconsin Legislature Act 9 of 1999, Wisconsin Public Service Corporation
15 and Wisconsin Power and Light Company (owners of KPS at the time) transferred ownership of
16 their transmission lines to ATC. The transmission Interconnection Agreement for KPS between
17 ATC, DEK, and Midwest Independent Transmission System Operator (MISO) constitutes that
18 ATC is the transmission system operator and MISO is the independent system operator.

19 All transmission lines associated with KPS were constructed in accordance with National
20 Electric Safety Code (NESC) and industry guidance in effect at that time (AEC, 1972). Since the
21 lines were constructed, a new criterion has been added to the NESC for power lines with
22 voltages exceeding 98 Kilovolt (kV). This criterion states that the minimum clearance for a line
23 must limit induced currents due to static effects to 5 milliamperes (mA). ATC has reviewed the
24 transmission lines for compliance with this criterion (DEK, 2008) and indicated that all
25 transmission lines within the scope of this review have been restudied. The results show there
26 are no locations under the transmission lines that have the capacity to induce more than 5 mA
27 in a vehicle parked beneath them. No induced shock hazard to the public should occur, since
28 the lines are operating within original design specifications and meet current NESC clearance
29 standards.

30 The NRC staff has reviewed the available information, including the applicant's evaluation and
31 computational results. Based on this information, the NRC staff evaluated the potential impacts
32 for electric shock resulting from operation of KPS and its associated transmission lines. The
33 NRC staff concludes that the potential impacts from electric shock during the renewal period
34 would be SMALL.

35 The NRC staff identified a variety of measures that could mitigate potential acute
36 electromagnetic fields (EMF) impacts resulting from continued operation of the KPS
37 transmission lines. These mitigation measures would include erecting barriers along the length
38 of the transmission line to prevent unauthorized access to the ground beneath the conductors
39 and installing road signs at road crossings. These mitigation measures could reduce human
40 health impacts by minimizing public exposures to electric shock hazards. The NRC staff did not
41 identify any cost benefit studies applicable to the mitigation measures mentioned above.

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1 **4.8.3 Electromagnetic Fields – Chronic Effects**

2 In the GEIS, the chronic effects of 60-Hz EMFs from power lines were not designated as
3 Category 1 or 2, and will not be, until a scientific consensus is reached on the health
4 implications of these fields.

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

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

20 This statement was not sufficient to cause the NRC staff to change its position with respect to
21 the chronic effects of electromagnetic fields. This position is expressed in footnote 5 of Table B-
22 1 of Appendix B to Subpart A of 10 CFR Part 51:

23 If, in the future, the Commission finds that, contrary to current indications, a
24 consensus has been reached by appropriate Federal health agencies that there
25 are adverse health effects from electromagnetic fields, the Commission will
26 require applicants to submit plant-specific reviews of these health effects as part
27 of their license renewal applications. Until such time, applicants for license
28 renewal are not required to submit information on this issue.

29 The NRC staff considers the GEIS finding of “uncertain” still appropriate and will continue to
30 follow developments on this issue.

31 **4.9 SOCIOECONOMICS**

32 Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B–1, which are applicable
33 to socioeconomic impacts during the renewal term are listed in Table 4-15. As stated in the
34 GEIS, the impacts associated with these Category 1 issues were determined to be SMALL, and
35 plant-specific mitigation measures would not be sufficiently beneficial to be warranted.

36 The NRC staff reviewed and evaluated the KPS Environmental Report, scoping comments,
37 other available information, and visited KPS in search of new and significant information that
38 would change the conclusions presented in the GEIS. No new and significant information was
39 identified during this review and evaluation. Therefore, it is expected that there would be no

1 impacts related to these Category 1 issues during the renewal term beyond those discussed in
 2 the GEIS.

3 **Table 4-15. Category 1 Issues Applicable to Socioeconomics During the Renewal Term**

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
Socioeconomics	
Public services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

4 **4.9.1 Generic Socioeconomic Issues**

5 The results of the review and brief statement of GEIS conclusions, as codified in Table B-1 of
 6 10 CFR Part 51, Subpart A, Appendix B, for each of the socioeconomic Category 1 issues are
 7 provided below.

8 **Public services: public safety, social services, and tourism and recreation.** Based on
 9 information in the GEIS, the NRC found that:

10 Impacts to public safety, social services, and tourism and recreation are
 11 expected to be of small significance at all sites.

12 **Public services: education (license renewal term).** Based on information in the GEIS, the
 13 NRC found that:

14 Only impacts of small significance are expected.

15 **Aesthetic impacts (license renewal term).** Based on information in the GEIS, the NRC found
 16 that:

17 No significant impacts are expected during the license renewal term.

18 **Aesthetic impacts of transmission lines (license renewal term).** Based on information in the
 19 GEIS, the NRC found that:

20 No significant impacts are expected during the license renewal term.

21 No new and significant information was identified for these issues during the review. Therefore,
 22 it is expected that there would be no impacts during the renewal term beyond those discussed
 23 in the GEIS.

24 Table 4.16 lists the Category 2 socioeconomic issues, which require plant-specific analysis, and
 25 an environmental justice impact analysis that was not addressed in the GEIS.

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1 **Table 4-16. Category 2 Issues Applicable to Socioeconomics and Environmental Justice**
 2 **During the Renewal Term**

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
Socioeconomics			
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3
Public services: transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
Environmental justice	Not addressed ^(a)	Not addressed ^(a)	4.4.6

^(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. Therefore, environmental justice must be addressed in plant-specific reviews.

3 **4.9.2 Housing Impacts**

4 Appendix C of the GEIS presents a population characterization method based on two factors,
 5 sparseness and proximity (GEIS, Section C.1.4). Sparseness measures population density
 6 within 20 miles (32 km) of the site, and proximity measures population density and city size
 7 within 50 miles (80 km). Each factor has categories of density and size (GEIS, Table C.1). A
 8 matrix is used to rank the population category as low, medium, or high (GEIS, Figure C.1).

9 According to the 2000 Census, approximately 86,224 people lived within 20 miles of KPS, which
 10 equates to a population density of 132 persons per square mile (DEK, 2008). This density
 11 translates to GEIS Category 4, least sparse (greater than, or equal to, 120 persons per square
 12 mile within 20 miles). Approximately 723,900 people live within 50 miles of KPS (DEK, 2008).
 13 This equates to a population density of 202 persons per square mile. Applying the GEIS
 14 proximity measures, KPS is classified as proximity Category 4 (greater than, or equal to,
 15 190 persons per square mile within 50 miles). Therefore, according to the sparseness and
 16 proximity matrix presented in the GEIS, rankings of sparseness Category 4 and proximity
 17 Category 4 result in the conclusion that KPS is located in a high population area.

18 Since Kewaunee, Manitowoc, and Brown counties are not subject to growth control measures
 19 that would limit housing development, any changes in employment at KPS would have little
 20 noticeable effect on housing availability in these counties. Considering that DEK has no plans to
 21 add non-outage employees during the license renewal period, employment levels at KPS would
 22 remain relatively constant with no additional demand for permanent housing during the license
 23 renewal term. Based on this information, there would be no impact on housing during the
 24 license renewal term beyond what has already been experienced.

1 **4.9.3 Public Services: Public Utilities**

2 Impacts on public utility services are considered SMALL if the existing infrastructure could
3 accommodate any plant-related demand without a noticeable effect on the level of service.
4 Impacts are considered MODERATE if the demand for service or use of the infrastructure is
5 sizeable and would noticeably decrease the level of service or require additional resources to
6 maintain the level of service. Impacts are considered LARGE when new programs, upgraded or
7 new facilities, or substantial additional staff is needed because of plant-related demand. In the
8 absence of new and relevant information to the contrary, the only significant impacts on public
9 utilities would be on public water supplies.

10 Analysis of impacts on the public water systems considered both plant demand and plant-
11 related population growth. Section 2.1.3 of this draft SEIS describes the permitted withdrawal
12 rate and actual use of water for reactor cooling at KPS.

13 Because DEK has no plans to add non-outage employees during the license renewal period,
14 employment levels at KPS would remain relatively unchanged with no additional demand for
15 public water services. Public water systems in the region would be adequate to meet the
16 demands of residential and industrial customers in the area. Therefore, there would be no
17 additional impact to public water services during the license renewal term beyond what is
18 currently being experienced.

19 **4.9.4 Offsite Land Use**

20 Offsite land use during the license renewal term is a Category 2 issue. Table B-1 of 10 CFR
21 Part 51, Subpart A, Appendix B notes that, "significant changes in land use may be associated
22 with population and tax revenue changes resulting from license renewal."

23 Section 4.7.4 of the GEIS defines the magnitude of land-use changes as a result of plant
24 operation during the license renewal term as follows:

- 25 • **SMALL** - Little new development and minimal changes to an area's land-use pattern.
- 26 • **MODERATE** - Considerable new development and some changes to the land-use
27 pattern.
- 28 • **LARGE** - Large-scale new development and major changes in the land-use pattern.

29 Tax revenue can affect land use because it enables local jurisdictions to provide the public
30 services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of
31 the GEIS states that the assessment of tax-driven land-use impacts during the license renewal
32 term should consider: (1) the size of the plant's tax payments relative to the community's total
33 revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to
34 which the community already has public services in place to support and guide development.

35 If the plant's tax payments are projected to be small relative to the community's total revenue,
36 tax-driven land-use changes during the plant's license renewal term would be SMALL,
37 especially where the community has pre-established patterns of development and has provided
38 public services to support and guide development. Section 4.7.2.1 of the GEIS states that if new

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1 tax payments are less than 10 percent of the taxing jurisdiction's revenue, the significance level
2 would be SMALL. If tax payments are 10 to 20 percent of the community's total revenue, new
3 tax driven land-use changes would be MODERATE. If tax payments are greater than 20 percent
4 of the community's total revenue, new tax-driven land-use changes would be LARGE. This
5 would be especially true where the community has no pre-established pattern of development or
6 has limited public services available to support and guide development.

7 4.9.4.1 *Population-Related Impacts*

8 DEK has no plans to add non-outage employees during the license renewal period. Therefore,
9 there would be no plant operations-driven population increase in the vicinity of KPS.
10 Additionally, there would be no population-related offsite land use impacts during the license
11 renewal term beyond what has already been experienced.

12 4.9.4.2 *Tax-Revenue-Related Impacts*

13 As previously discussed in Chapter 2, by state law, DEK makes annual gross revenue tax
14 Payments In Lieu Of Taxes (PILOT) to the State of Wisconsin. Since DEK started making
15 payments, population levels and land use conditions have not changed significantly, which
16 might indicate that these tax revenues have had little or no effect on land use activities within
17 the county.

18 Beginning in 2009, the Wisconsin Department of Revenue changed the methodology for
19 computing the utility aid payment. Because of pending changes to the Wisconsin Shared
20 Revenue Program (WSRP) methodology for taxing public utilities in the State of Wisconsin, it is
21 anticipated that KPS will be taxed differently beginning in tax-year 2009. The estimated WSRP
22 Utility payment from the State of Wisconsin to the town of Carlton and Kewaunee County will
23 increase over previous years. Although these changes will increase the size of the payment, the
24 overall tax-revenue-related impact from KPS in Kewaunee County and the town of Carlton will
25 not change because KPS does not directly pay taxes to these jurisdictions and there is no direct
26 correlation between the amount of taxes KPS pays to the State of Wisconsin and the distribution
27 of funds to local jurisdictions.

28 DEK has no plans to add non-outage employees during the license renewal period. Therefore,
29 employment levels would remain relatively unchanged. After the 2009 tax payment increase,
30 annual PILOT payments would likely remain unchanged throughout the license renewal period.
31 Based on this information, there would be no tax-revenue-related offsite land use impacts during
32 the license renewal term beyond what has already been experienced.

33 **4.9.5 Public Services: Transportation Impacts During Operations**

34 Table B-1, 10 CFR Part 51 states: "Transportation impacts (level of service) of highway traffic
35 generated... during the term of the renewed license are generally expected to be of small
36 significance. However, the increase in traffic associated with additional workers and the local
37 road and traffic control conditions may lead to impacts of moderate or large significance at some
38 sites." All applicants are required by 10 CFR, Part 51.53(c)(3)(ii)(J) to assess the impacts of
39 highway traffic generated by the proposed project on the level of service of local highways
40 during the term of the renewed license.

1 Since DEK has no plans to add non-outage employees during the license renewal period, there
2 would be no noticeable change in traffic volume and levels of service on roadways in the vicinity
3 of KPS. Therefore, there would be no transportation impacts during the license renewal term
4 beyond what is currently being experienced.

5 **4.9.6 Historic and Archaeological Resources**

6 The National Historic Preservation Act (NHPA) requires Federal agencies to consider the effects
7 of their undertakings on historic properties. Historic properties are defined as resources that are
8 eligible for listing on the National Register of Historic Places (NRHP). The criteria for eligibility
9 are listed in Title 36, "Parks, Forests, and Public Property," Part 60, Section 4, "Criteria for
10 Evaluation," of the *Code of Federal Regulations* (36 CFR Part 60.4) and include: (1) association
11 with significant events in history; (2) association with the lives of persons significant in the past;
12 (3) distinctive characteristics of type and period of construction, and (4) sites or places that have
13 yielded or are likely to yield important information (Advisory Council on Historic Preservation
14 (ACHP) 2009). The historic preservation review process (Section 106 of the NHPA) is outlined
15 in regulations issued by the ACHP in Title 36, "Parks, Forests, and Public Property," Part 800,
16 "Protection of Historic Properties," of the *Code of Federal Regulations* (36 CFR Part 800).

17 The issuance of a renewed operating license for a nuclear power plant is a Federal action that
18 could affect historic properties on or near the nuclear plant site and transmission lines. In
19 accordance with the provisions of the NHPA, the NRC is required to make a reasonable effort to
20 identify historic properties included in, or eligible for inclusion in, the NRHP in the area of
21 potential effect (APE). The APEs for license renewal are the nuclear power plant site,
22 transmission lines, and immediate environs. If historic properties are present, the NRC is
23 required to contact the State Historic Preservation Office (SHPO), assess the potential impact,
24 and resolve any possible adverse effects of the undertaking (license renewal) on historic
25 properties. The NRC is also required to notify the SHPO if historic properties would not be
26 affected by license renewal or if no historic properties are present.

27 Dominion contacted the Wisconsin Historical Society (WHS) in February requesting information
28 on historic and archaeological resources in the vicinity of KPS and describing the proposed
29 action (license renewal) (DEK, 2008). In October 2007, Dominion forwarded its Phase 1
30 Archaeological Survey (AVD Archaeological Services, Inc. (AVD)) to the WHS for review and
31 comment (DEK, 2008). In December 2007, the WHS concurred with the archaeological
32 assessment (WHS, 2007).

33 In accordance with 36 CFR 800.8(c), the NRC contacted the WHS (NRC 2008a), the Advisory
34 Council on Historic Preservation (NRC, 2008b), and Federally-recognized American Indian
35 Tribes to initiate Section 106 consultation. These letters are presented in Appendix D.

36 As discussed in Section 2.2.9, a search of the WHS site files identified no previously recorded
37 historic properties at KPS; however, the AVD report indicates that portions of site 47KE72 could
38 extend onto KPS property. In addition, there are no eligible or listed NRHP properties located on
39 the KPS site.

40 A review of WHS records found only 141 historic and archaeological sites within Kewaunee
41 County compared with more than 500 each for bordering Manitowoc, Brown, and Door counties

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1 (AVD, 2007). Only fourteen archaeological sites have been recorded in Carlton Township. Five
2 of these sites are cemeteries and the remaining are pre-contact sites (AVD, 2007). Three
3 archaeological sites are located within one mile of the KPS site.

4 In 2007, DEK contracted with AVD to conduct a Phase 1 survey of the KPS site. Approximately
5 80 acres of the site were heavily disturbed from construction of KPS. A majority of the remaining
6 land is open grassland and approximately 407 acres are leased agricultural cropland (AVD,
7 2007). The survey identified three known archaeological sites (47KE10, 47KE72, and 47KE44
8 [BKE-0044]) within one mile of KPS and nine new isolated artifact finds on the KPS site.
9 However, there remains a potential for additional prehistoric sites and historic (camp) sites to be
10 in the area. This area was part of the Potawatomi hunting, farming, and gathering lands. In
11 addition, historical records indicate that American Indians utilized the Sandy Bay area for fishing
12 and hunting.

13 The area in the vicinity of KPS was also settled by Euro-Americans who farmed the area prior to
14 the construction of KPS. While there are no visible remnants of the former farmhouses and
15 outbuildings at KPS, subsurface portions of these buildings could remain. During NRC's
16 walkover survey, the staff noted the presence of barbed wire fencing, farm equipment,
17 rudimentary farm bridges, and historic artifact scatters on KPS property.

18 Site 47KE10 is a campsite/village of unknown prehistoric affiliation. Very little information about
19 this site exists within the WHS database. The site is located offsite and would not be affected by
20 plant operation.

21 In 1996, site 47KE72 was recorded and listed as a Late Archaic site of unknown purpose. The
22 extent of this site remains undetermined. Portions of this archaeological site could extend onto
23 the KPS site. According to the site file, previous land owners recovered a few artifacts which
24 remain in a private collection. Any land disturbing activities near 47KE72 should be surveyed
25 prior to any disturbance.

26 Site 47KE44 is the Sandy Bay Cemetery (St. John's Cemetery) and was associated with St.
27 John's Church. The church was founded in 1869 and the congregation disbanded in 1947. The
28 church no longer exists; however, subsurface portions of the church could remain. Burials
29 associated with fifteen families are located in this cemetery with the last burial dating to 1943. In
30 1969, the cemetery was turned over to Carlton Township (AVD, 2007). The township maintains
31 the cemetery.

32 Nine locations on the KPS site yielded artifacts. Location #71 was a scatter of nineteenth to
33 twentieth century (domestic) artifacts found in the vicinity of a former farm. A single diagnostic
34 point was recovered at location #72, which could date to either the Late Archaic or Woodland
35 time periods (AVD, 2007). No other lithics materials were recovered in this area. One thermally
36 altered piece of chert was recovered from Location #73. AVD noted that this piece of chert was
37 probably pushed to this location during construction of KPS. One chert diagnostic fragment
38 (Location #74) was recovered in a cultivated field. The fragment appears to date to the Middle
39 Woodland Period. A uniface of off-white chert was found at Location #75. There is no sign of
40 utilization on the edge of the piece (AVD, 2007). No other lithics materials were recovered from
41 this location.

1 A projectile point chert tip was recovered from Location #76. No temporal affiliation can be
2 assigned to this point. An oolitic chert projectile point fragment that potentially dates to either the
3 Late Archaic or Woodland time periods was recovered from Location #77 (AVD, 2007). A side
4 notched chert projectile point (tip missing) was found at Location 78. This point bears
5 resemblance to the Madison side-notched type (AVD, 2007). A possible chert tool which had
6 indications of pressure flaking on one edge was recovered at Location #79 (AVD, 2007). In total,
7 one historic scatter, five projectile point fragments, one possible chert scraping or cutting tool,
8 and two possible tools. These finds indicate that pre-contact American Indians hunted in this
9 area and provides evidence of Euro-American occupation. According to AVD, all farmstead-
10 related artifacts are out of context due to the demolition of the buildings prior to the construction
11 of KPS. The fixed projectile point fragments and three pieces of chert were single items found
12 without context or association with other artifacts. AVD stated that either the projectile points
13 were merely discarded or lost in use, or later dispersed/damaged by farm equipment (AVD,
14 2007).

15 DEK is in the process of revising its procedures and establishing a Cultural Resources
16 Protection Plan for the protection of historic and archaeological resources at KPS. In its plan,
17 KPS has an inadvertent discovery (stop work) provision. Should historic and archaeological
18 resources be encountered during land disturbing activities, work will be halted and the WHS will
19 be consulted for guidance.

20 DEK currently has no planned changes or ground disturbing activities associated with license
21 renewal at KPS. However, given the potential for the discovery of additional historic and
22 archaeological resources at the KPS site, DEK needs to ensure that these resources are
23 considered prior to any ground disturbance during future plant operations and maintenance
24 activities. DEK currently has a stop work order within its Cultural Resource Protection Plan and
25 procedures to ensure that proper notification is taken to protect these resources should they be
26 discovered.

27 Based on review of WHS archaeological file surveys, assessments, and other information, the
28 potential impacts of continued operations and maintenance on historic and archaeological
29 resources at KPS would be SMALL. DEK could reduce any potential impacts to historic and
30 archaeological resources located at the KPS by training staff in the Section 106 consultation
31 process and cultural awareness training to ensure that informed decisions are made prior to any
32 ground disturbing activities. In addition, KPS may also forward its Cultural Resources Protection
33 Plan to the WHS for review and comment. This will ensure that historic and archaeological
34 resources are protected at the KPS site. Any revisions to the Cultural Resources Protection
35 Plan should be developed in consultation with the NRC and the WHS. In addition, lands not
36 surveyed should be investigated by a qualified archaeologist prior to any ground disturbing
37 activity.

38 **4.9.7 Environmental Justice**

39 Under Executive Order (E.O.) 12898 (59 FR Federal Register 7629), Federal agencies are
40 responsible for identifying and addressing potential disproportionately high and adverse human
41 health and environmental impacts on minority and low-income populations. In 2004, the
42 Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in

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1 NRC Regulatory and Licensing Actions (69 FR 52040). That policy states: “The NRC is
2 committed to the general goals of E.O. 12898, [and] will strive to meet those goals through its
3 normal and traditional NEPA review process.”

4 The Council of Environmental Quality (CEQ) provides the following information in Environmental
5 Justice: Guidance Under the National Environmental Policy Act (NEPA) 1997:

6 **Disproportionately High and Adverse Human Health Effects.** Adverse health
7 effects are measured in risks and rates that could result in latent cancer fatalities,
8 as well as other fatal or nonfatal adverse impacts on human health. Adverse
9 health effects may include bodily impairment, infirmity, illness, or death.
10 Disproportionately high and adverse human health effects occur when the risk or
11 rate of exposure to an environmental hazard for a minority or low-income
12 population is significant (as defined by NEPA) and appreciably exceeds the risk
13 or exposure rate for the general population or for another appropriate comparison
14 group (CEQ, 1997).

15 **Disproportionately High and Adverse Environmental Effects.** A
16 disproportionately high environmental impact that is significant (as defined by
17 NEPA) refers to an impact or risk of an impact on the natural or physical
18 environment in a low-income or minority community that appreciably exceeds the
19 environmental impact on the larger community. Such effects may include
20 ecological, cultural, human health, economic, or social impacts. An adverse
21 environmental impact is an impact that is determined to be both harmful and
22 significant (as defined by NEPA). In assessing cultural and aesthetic
23 environmental impacts, impacts that uniquely affect geographically dislocated or
24 dispersed minority or low-income populations or American Indian tribes are
25 considered (CEQ, 1997).

26 The environmental justice analysis assesses the potential for disproportionately high and
27 adverse human health or environmental effects on minority and low-income populations that
28 could result from the operation of KPS during the renewal term. In assessing the impacts, the
29 following CEQ (1997) definitions of minority individuals and populations and low-income
30 population were used:

31 **Minority individuals.** Individuals who identify themselves as members of the
32 following population groups: Hispanic or Latino, American Indian or Alaska
33 Native, Asian, Black or African American, Native Hawaiian or Other Pacific
34 Islander, or two or more races meaning individuals who identified themselves on
35 a Census form as being a member of two or more races, for example, Hispanic
36 and Asian.

37 **Minority populations.** Minority populations are identified when (1) the minority
38 population of an affected area exceeds 50 percent, or (2) the minority population
39 percentage of the affected area is meaningfully greater than the minority
40 population percentage in the general population or other appropriate unit of
41 geographic analysis.

1 **Low-income population.** Low-income populations in an affected area are
2 identified with the annual statistical poverty thresholds from the Census Bureau's
3 Current Population Reports, Series PB60, on Income and Poverty.

4 4.9.7.1 *Minority Population in 2000*

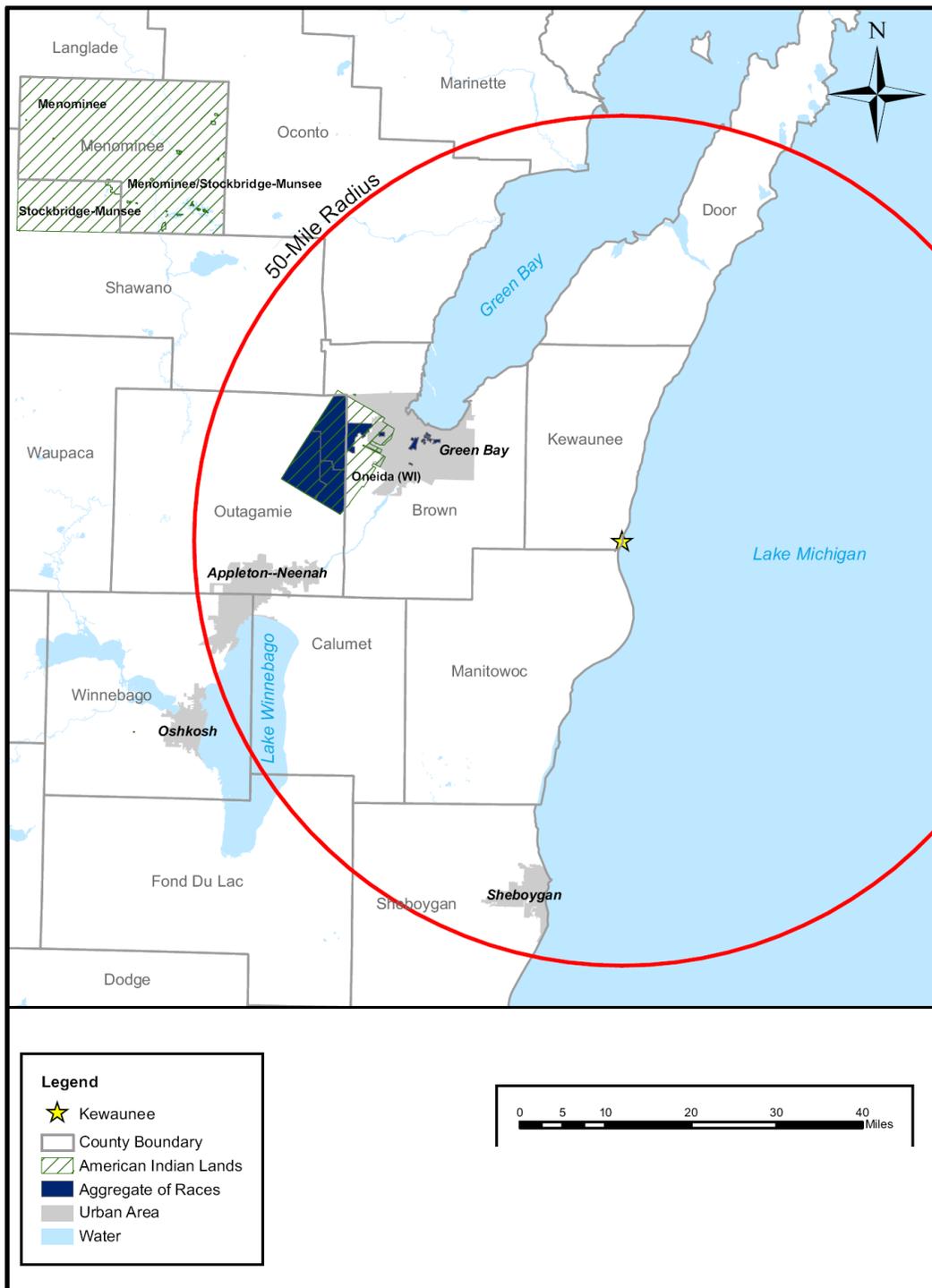
5 The 50-mile radius around KPS includes 12 counties in Wisconsin. The geographic area
6 includes any census block with all or part of its area within the 50-mile radius. According to 2000
7 census data, 7.6 percent of the population (approximately 724,241 individuals) residing within a
8 50-mile (80-km) radius of KPS identified themselves as minority individuals. The largest minority
9 group was Hispanic or Latino (19,195 persons or 2.7 percent), followed by Asian (17,200 or
10 about 2.4 percent) (USCB, 2003 – Land View 6). About 1.8 percent of the Kewaunee County
11 population identified themselves as minorities, with Hispanic or Latino as the largest minority
12 group (0.8 percent) followed by American Indian and Alaska Native (0.6 percent) (USCB, 2009)
13 (see Table 2.2.8.5–2).

14 Approximately 15 census block groups within 50 miles of KPS were determined to have high
15 density minority population percentages that exceeded the state average by 20 percentage
16 points or more. The largest number of high density minority block groups was Hispanic or
17 Latino, with six census block groups that exceed the state average 20 percent or more. The
18 greatest concentrations of high density minority population block groups are located near Green
19 Bay, Wisconsin, or the Oneida Indian Reservation just west of Green Bay. No high density
20 minority census block groups were found within 20 miles of KPS (DEK, 2008). The Oneida
21 Nation Indian Reservation is located west of Green Bay, Wisconsin (Brown and Outagamie
22 counties).

23 Based on 2000 census data, Figure 4-1 shows the location of high density minority blocks within
24 a 50-mile radius of KPS.

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3 **Figure 4-1. Minority Blocks in 2000 within a 50-Mile Radius of Kewaunee Power Station**
4 **(DEK, 2008; USCB, 2003)**

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4.9.7.2 *Low-Income Population in 2000*

According to 2000 census data, approximately 7,418 families and 41,197 individuals (approximately 3.9 and 5.7 percent, respectively) residing within a 50-mile radius of KPS were identified as living below the Federal poverty threshold in 1999 (USCB, 2003 LandView 6). The 1999 Federal poverty threshold was \$17,029 for a family of four.

According to census data estimates, the median household income for Wisconsin in 2007 was \$50,567, with 10.8 percent of the State population living below the Federal poverty threshold. Kewaunee County had the highest median household income average (\$53,356) and the lowest percentage (7.3 percent) of individuals living below the poverty level when compared to the State average and the other three counties. Manitowoc County had the lowest median household income of the four counties (\$48,175) and a lower percentage (8.6 percent) of individuals living below the poverty level when compared to the State. Brown County had a median household income of \$52,452 and the highest percentage (10.3 percent) of individuals living below the poverty level among the three counties (USCB, 2009).

Census block groups were considered high density low-income block groups if the percentage of households below the Federal poverty threshold exceeded the State average by 20 percent or more. Based on 2000 Census data, there were 2 block groups within the 50-mile radius of KPS that exceeded the State average for low income households by 20 percent or more. The census block groups with low-income populations were located in Brown County and in Green Bay, Wisconsin (DEK, 2008). Figure 4-2 shows the location of the high density low-income census block groups within a 50-mile radius of KPS.

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 2 **Figure 4-2. Low-Income Block Groups within a 50-Mile Radius of Kewaunee Power**
 3 **Station (DEK, 2008; USCB, 2003)**

1 4.9.7.3 *Analysis of Impacts*

2 Consistent with the impact analysis for the public and occupational health and safety, the
3 affected populations are defined as minority and low-income populations who reside within a 50-
4 mile radius of the KPS. Based on the analysis of environmental health and safety impacts
5 presented in Chapter 4 of this draft SEIS for other resource areas, there would be no
6 disproportionately high and adverse impacts to minority and low-income populations from the
7 continued operation of the KPS during the license renewal period.

8 The NRC analyzed the risk of radiological exposure through the consumption patterns of special
9 pathway receptors, including subsistence consumption of fish, native vegetation, surface
10 waters, sediments, and local produce. The NRC also analyzed the absorption of contaminants
11 in sediments through the skin and inhalation of plant materials. The special pathway receptors
12 analysis is important to the environmental justice analysis because consumption patterns may
13 reflect the traditional or cultural practices of minority and low-income populations in the area.
14 This analysis is presented below.

15 4.9.7.4 *Subsistence Consumption of Fish and Wildlife*

16 Section 4-4 of E.O. 12898 (1994) directs Federal agencies, whenever practical and appropriate,
17 to collect and analyze information on the consumption patterns of populations that rely
18 principally on fish and/or wildlife for subsistence and to communicate the risks of these
19 consumption patterns to the public. The NRC staff considered whether or not there were any
20 means for minority or low-income populations to be disproportionately affected by examining
21 impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors.
22 In addition, the NRC staff considered special pathways that took into account the levels of
23 contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game
24 animals in the vicinity of KPS.

25 DEK has an ongoing comprehensive Radiological Environmental Monitoring Program (REMP)
26 at KPS that assesses the radiological impact of site operations on the environment. The REMP
27 program monitors radiation levels in atmospheric, terrestrial, and aquatic environments. All
28 samples are collected by DEK personnel and are shipped to a laboratory for analysis.

29 To assess the radiological impact of the plant on the environment, the monitoring program at
30 KPS uses indicator-control sampling. Samples are collected at nearby indicator locations
31 downwind and downstream from the plant and at distant control locations upwind and upstream
32 from the plant. A plant effect would be indicated if the radiation level at an indicator location was
33 significantly larger than at the control location. The difference would also have to be greater
34 than could be accounted for by typical fluctuations in radiation levels arising from other
35 naturally-occurring sources.

36 Samples are collected from the aquatic and terrestrial pathways in the vicinity of KPS. The
37 aquatic pathways include fish, surface water, slime, bottom sediment, and ground water. The
38 terrestrial pathways include airborne particulates, milk, domestic meat, eggs, garden
39 vegetables, grass and cattle feed, soil, and direct radiation. During 2007, analyses performed on
40 collected samples of environmental media showed no significant or measurable radiological
41 impact from KPS operations (DEK, 2008b).

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1 Surface water sampling at KPS consists of monthly samples from three locations on Lake
2 Michigan and three creeks (North, Middle, and South creeks) that pass through the site. All
3 samples are analyzed for gamma-emitting isotopes. Tritium activity is measured through one
4 composite sample from South Creek. All results from the 2007 REMP were below the required
5 lower limit of detection (DEK, 2008b).

6 In bottom sediment samples, the mean gross beta concentrations measured lower at the
7 indicator locations than the control locations. Cesium-134 measured below detection levels in all
8 samples. A low level of cesium-137 was observed in one of the two control samples tested. On
9 average, cesium-137 measurements are lower than, or similar to, levels observed from 1979
10 through 2006. Levels of strontium-89 and strontium-90 measured below respective detection
11 limits in all samples (DEK, 2008b).

12 In fish, gross beta concentration was primarily due to potassium-40 activity. A concentration of
13 Cesium-137 was detected in one of three tested samples in levels lower than those observed
14 between 1979 and 1991, but at similar levels to those seen from 1992 through 2006. The
15 strontium-89 and strontium-90 concentrations were below detection levels in all samples (DEK,
16 2008b).

17 According to the 2007 KPS REMP, 126 milk samples were collected and analyzed for low-level
18 iodine-131 by radiochemical separation. All samples were below detection levels. Naturally
19 occurring potassium-40 results were almost identical in all samples. Strontium-89
20 concentrations measured below detection levels in all samples. Low levels of strontium-90 were
21 found in 62 of the 84 samples tested. Mean values were almost identical for indicator and
22 control sample locations and are similar to or less than averages seen from 1990 through 2006
23 (DEK, 2008b).

24 Ground water was collected from two onsite wells and analyzed for tritium and gamma emitting
25 radionuclides. All samples were tested for tritium and gamma emitting isotopes. Tritium
26 concentrations measured below detection levels. Gamma-emitting isotopes measured below
27 respective detection levels (DEK, 2008b).

28 In domestic meat and egg samples, gross alpha concentration measured below detection levels
29 for both indicator and control locations. Gamma-spectroscopic analyses showed that almost all
30 beta activity was due to naturally occurring potassium-40. All other gamma-emitting isotopes
31 were below their respective detection levels (DEK, 2008b).

32 In vegetables, gamma-spectroscopic analyses showed that almost all beta activity was due to
33 naturally occurring potassium-40 and was below respective levels of detection. Levels of
34 strontium-89 and strontium-90 measured below their respective levels of detection (DEK,
35 2008b).

36 In two samples (clover and oats) gamma-spectroscopic analyses showed that almost all beta
37 activity was due to naturally occurring potassium-40 and beryllium-7 observed in the samples.
38 Beryllium-7 is produced continuously in the upper atmosphere by cosmic radiation. Other
39 gamma-emitting isotopes were below their respective levels of detection. Levels of strontium-89
40 and strontium-90 measured below their respective levels of detection (DEK, 2008b).

1 In grass and cattlefeed samples, gamma-spectroscopic analyses showed that almost all beta
2 activity was due to naturally occurring potassium-40 and beryllium-7. Other gamma-emitting
3 isotopes were below their respective levels of detection. Levels of strontium-89 measured below
4 the levels of detection in grass and cattlefeed samples. Strontium-90 activity was found in one
5 of twelve cattlefeed samples tested, and was similar or lower than levels observed from 1996
6 through 2006 (DEK, 2008b).

7 Gross alpha concentrations in soil samples at the indicator locations were similar to
8 concentrations at the control locations. Levels of strontium-89 measured below the levels of
9 detection. Low levels of strontium-90 activity were detected in nine of fourteen samples tested
10 (DEK, 2008b).

11 Low levels of cesium-137 were detected in 12 of 14 soil samples, similar at both indicator and
12 control locations. Potassium-40 was detected in all samples and averaged the same at indicator
13 and control locations. All other gamma-emitting isotopes were below their respective detection
14 levels. These levels of detected activities are similar to those observed from 1990 through 2006.
15 The data suggests no evidence of a plant effect on soil measurements (DEK, 2008b).

16 The results of the KPS 2007 REMP sampling demonstrate that the routine operation at KPS has
17 had no significant or measurable radiological impact on the environment. No elevated radiation
18 levels were detected in the offsite environment as a result of plant operations and the storage of
19 radioactive waste. The results of the REMP continue to demonstrate that the operation of the
20 KPS did not result in a significant measurable dose to a member of the general population or
21 adversely impact the environment as a result of radiological effluents. The REMP continues to
22 demonstrate that the dose to a member of the public from the operation of KPS remains
23 significantly below the Federally required dose limits specified in 10 CFR Part 20, 10 CFR Part
24 72, and 40 CFR Part 190.

25 Based on recent monitoring results, concentrations of contaminants in native leafy vegetation,
26 soils and sediments, surface water, and fish in areas surrounding KPS have been quite low (at
27 or near the threshold of detection) and seldom above background levels. Consequently, no
28 disproportionately high and adverse human health impacts would be expected in special
29 pathway receptor populations in the region as a result of subsistence consumption of fish and
30 wildlife.

31 **4.10 EVALUATION OF NEW AND POTENTIALLY SIGNIFICANT INFORMATION**

32 The new and significant assessment process that DEK used during preparation of the KPS ER
33 (DEK, 2008) license renewal application included:

- 34 (1) Interviews with DEK, Dominion Resources Services, Inc., WPSC, and ATC subject
35 experts on information related to the conclusions in the GEIS as they relate to KPS;
- 36 (2) Review of DEK and KPS environmental management systems for how current
37 programs manage potential impacts and/or provide mechanisms for KPS staff to
38 become aware of new and significant information;

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- 1 (3) Correspondence with State and Federal regulatory agencies to determine if the
2 agencies had concerns;
- 3 (4) Review of documents related to environmental issues at KPS and regional environs;
- 4 (5) Credit for oversight provided by inspections of plant facilities and environmental
5 monitoring operations by State and Federal regulatory agencies; and
- 6 (6) Independent review of plant-related information contracted by DEK with industry
7 experts on license renewal and environmental impacts.

8 DEK stated in the KPS ER (DEK, 2008) that it is aware of no new and significant information
9 regarding the environmental impacts of KPS license renewal.

10 The NRC staff evaluated this information during its independent review of the KPS ER, the
11 scoping process, the site audit, and interviews with knowledgeable DEK personnel. The NRC
12 staff concluded that there is no new and significant information related to the environmental
13 impacts of the KPS license renewal.

14 **4.11 CUMULATIVE IMPACTS**

15 The NRC staff considered potential cumulative impacts in its environmental analysis of
16 continued operation of KPS. For the purposes of this analysis, past actions are those related to
17 the resources at the time of the power plant licensing and construction; present actions are
18 those related to the resources at the time of current operation of the power plant, and future
19 actions are considered to be those that are reasonably foreseeable through the end of plant
20 operation including the period of extended operation. Therefore, the analysis considers potential
21 impacts through the end of the current license terms as well as the 20-year renewal license
22 term. The geographic area over which past, present, and future actions would occur is
23 dependent on the type of action considered and is described below for each impact area.

24 The impacts of the proposed action, as described in Sections 4.1 through 4.9, are combined
25 with other past, present, and reasonably foreseeable future actions regardless of what agency
26 (Federal or non-Federal) or person undertakes such other actions.

27 **4.11.1 Cumulative Impacts on Water and Aquatic Resources**

28 This section addresses the impacts of the proposed action that relate to the withdrawal and
29 discharge of lake water by the KPS once-through cooling system, combined with other past,
30 present, and future actions that occur within the defined geographic area of Lake Michigan. The
31 geographic area considered for the analysis of cumulative impacts on aquatic resources
32 focuses on the western portion of Lake Michigan.

33 The water quality of Lake Michigan directly affects the aquatic resources in the vicinity of KPS.
34 Lake Michigan's water quality in turn is affected, and will continue to be affected, by boating and
35 fishing, agricultural runoff, and development along and near the waterfront. Water quality has
36 been a recognized issue within the Great Lakes for over a century. The Great Lakes Water
37 Quality Agreement, which was first signed in 1972, was formed to address the deteriorating

1 water quality within the Great Lakes. Numerous fish species in Lake Michigan have
2 consumption advisories as a result of elevated levels of mercury. Atrazine and other compounds
3 found in herbicides and pesticides also contribute to the lake's water quality problems. These
4 compounds affect water quality most in the spring and summer months, corresponding to
5 agricultural production. Atrazine concentrations, specifically, may be increasing under present
6 loads to Lake Michigan (Brent et al., 2001). However, with continued bi-national management
7 efforts, including the Great Lakes Fishery Commission, Great Lakes Water Quality Agreements,
8 and the International Joint Commission, which are discussed in Section 2.2.5, Aquatic
9 Resources, water quality is expected to improve in the future.

10 Lake Michigan has undergone drastic changes in its fish communities due to exotic species
11 introductions. As discussed in Section 2.2.5, Aquatic Resources, the sea lamprey (*Petromyzon*
12 *marinus*) and alewife (*Alosa pseudoharengus*) have had the most pronounced impact on native
13 aquatic populations. Overfishing and predation by sea lamprey is thought to be responsible for
14 the extirpation of lake trout (*Salvelinus namaycush*) in Lake Michigan (USGS, 2008). Sea
15 lamprey have also led to the extinction of three deepwater cisco species: the long jaw cisco
16 (*Coregonus alpenae*), the deepwater cisco (*C. johannae*), and the blackfin cisco (*C. nigripinnis*)
17 (Fuller et al. 2007). Alewives negatively impact water clarity by consuming zooplankton,
18 outcompeting native species for food, and also preying on other species' eggs (Crowder 1980).
19 Future management challenges will include keeping the salmonid community stable given the
20 available forage base, and suppressing the alewife population growth to a level that does not
21 threaten the continued existence of native species (Eshenroder et al. 1995).

22 Point Beach Nuclear Plant (PBNP) is located about 5 miles (8 km) south of KPS along Lake
23 Michigan. PBNP is a two-unit pressurized-water reactor plant with a once-through cooling
24 system. PBNP received a renewed license through 2030 and 2033 for Units 1 and 2,
25 respectively, and therefore, will continue to operate during the term of KPS's continued
26 operation. The PBNP SEIS (NRC, 2005) concluded that the impacts of continued operation of
27 PBNP on the impingement and entrainment of aquatic organisms and heat shock to aquatic
28 organisms are all SMALL. Studies at PBNP indicated that alewives and rainbow smelt
29 (*Osmerus mordax*) were the primary species in both impingement and entrainment samples.
30 Though both cooling systems alone have been determined to have a SMALL effect on aquatic
31 organisms, the combined impact of KPS and PBNP on the alewife and rainbow smelt
32 populations, specifically, may be noticeable, though these combined impacts have not been
33 specifically studied and both the alewife and rainbow smelt are considered invasive, nuisance
34 species. The PBNP SEIS concluded that cumulative impacts from heat shock are not expected
35 to be any greater when both plants are considered because the KPS and PBNP heated
36 discharge mixing zones do not overlap (NRC, 2005).

37 The NRC staff has determined that the cumulative impacts on aquatic resources resulting from
38 all past, present, and reasonably foreseeable future actions, including non-KPS actions, would
39 be MODERATE. This designation is largely the result of past actions including water quality
40 issues and native aquatic community destabilization due to invasive species introductions.

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1 **4.11.2 Cumulative Impacts on Terrestrial Resources**

2 This section addresses past, present, and future actions that could result in adverse cumulative
3 impacts to terrestrial resources, including wildlife populations, upland habitats, wetlands, Lake
4 Michigan shoreline, riparian zones, invasive species, protected species, and land use. For
5 purposes of this analysis, the geographic area considered in the evaluation includes the KPS
6 site, the adjacent shoreline both to the north and south, any wetlands on the KPS site or
7 adjacent to the KPS site, and the in-scope transmission line ROWs identified in section 2.1.5 of
8 this draft SEIS.

9 Before construction of KPS, terrestrial communities on the surrounding area supported forested
10 habitat, wetland habitat, Lake Michigan coastline, and agricultural lands. With the construction
11 of KPS, 60 acres (24 ha) were converted to developed areas for the reactor building and other
12 plant structures.

13 Construction of the transmission line ROWs maintained by ATC for the KPS site resulted in
14 changes to the plant species, and possibly wildlife within the ROWs. Habitat fragmentation
15 resulting from the transmission line ROWs likely caused effects such as change in light, wind,
16 and temperature; an increased susceptibility to invasive species; and a possible reduction in
17 habitat ranges for certain species. ROW maintenance has likely had past impacts and is likely to
18 have present and future impacts on the terrestrial habitat, which may include the buildup of
19 herbicides, prevention of natural selection stages, an increase in edge species, a decrease in
20 interior species, and an increase in invasive species. Continuing to lease agricultural land to
21 farmers for areas within the transmission line ROWs will help reduce some of these potential
22 impacts.

23 Neither DEK nor ATC manage invasive species on their land holdings. Therefore, a potential
24 exists for invasive species to be introduced on or in the vicinity of the KPS site or its associated
25 transmission line ROWs from present and future actions. Introduction of these species may
26 contribute to the establishment of an invasive species population, which could compete with
27 native populations for resources and degrade areas of terrestrial habitat.

28 Erosion to the Lake Michigan shoreline on the KPS site and its associated transmission lines
29 from activities such as boating and fishing have the potential for adverse cumulative impacts.
30 Continued maintenance for erosion on the shoreline by KPS should minimize impacts.

31 Prior and continued residential, commercial, agricultural, and industrial development of the
32 areas surrounding the KPS site and its associated transmission line ROWs may impact
33 terrestrial habitat in the area. Increases in both commercial and residential development have
34 occurred in these areas over the past 40 years. As this area continues to grow, additional runoff
35 from roads and impervious surfaces, development adjacent to wetlands and riparian zones, and
36 an increase in waste releases could have future impacts on the terrestrial habitat. Section
37 2.2.8.3 of this draft SEIS discusses offsite land use in the vicinity of KPS.

38 The potential cumulative effects of climate change could result in a variety of changes to
39 terrestrial resources on and around the KPS site. Increases in average annual temperature and
40 increased frequency of heat waves, droughts, and heavy rainfall events all have the potential to
41 impact wildlife populations, protected species, upland habitats, wetlands, riparian zones, and

1 invasive species. Increased precipitation could change vegetation composition on the KPS site,
2 potentially increasing wetlands, and decreasing riparian communities due to coastal erosion.
3 Long-term effects of climate change on terrestrial resources could include a shift in forest
4 composition or even an overall loss of forests, loss of bird diversity, a change in local mammal
5 populations, and an increase in the range of invasive species and other pests (CEQ, 1997).

6 The NRC staff believes that the cumulative impacts during the term of license renewal on
7 terrestrial habitat and associated species, when added to past, present, and reasonably
8 foreseeable future actions, would be SMALL.

9 **4.11.3 Cumulative Impacts on Human Health**

10 The NRC and the EPA established radiological dose limits for protection of the public and
11 workers from both acute and long-term exposure to radiation and radioactive materials. These
12 dose limits are codified in 10 CFR Part 20 and 40 CFR Part 190. As discussed in Section 4.8.1
13 of this draft SEIS, the doses resulting from operation of KPS are below regulatory limits and the
14 impacts of these exposures would be SMALL. For the purposes of this analysis, the
15 geographical area considered is within a 50-mile (80-km) radius of the KPS site.

16 EPA regulations at 40 CFR Part 190 limit the dose to members of the public from all sources in
17 the nuclear fuel cycle, including nuclear power plants, fuel fabrication facilities, waste disposal
18 facilities, storage of spent nuclear fuel in dry casks, and transportation of fuel and waste. In
19 addition, as discussed in Section 4.8.1, KPS has conducted a radiological environmental
20 monitoring program around its site since before operations began in 1974. This program
21 measures radiation and radioactive materials from KPS and all other sources, including the
22 nearby PBNP.

23 PBNP is located approximately 5 miles south of KPS on the western shore of Lake Michigan in
24 Manitowoc County, Wisconsin. PBNP has two pressurized-water reactors and an independent
25 spent fuel storage installation. In 2005, the NRC completed a supplemental EIS regarding the
26 PBNP license renewal application. The NRC concluded that the cumulative doses from PBNP
27 and KPS were within the dose limits in 10 CFR Part 20 and 40 CFR Part 190 (NRC, 2005).

28 As discussed in Section 4.8.1 of this report, the staff reviewed the radiological environmental
29 radiation monitoring results for KPS for the five-year period from 2004 through 2008 as part of
30 the cumulative impacts assessment. Cumulative radiological impacts from all uranium fuel cycle
31 facilities within a 50-mile (80-km) radius of the KPS site, which includes PBNP, are limited by
32 the dose limits in 10 CFR Part 20 and 40 CFR Part 190. Based on the NRC staff review of the
33 radiological environmental monitoring data from KPS and the State of Wisconsin, the
34 radioactive effluent release data from KPS, and the SEIS regarding the PBNP license renewal,
35 the cumulative radiological impacts to the public from the operation of KPS during the renewal
36 term would be SMALL. The NRC and the State of Wisconsin will regulate any future
37 development or actions in the vicinity of the KPS site that could contribute to cumulative
38 radiological impacts. Therefore, the NRC staff has concluded that the cumulative radiological
39 impacts to human health from the continued operation of KPS during the license renewal term
40 would be SMALL.

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1 The NRC staff determined that the electric-field-induced currents from the KPS transmission
2 lines are well below the NESC recommendations for preventing electric shock from induced
3 currents. Therefore, the KPS transmission lines do not detectably affect the overall potential for
4 electric shock from induced currents within the analysis area. With respect to chronic effects of
5 EMFs, although the GEIS finding of “not applicable” is appropriate to KPS, the transmission
6 lines associated with KPS are not likely to detectably contribute to the regional exposure to ELF-
7 EMFs. Therefore, the NRC staff determined that the cumulative impacts of the continued
8 operation of the KPS transmission lines would be SMALL. The NRC staff identified a variety of
9 measures that could mitigate potential acute EMF impacts resulting from continued operation of
10 the KPS’s transmission lines. These mitigation measures would include erecting barriers along
11 the length of the transmission line to prevent unauthorized access to the ground beneath the
12 conductors and installing road signs at road crossings. These mitigation measures could reduce
13 human health impacts by minimizing public exposures to electric shock hazards. The NRC staff
14 did not identify any cost benefit studies applicable to these mitigation measures.

15 **4.11.4 Cumulative Impacts on Socioeconomics**

16 As discussed in Section 4.4 of this draft SEIS, continued operation of KPS during the license
17 renewal term would have no impact on socioeconomic conditions in the region beyond those
18 already experienced. Since DEK has no plans to hire additional workers during the license
19 renewal term, overall expenditures and employment levels at KPS would remain relatively
20 constant with no additional demand for permanent housing and public services. In addition,
21 since employment levels and tax payments would not change, there would be no population or
22 tax revenue-related land use impacts. There would also be no disproportionately high and
23 adverse health and environmental impacts on minority and low-income populations in the
24 region. Based on this and other information presented in this chapter there would be no
25 cumulative socioeconomic impacts from the continued operation of KPS during the license
26 renewal term beyond what is currently being experienced.

27 Any ground disturbing activities during the license renewal term could, however, result in the
28 cumulative loss of historic and archaeological resources. Historic and archaeological resources
29 are non-renewable; therefore, the loss of archaeological resources is cumulative. The continued
30 operation of KPS during the license renewal term has the potential to impact historic and
31 archaeological resources.

32 As discussed in Section 4.9.6, continued operation of the KPS during the license renewal term
33 would have a SMALL impact on archaeological resources. While archaeological surveys were
34 not conducted prior to the construction of KPS, DEK has conducted a Phase I survey to identify
35 historic and archaeological resources on the KPS site. DEK is also revising its corporate
36 procedures and establishing a “Cultural Resources Protection Plan” to improve the protection of
37 archaeological resources at KPS. DEK could also train staff to ensure that historic and
38 archaeological resources are protected at the KPS site.

39 DEK has no plans to alter the KPS site for license renewal. Any future land disturbing activities
40 would be carried out under corporate procedures. These procedures have stop work provisions
41 in the case of any inadvertent discoveries. Should plans change, further consultation would be
42 initiated by DEK with the NRC and WHS. Because impacts to historic and archaeological

1 resources from the continued operation of KPS would be SMALL, the cumulative environmental
2 impacts to historic and archaeological resources would be SMALL.

3 **4.11.5 Cumulative Impacts on Air Quality**

4 KPS is located in Kewaunee County, Wisconsin, which belongs to EPA Region 5. Kewaunee
5 County belongs to the Lake Michigan Intrastate Air Quality Control Region (Wisconsin) (AQCR)
6 designated by the EPA and codified in 40 CFR 81.67 and Chapter 404.03 of the Wisconsin
7 Administrative Code. Seventeen counties in the State of Wisconsin belong to the Lake Michigan
8 Intrastate AQCR, three counties among them (Door County, Manitowoc County and Sheboygan
9 County) are currently designated by the EPA as 8-hour ozone non-attainment areas. Kewaunee
10 County is a maintenance county for 8-hour ozone and is in attainment for all other criteria
11 pollutants (EPA, 2009).

12 As discussed in Air Quality Impacts Section 2.2.2.1, WDNR has primary responsibility for
13 regulating air emission sources within the State of Wisconsin and also conducting ambient air
14 monitoring in the State. WDNR is in the process of registering the Mayville monitoring site as a
15 National Core (NCore) multi-pollutant higher-sensitivity monitoring station, therefore fulfilling the
16 EPA's final amendments to the ambient air monitoring regulations for criteria pollutants
17 contained in 40 CFR Parts 53 and 58. KPS is recognized as a Synthetic Minor facility, non-Part
18 70 by WDNR due to the quantities of emissions and restrictions on the hours of operation of its
19 stationary sources of criteria pollutants (DEK, 2009a).

20 In April 2009, the EPA published the official United States inventory of greenhouse gas (GHG)
21 emissions that identifies and quantifies the primary anthropogenic sources and sinks of GHGs
22 (EPA 2009a). GHG inventories, such as this, are mechanisms developed by the United Nations
23 Framework Convention on Climate Change that enable participating countries to compare their
24 relative global contributions from different emission sources and GHGs to assess their impact
25 on climate change. In its report, the EPA estimates that energy-related activities in the United
26 States account for three-quarters of human-generated GHG emissions, mostly in the form of
27 carbon dioxide emissions from burning fossil fuels. More than half of the energy-related
28 emissions come from major stationary sources like power plants, and approximately a third
29 come from transportation. Industrial processes (production of cement, steel, and aluminum),
30 agriculture, forestry, other land use and waste management are also sources of GHG emissions
31 in the United States (EPA, 2009a).

32 Potential cumulative effects of climate change on the Great Lakes Region, whether from natural
33 cycles or anthropogenic (man-induced) activities, could result in a variety of changes to the air
34 quality of the area. As projected in the "Global Climate Change Impacts in the United States"
35 report by United States Global Change Research Program (USGCRP, 2009), average annual
36 temperatures in the Great Lakes Region and Midwest are expected to rise, causing more
37 frequent extreme weather events. The climate of the Midwest, and Wisconsin in particular, is
38 projected to become drier in summer, causing mild to significant reductions in Great Lakes
39 water levels and reduced ice cover. Reduced ice cover will contribute to faster evaporation in
40 winter, causing water deficits. The projected increase in winter and spring precipitation will
41 cause more frequent occurrences of severe weather events. Increases in average annual
42 temperatures, increased occurrences of intense rainfall or drought, and changes in wind

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1 patterns could affect concentrations and long-range transport of air pollutants. The formation of
2 air pollutants partially depends on temperature and humidity and interactions between hourly
3 changes in the physical and dynamic properties of the atmosphere, including circulation
4 features, wind, topography and energy use (IPCC, 2009).

5 In 1993, WDNR conducted the "Wisconsin Greenhouse Gas Emissions Inventory and Emission
6 Reduction Cost Study" which led to the development of a Climate Change Action Plan in 1998.
7 The Wisconsin GHG emissions inventory is periodically updated per this plan. In 2007, the
8 enactment of E.O. 191 in Wisconsin led to the creation of the Governor's Task Force on Global
9 Warming, which outlined its mission, goals and recommendations in the 2008 final report to the
10 governor, "Wisconsin's Strategy for Reducing Global Warming" (WDNR, 2009). WDNR is also a
11 member of the Wisconsin Initiative on Climate Change Impacts that assesses and evaluates
12 climate change impacts on specific Wisconsin natural resources, industry, agriculture, tourism,
13 and other human activities.

14 Consistent with the findings in the GEIS, the Staff concludes that the impacts from continued
15 operation of KPS on air quality are SMALL. In addition, as no refurbishment is planned at KPS
16 during the license renewal period, no additional air emissions would result from refurbishment
17 activities. With respect to GHG, the EPA has not established limits on such emission sources,
18 as further evaluation of data is still needed. Therefore, the Staff concludes that, combined with
19 the emissions from other past, present, and reasonably foreseeable future actions, cumulative
20 hazardous and criteria air pollutants emissions on air quality from KPS-related actions would be
21 SMALL.

22 4.11.6 Summary of Cumulative Impacts

23 The NRC staff considered the potential impacts resulting from the operation of KPS during the
24 period of extended operation and other past, present, and future actions in its vicinity. The
25 preliminary determination is that most of the potential cumulative impacts resulting from KPS
26 operation during the period of extended operation would be SMALL.

27 **Table 4-17. Summary of Cumulative Impacts on Resource Areas.** *The cumulative impacts*
28 *were determined to be SMALL for most of the resource areas.*

Resource Area	Impact	Discussion
Water/Aquatic Resources	MODERATE	See Section 4.11.1
Terrestrial Resources	SMALL	See Section 4.11.2
Human Resources	SMALL	See Section 4.11.3
Socioeconomics	SMALL	See Section 4.11.4
Air Quality	SMALL	See Section 4.11.5

1 4.12 REFERENCES

- 2 10 CFR 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, “Standards for Protection
3 Against Radiation.”
- 4 10 CFR 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Domestic Licensing of
5 Production and Utilization Facilities.”
- 6 10 CFR 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection
7 Regulations for Domestic Licensing and Related Regulatory Functions.”
- 8 10 CFR 72. *Code of Federal Regulations*, Title 10, *Energy*, Part 72, “Licensing Requirements for
9 the Independent Storage of Spent Nuclear Fuel, High-Level Waste, and Reactor-Related
10 Greater Than Class C Waste.”
- 11 33 USC 1326. Title 33, Section 1326 of the *United States Code*, Thermal Discharges.
- 12 36 CFR Part 60. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*,
13 Part 60, Section 4, “Criteria for Evaluation.”
- 14 36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*,
15 Part 800, “Protection of Historic Properties.”
- 16 40 CFR 53. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 53, “Ambient
17 Air Monitoring Reference and Equivalent Methods.”
- 18 40 CFR 58. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 58, “Ambient
19 Air Quality Surveillance.”
- 20 40 CFR 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190,
21 “Environmental Radiation Protection Standards for Nuclear Power Operations.”
- 22 69 FR 41575. July 9, 2004, U.S. Environmental Protection Agency, “National Pollutant
23 Discharge Elimination System – Final Regulations to Establish Requirements for Cooling Water
24 Intake Structures at Phase II Existing Facilities: Final Rule,” *Federal Register*. Volume 69, pp.
25 41575.
- 26 72 FR 37107. July 9, 2007, U.S. Environmental Protection Agency, “National Pollutant
27 Discharge Elimination System – Suspension of the Regulations Establishing Requirements for
28 Cooling Water Intake Structures at Phase II Existing Facilities,” *Federal Register*. Volume 72,
29 No. 130, pp. 37107–37109.
- 30 Advisory Council on Historic Preservation (ACHP). 2009. “National Register Evaluation Criteria.”
31 Available URL: <http://www.achp.gov/nrcriteria.html> (accessed September 8, 2009).
- 32 U.S. Atomic Energy Commission (AEA). 1972. “Final Environmental Statement Related to the
33 Operation of Kewaunee Nuclear Power Plant”. Wisconsin Public Service Corporation. Docket
34 No. 50-305. Directorate of Licensing. Washington, D.C. December 1972. Agencywide
35 Documents Access and Management System (ADAMS) Accession No. ML082820122.
- 36 AVD Archaeological Services, Inc. (AVD). 2007. “Phase I Archaeological Survey at the
37 Kewaunee Power Station in Kewaunee County, Wisconsin.” Prepared for Dominion Energy
38 Kewaunee, Kewaunee, Wisconsin. [Non-public document. Withheld per 36 CFR 800.11(c)]

Environmental Impacts of Operation

- 1 Bigelow, H.B. and W.C. Schroeder. 1953. "Alewife" in Fishes of the Gulf of Maine. U.S. Fish and
2 Wildlife Service. Fishery Bulletin 74. Available URL: <http://www.gma.org/fogm/Default.htm>
3 (accessed July 21, 2009). ADAMS Accession No. ML093250060.
- 4 Brent, R., J. Schofield, and K. Miller. 2001. "Results of the Lake Michigan Mass Balance Study:
5 Atrazine Data Report." U.S. EPA Great Lakes National Program Office, EPA 905R-01-010.
6 Available URL: http://www.epa.gov/glnpo/lmmb/results/atra_final.pdf (accessed May 18, 2009).
7 ADAMS Accession No. ML093250007.
- 8 Bunnell, D.B., C.P. Madenjian, J.D. Holuszko, T.J. Desorcie, and J.V. Adams. 2007. "Status and
9 Trends of Prey Fish Populations in Lake Michigan, 1992-2006." Lake Michigan Committee, U.S.
10 Geological Survey. March 20, 2007. Available URL:
11 http://www.michigandnr.com/publications/pdfs/fishing/research/Charlevoix/130_2006LakeMichigan
12 [anAcoustic.pdf](http://www.michigandnr.com/publications/pdfs/fishing/research/Charlevoix/130_2006LakeMichigan) (accessed November 24, 2009).
- 13 Clean Water Act (CWA) of 1977 (P.L. 95-217).
- 14 Council of Environmental Quality (CEQ). 1997. "Environmental Justice: Guidance Under the
15 National Environmental Policy Act (NEPA)," 1997.
- 16 Crawford, S. S. 2001. "Salmonine Introductions to the Laurentian Great Lakes: An Historical
17 Review and Evaluation of Ecological Effects." Executive Summary. Canadian Special
18 Publication of Fisheries and Aquatic Sciences. Available URL:
19 http://www.uoguelph.ca/~scrawfor/research/research_greatlakes/research_greatlakes_fisheries/
20 [research_greatlakes_fisheries_issues/research_greatlakes_fisheries_issues_salmon_monogra](http://www.uoguelph.ca/~scrawfor/research/research_greatlakes/research_greatlakes_fisheries/)
21 [ph.shtml](http://www.uoguelph.ca/~scrawfor/research/research_greatlakes/research_greatlakes_fisheries/) (accessed July 15, 2009). ADAMS No. ML093250009.
- 22 Crowder, L.B. 1980. "Alewife, Rainbow Smelt, and Native Fishes in Lake Michigan: Competition
23 or Predation?" *Environmental Biology of Fishes*, 5(3): 225-233.
- 24 Dominion Energy Kewaunee, Inc. (DEK). 2005. Kewaunee Power Station. "2004 Annual
25 Environmental Monitoring Report." Kewaunee, Wisconsin. ADAMS Accession No.
26 ML051250449.
- 27 Dominion Energy Kewaunee, Inc. (DEK). 2006. Kewaunee Power Station. "2005 Annual
28 Environmental Monitoring Report." Kewaunee, Wisconsin. ADAMS Accession No.
29 ML061240127.
- 30 Dominion Energy Kewaunee, Inc. (DEK). 2007. Kewaunee Power Station. "2006 Annual
31 Environmental Monitoring Report." Kewaunee, Wisconsin. ADAMS Accession No.
32 ML071350508.
- 33 Dominion Energy Kewaunee, Inc. (DEK). 2008. "Applicant's Environmental Report – Operating
34 License Renewal Stage." Appendix E of Application for Renewed Operating License,
35 Kewaunee Power Station. Docket No. 50-305. August 2008. ADAMS Accession No.
36 ML082341039.
- 37 Dominion Energy Kewaunee, Inc. (DEK). 2008a. Kewaunee Power Station. "2007 Annual
38 Environmental Monitoring Report." Kewaunee, Wisconsin. ADAMS Accession No.
39 ML081340603.
- 40 Dominion Energy Kewaunee, Inc. (DEK). 2008b. "2007 Radiological Annual Environmental
41 Monitoring Report, Kewaunee Power Station." Kewaunee, Wisconsin. April 24, 2008. ADAMS
42 Accession No. ML0813406033.

- 1 Dominion Energy Kewaunee, Inc. (DEK). 2009. Kewaunee Power Station. "2008 Annual
2 Environmental Monitoring Report." Kewaunee, Wisconsin. ADAMS Accession No.
3 ML091480351.
- 4 Dominion Energy Kewaunee, Inc. (DEK) 2009a. Dominion Energy Kewaunee, Inc. Kewaunee
5 Power Station. "Response To Request To Docket Information Related To The Environmental
6 Site Audit for Kewaunee Power Station." Enclosure A – Meteorology and Air Compliance.
7 ADAMS Accession No. ML09190514.
- 8 Dominion Resource Services, Inc (Dominion). 2008. Letter from P. Faggert, Dominion Energy
9 Kewaunee, Inc., to D. Hantz, Wisconsin Department of Natural Resources. Subject: Reply to
10 Information Requirements Related to Cooling Water Intake Structures, WPDES Permit WI-000-
11 071571. January 4, 2008. ADAMS Accession No. ML083520612.
- 12 Dominion Resource Services, Inc. (Dominion). 2009. "Dominion's plan to address Greenhouse
13 Gases." Available URL: http://www.dom.com/about/environment/pdf/ghg_report.pdf (accessed
14 June, 2009). ADAMS Accession No. ML093250061.
- 15 EA Engineering, Science, and Technology, Inc. (EAE). 2007. "Impingement Mortality and
16 Entrainment Characterization Report, Kewaunee Power Station, March 2006–February 2007."
17 Prepared for Dominion Resources Services, Inc., Glen Allen, Virginia. ADAMS Accession No.
18 ML083520612.
- 19 Edsall, T.A. and M.I. Saxon. 1970. The Effect of Temperature on the Rate of Development and
20 Survival of Alewife Eggs and Larvae. *Trans. Am. Fish. Soc.* 99(2): 376-380. in Fay, C. W., R. J.
21 Neves, and G. B. Pardue. 1983. "Species Profile: Life Histories and Environmental
22 Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic) – Alewife/Blueback Herring."
23 U.S. Fish and Wildlife Service Biol. Rep. 82 (11.45). U.S. Army Corps of Engineers, TR EL-82-
24 4. Available URL: http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-009.pdf (accessed
25 July 21, 2009). ADAMS Accession No. ML093250062.
- 26 Environmental Protection Agency (EPA). 2009. "EPA Green Book Nonattainment Areas for
27 Criteria Pollutants." Available URL: <http://www.epa.gov/air/oaqps/greenbk/index.html> (accessed
28 May, 2009). ADAMS Accession No. ML093250063.
- 29 Environmental Protection Agency (EPA). 2009a. "2009 U.S. Greenhouse Gas Inventory
30 Report." Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2007. Available URL:
31 <http://www.epa.gov/climatechange/emissions/usinventoryreport.html> (accessed June, 2009).
32 ADAMS Accession No. ML093250064.
- 33 Eshenroder, R. L., M. E. Holey, T. K. Gorenflo, and R. D. Clark, Jr. 1995. "Fish-Community
34 Objectives for Lake Michigan." Great Lakes Fishery Commission Publication Spec. Pub. 95–3.
35 Available URL: http://www.glfsc.org/pubs/SpecialPubs/Sp95_3.pdf (accessed July 15, 2009).
36 ADAMS Accession No. ML093250065.
- 37 Fay, C. W., R. J. Neves, and G. B. Pardue. 1983. "Species Profile: Life Histories and
38 Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic) –
39 Alewife/Blueback Herring." U.S. Fish and Wildlife Service Biol. Rep. 82 (11.45). U.S. Army
40 Corps of Engineers, TR EL-82-4. Available URL:
41 http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-009.pdf (accessed July 21, 2009).
42 ADAMS Accession No. ML093250066.

Environmental Impacts of Operation

- 1 Froese, R. and D. Pauly. Ed. 2009. "Cyprinus carpio carpio: Common Carp." FishBase. May
2 2009 Version. Available URL: <http://www.fishbase.org/Summary/SpeciesSummary.php?id=1450>
3 (accessed July 20, 2009). ADAMS Accession No. ML093250067.
- 4 Fuller, P., E. Maynard, and D. Raikow. 2007. "Alosa pseudoharengus." USGS Nonindigenous
5 Aquatic Species Database. Available URL:
6 <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=490> (accessed January 6, 2009).
7 ADAMS Accession No. ML093250022.
- 8 Institute of Electrical and Electronics Safety Code (IEEE). 2007. National Electric Safety Code.
- 9 Intergovernmental Panel on Climate Change (IPCC). 2009. IPCC Fourth Assessment Report:
10 Working Group II Report "Impacts, Adaptation and Vulnerability." Available URL:
11 [http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_re](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm)
12 [port_impacts_adaptation_and_vulnerability.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm) (accessed June, 2009). ADAMS Accession No.
13 ML093250068.
- 14 Madenjian, C.P., T.O. Hook, E.S. Rutherford, D.M. Mason, T.E. Croley, E.B. Szalai, and J.R.
15 Bence. 2005. "Recruitment Variability of Alewives in Lake Michigan." Transactions of the
16 American Fisheries Society 134: 218-230. Available URL:
17 <http://www.glerl.noaa.gov/pubs/fulltext/2005/20050002.pdf> (accessed July 20, 2009). ADAMS
18 Accession No. ML093250069.
- 19 Madenjian, C.P., D.B. Bunnell, J.D. Holuszko, T.J. Desorcie, and J.V. Adams. 2008. "Status and
20 Trends of Prey Fish Populations in Lake Michigan, 2007." Lake Michigan Committee, Great
21 Lakes Fishery Commission. Published by the U.S. Geological Survey. March 20, 2008.
22 Available URL: <http://www.glsc.usgs.gov/files/reports/2007LakeMichiganPreyfish.pdf> (accessed
23 July 21, 2009). ADAMS Accession No. ML093250070.
- 24 National Institute of Environmental Health Sciences (NIEHS). 1999. "NIEHS Report on Health
25 Effects from Exposure to Power Line Frequency and Electric and Magnetic Fields." Publication
26 No. 99-4493, Research Triangle Park, North Carolina.
- 27 National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.
- 28 Nalco Environmental Sciences (NES). 1976. Kewaunee Nuclear Power Plant 316(b)
29 Demonstration: Environmental Effects of Existing Cooling Water Intake Structures. ADAMS
30 Accession No. ML083520612.
- 31 National Historic Preservation Act of 1966 (NHPA), 16 USC 470, et seq.
- 32 National Oceanic and Atmospheric Administration (NOAA). 2007. "Annual Commercial Landing
33 Statistics." Database. Available URL:
34 http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html (accessed July 21,
35 2009). ADAMS Accession No. ML093250071.
- 36 U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement*
37 *for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C.
38 ADAMS Accession No. ML061770605.
- 39 U.S. Nuclear Regulatory Commission (NRC). 2005. *Generic Environmental Impact Statement*
40 *for the Renewal of Nuclear Power Plants: Regarding Point Beach Nuclear Plant, Units 1 and 2*.
41 Final Report. NUREG-1437, Supplement 23. Office of Nuclear Reactor Regulation. Washington,
42 D.C. ADAMS Accession No. ML052230490.

Environmental Impacts of Operation

- 1 U.S. Nuclear Regulatory Commission (NRC). 2008. Letter from D. Pelton, Branch Chief,
2 Division of License Renewal, to L. Clemency, Field Supervisor, Green Bay Field Office, U.S.
3 Fish and Wildlife Service. Subject: Request for List of State Protected Species Within the Area
4 Under Evaluation for the Kewaunee Power Station License Renewal Application Review.
5 September 30, 2008. ADAMS Accession No. ML082610748.
- 6 U.S. Nuclear Regulatory Commission (NRC). 2008a. Letter from D. Pelton, U.S. Nuclear
7 Regulatory Commission, Washington, D.C., to S. Banker, Wisconsin Historical Society,
8 Madison, Wisconsin. Subject: "Kewaunee Power Station License Renewal Application Review
9 (Case #07-0127/KE)." ADAMS Accession No. ML082670685.
- 10 U.S. Nuclear Regulatory Commission (NRC). 2008b. Letter from D. Pelton, U.S. Nuclear
11 Regulatory Commission, Washington, D.C., to D. Klima, Advisory Council on Historic
12 Preservation, Washington, D.C. Subject: "Kewaunee Power Station License Renewal
13 Application Review." ADAMS Accession No. ML082610168.
- 14 U.S. Census Bureau (USCB). 2003. "LandView 6 – Census 2000 Profile of General
15 Demographic Characteristics DP-1 (100%) and Census Profile of Selected Economic
16 Characteristics DP-3, Summary of Census Block Groups in a 50-mile radius around the KPS
17 (44.342222 Lat., -87.536111 Long.)."
- 18 U.S. Census Bureau (USCB). 2009. American FactFinder, Census 2000 information and State
19 and County QuickFacts on Kewaunee, Manitowoc, and Brown Counties. Available online at
20 <http://factfinder.census.gov> and <http://quickfacts.census.gov> (accessed July 2009).
- 21 U.S. Fish and Wildlife Service (USFWS). 2003. "12-Month Finding For a Petition to List the
22 Kootenai River Burbot (*Lota lota*) as Threatened or Endangered." *Federal Register*
23 68(47):11574-11579. March 11.
- 24 U.S. Fish and Wildlife Service (USFWS). 2008. Letter from L. Clemency, Field Supervisor,
25 Green Bay Field Office, U.S. Fish and Wildlife Service, to D. Pelton, Branch Chief, Division of
26 License Renewal. Subject: Reply to Request for Species List for License Renewal Application
27 Review of Kewaunee Power Station, Kewaunee County, Wisconsin. October 28, 2008. ADAMS
28 Accession No. ML083390643.
- 29 U.S. Fish and Wildlife Service (USFWS). 2008a. Letter to the NRC regarding the Renewal
30 Application Review of Kewaunee Power Station, Kewaunee County, Wisconsin. October 28,
31 2008. ADAMS Accession No. ML 083390643.
- 32 United States Global Change Research Program (USGCRP). 2009. *Global Climate Change*
33 *Impacts in the United States*. Cambridge University Press.
- 34 U.S. Geological Survey (USGS). 2008. "Sea Lamprey." Available URL:
35 [http://www.glsc.usgs.gov/main.php?content=research_lamprey&title=Invasive%20Fish0&menu=](http://www.glsc.usgs.gov/main.php?content=research_lamprey&title=Invasive%20Fish0&menu=research_invasive_fish)
36 [research_invasive_fish](http://www.glsc.usgs.gov/main.php?content=research_lamprey&title=Invasive%20Fish0&menu=research_invasive_fish) (accessed November 4, 2008). ADAMS Accession No. ML093250040.
- 37 Wisconsin Department of Health Services, Division of Public Health (WDHS). 2008. "State of
38 Wisconsin 2007 Point Beach – Kewaunee Environmental Radioactivity Survey." Madison, WI.
39 ADAMS Accession No. ML083400062.
- 40 Wisconsin Department of Natural Resources (WDNR). 2005. Letter from R. Rasmussen,
41 Wisconsin Department of Natural Resources, to P. Faggert, Dominion Energy Kewaunee, Inc.,

Environmental Impacts of Operation

- 1 transmitting WPDES Permit and Permit Fact Sheet. Subject: WPDES Permit Reissuance No.
2 WI-0001571-07-0 – Kewaunee Power Station, State Highway 42, Kewaunee, WI. July 18, 2005.
- 3 Wisconsin Department of Natural Resources (WDNR). 2005a. State of Wisconsin Department
4 of Natural Resources Permit to Discharge Under the Wisconsin Pollutant Discharge Elimination
5 System, Permit No. WI-0001571-07-0, Kewaunee Power Station, July, 2005. ADAMS Accession
6 No. ML083520612.
- 7 Wisconsin Department of Natural Resources (WDNR). 2007. Letter from D. Hantz, Wisconsin
8 Department of Natural Resources, to P. Faggert, Dominion Energy Kewaunee, Inc. Subject:
9 Requirements for Cooling Water Intake Structures – WPDES Permit WI-0001571-07. December
10 3, 2007. ADAMS Accession No. ML083520612.
- 11 Wisconsin Department of Natural Resources (WDNR). 2009. “Global Climate Change. Reports
12 and Documents.” Available URL: <http://dnr.wi.gov/air/aq/global/climatechange/reports.html>
13 (accessed June, 2009). ADAMS Accession No. ML093250072.
- 14 Wisconsin Department of Natural Resources (WDNR). 2009a. “Lake Michigan.” Available URL:
15 <http://www.dnr.state.wi.us/org/water/greatlakes/LakeMichigan.html> (accessed July 28, 2009).
16 ADAMS Accession No. ML093250073.
- 17 Wisconsin Department of Natural Resources (WDNR). 2009b. “Proposed Revisions to NR 102
18 and NR 106 (Wisconsin Administrative Code).” Available URL:
19 <http://www.dnr.state.wi.us/org/water/wm/wqs/ThermalRules2009.pdf> (accessed July 8, 2009).
20 ADAMS Accession No. ML093250074.
- 21 Wisconsin Historical Society (WHS). 2007, Fax from S. Banker to P. Faggert, December 3,
22 2007, “Request for SHPO Comment and Consultation on a Federal Undertaking.”
23

1 5.0 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS

2 This chapter describes the environmental impacts from postulated accidents that might occur
3 during the period of extended operation. The term “accident” refers to any unintentional event
4 outside the normal plant operational envelope that results in a release or the potential for
5 release of radioactive materials into the environment. Two classes of postulated accidents,
6 listed in Table 5-1 below, are evaluated in the generic environmental impact statement (GEIS).
7 These are design-basis accidents (DBAs) and severe accidents.

8 **Table 5-1. Issues Related to Postulated Accidents.** *Two issues related to postulated*
9 *accidents are evaluated under the National Environmental Policy Act (NEPA) in the license*
10 *renewal review: DBAs and severe accidents.*

Issue	GEIS Section	Category
DBAs	5.3.2; 5.5.1	1
Severe accidents	5.3.3; 5.3.3.2; 5.3.3.3; 5.3.3.4; 5.3.3.5; 5.4; 5.5.2	2

11 5.1 DESIGN-BASIS ACCIDENTS

12 In order to receive U.S. Nuclear Regulatory Commission (NRC) approval to operate a nuclear
13 power facility, an applicant for an initial operating license must submit a safety analysis report
14 (SAR) as part of its application. The SAR presents the design criteria and design information for
15 the proposed reactor and comprehensive data on the proposed site. The SAR also discusses
16 various hypothetical accident situations and the safety features that are provided to prevent and
17 mitigate accidents. The NRC staff reviews the application to determine whether or not the plant
18 design meets NRC regulations and requirements and includes, in part, the nuclear plant design
19 and its anticipated response to an accident.

20 DBAs are those accidents that both the licensee and the staff evaluate to ensure that the plant
21 can withstand normal and abnormal transients, and a broad spectrum of postulated accidents,
22 without undue hazard to the health and safety of the public. A number of these postulated
23 accidents are not expected to occur during the life of the plant, but are evaluated to establish
24 the design basis for the preventive and mitigative safety systems of the facility. The acceptance
25 criteria for DBAs are described in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50
26 and Part 100.

27 The environmental impacts of DBAs are evaluated during the initial licensing process, and the
28 ability of the plant to withstand these accidents is demonstrated to be acceptable before
29 issuance of the operating license. The results of these evaluations are found in license
30 documentation such as the applicant’s final safety analysis report (FSAR), the safety evaluation
31 report (SER), the final environmental statement (FES), and Section 5.1 of this supplemental
32 environmental impact statement (SEIS). A licensee is required to maintain the acceptable
33 design and performance criteria throughout the life of the plant, including any period of extended
34 operation. The consequences for these events are evaluated for the hypothetical maximum

Environmental Impacts of Postulated Accidents

1 exposed individual; as such, changes in the plant environment will not affect these evaluations.
2 Because of the requirements that continuous acceptability of the consequences and aging
3 management programs must be in effect for the period of extended operation, the
4 environmental impacts as calculated for DBAs should not differ significantly from initial licensing
5 assessments over the life of the plant, including the period of extended operation. Accordingly,
6 the design of the plant relative to DBAs during the period of extended operation is considered to
7 remain acceptable and the environmental impacts of DBAs were not examined further in the
8 GEIS.

9 The Commission has determined that the environmental impacts of DBAs are of SMALL
10 significance for all plants because the plants were designed to successfully withstand these
11 accidents. Therefore, for the purposes of license renewal, DBAs are designated as a Category 1
12 issue. The early resolution of the DBAs makes them a part of the current licensing basis of the
13 plant; the current licensing basis of the plant is to be maintained by the licensee under its
14 current license and, therefore, under the provisions of 10 CFR 54.30, is not subject to review
15 under license renewal.

16 No new and or significant information related to DBAs was identified during the review of the
17 Dominion Energy Kewaunee, Inc.'s (DEK) environmental report (ER) (DEK, 2008a), site audit,
18 the scoping process, or evaluation of other available information. Therefore, there are no
19 impacts related to these issues beyond those discussed in the GEIS.

20 **5.2 SEVERE ACCIDENT MITIGATION ALTERNATIVES**

21 Regulation under 10 CFR 51.53(c)(3)(ii)(L) requires that license renewal applicants consider
22 alternatives to mitigate severe accidents if the staff has not previously evaluated severe
23 accident mitigation alternatives (SAMAs) for the applicant's plant in a GEIS or related
24 supplement or in an environmental assessment. The purpose of this consideration is to ensure
25 that plant changes (i.e., hardware, procedures, and training) with the potential for improving
26 severe accident safety performance are identified and evaluated. SAMAs have not been
27 previously considered for Kewaunee Power Station (KPS); therefore, the remainder of Chapter
28 5 addresses those alternatives.

29 **5.2.1 Introduction**

30 This section presents a summary of the SAMA evaluation for KPS conducted by DEK and the
31 NRC staff's review of that evaluation. The NRC staff performed its review with contract
32 assistance from Information Systems Laboratories. The NRC staff's review is available in full in
33 Appendix F of this document; the SAMA evaluation is available in full in DEK's ER.

34 The SAMA evaluation for KPS was conducted with a four-step approach. In the first step DEK
35 quantified the level of risk associated with potential reactor accidents using the plant-specific
36 probabilistic risk assessment (PRA) and other risk models.

37 In the second step DEK examined the major risk contributors and identified possible ways
38 (SAMAs) for reducing that risk. Common ways of reducing risk are changes to components,
39 systems, procedures, and training. DEK identified 189 potential SAMAs for KPS. DEK
40 performed an initial screening to determine if any SAMAs could be eliminated because they: (1)

1 are not applicable at KPS due to design differences, (2) have been effectively implemented at
 2 KPS, (3) have estimated costs that would exceed the dollar value associated with completely
 3 eliminating all severe accident risk at KPS, or (4) have a very low benefit because they are
 4 associated with a non-risk-significant system. This screening reduced the list of potential
 5 SAMAs to 64.

6 In the third step DEK estimated the benefits and the costs associated with each of the remaining
 7 SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates
 8 were developed in terms of dollars in accordance with NRC guidance for performing regulatory
 9 analyses (NRC, 1997). The cost of implementing the proposed SAMAs was also estimated.

10 Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were
 11 compared to determine whether or not the SAMA was cost beneficial, meaning the benefits of
 12 the SAMA were greater than the cost (a positive cost benefit). DEK concluded in its ER that
 13 several of the SAMAs evaluated are potentially cost-beneficial (DEK, 2008a). However, in
 14 response to NRC staff inquiries regarding estimated benefits for certain SAMAs and lower cost
 15 alternatives, several additional potentially cost-beneficial SAMAs were identified (DEK, 2009a).

16 The potentially cost-beneficial SAMAs do not relate to adequately managing the effects of aging
 17 during the period of extended operation; therefore, they need not be implemented as part of
 18 license renewal pursuant to 10 CFR Part 54. DEK's SAMA analyses and the NRC's review are
 19 discussed in more detail below.

20 **5.2.2 Estimate of Risk**

21 DEK submitted an assessment of SAMAs for KPS as part of the ER (DEK, 2008a). This
 22 assessment was based on the most recent KPS PRA available at that time, a plant-specific
 23 offsite consequence analysis performed using the MELCOR Accident Consequence Code
 24 System 2 (MACCS2) computer program, and insights from the KPS individual plant examination
 25 (IPE) (WPSC, 1992) and individual plant examination of external events (IPEEE)
 26 (WPSC, 1994).

27 For the purpose of the SAMA evaluation, the baseline core damage frequency (CDF) is
 28 approximately 7.7×10^{-5} per year. The CDF value is based on the risk assessment for internally-
 29 initiated events. DEK did not include the contributions from external events within the KPS risk
 30 estimates; however, it did account for the potential risk reduction benefits associated with
 31 external events by increasing the estimated benefits for internal events by a factor of two. The
 32 breakdown of CDF by initiating event is provided in Table 5-2 that follows.

33 **Table 5-2. Kewaunee Power Station Internal Events Core Damage Frequency**

Initiating Event	CDF (Per Year)	% Contribution to CDF
Internal floods	4.5×10^{-5}	58
Transient with main feedwater available	6.5×10^{-6}	8
Loss of component cooling water	6.0×10^{-6}	8
Steam generator tube rupture (SGTR)	4.7×10^{-6}	6
Loss of offsite power	3.9×10^{-6}	5
Stuck open pressurizer	2.0×10^{-6}	3

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Initiating Event	CDF (Per Year)	% Contribution to CDF
Loss of service water	1.9 x 10 ⁻⁶	3
Loss of main feedwater	1.6 x 10 ⁻⁶	2
Small loss-of-coolant accident (LOCA)	1.2 x 10 ⁻⁶	2
Vessel failure	9.5 x 10 ⁻⁷	1
Loss of instrument air	8.0 x 10 ⁻⁷	1
All others	2.5 x 10 ⁻⁶	3
Total CDF (internal events)	7.7 x 10⁻⁵	100

1 As shown in this table, events initiated by internal flooding are the dominant contributors to
2 CDF.

3 DEK estimated the dose to the population within 50 miles (80 km) of the KPS site to be
4 approximately 0.302 person-sievert (Sv) (30.2 person-rem) per year. The breakdown of the total
5 population dose by containment release mode is summarized in Table 5-3. Containment bypass
6 events (such as transients with an induced SGTR, or SGTR-initiated accidents with a stuck
7 open safety relief valve on the ruptured steam generator) and late containment failures without
8 containment spray dominate the population dose risk at KPS.

9 **Table 5-3. Breakdown of Population Dose by Containment Release Mode**

Containment Release Mode	Population Dose (Person-Rem Per Year)	% Contribution
Late containment failure without containment sprays	8.6	29
Interfacing-systems loss-of-coolant accident (ISLOCA) with scrubbing	0.2	<1
ISLOCA without scrubbing	0.9	3
SGTR with failure of secondary side isolation	19.5	64
SGTR with successful secondary side isolation	0.9	3
Other	0.1	1
Total	30.2	100

¹One person-rem = 0.01 person-Sv

10 The NRC staff has reviewed DEK's data and evaluation methods and concludes that the quality
11 of the risk analyses is adequate to support an assessment of the risk reduction potential for
12 candidate SAMAs. Accordingly, the staff based its assessment of offsite risk on the CDFs and
13 offsite doses reported by DEK.

14 5.2.3 Potential Plant Improvements

15 Once the dominant contributors to plant risk were identified, DEK searched for ways to reduce
16 that risk. In identifying and evaluating potential SAMAs, DEK considered insights from the plant-
17 specific PRA, and SAMA analyses performed for other operating plants that have submitted
18 license renewal applications. DEK identified 189 potential risk-reducing improvements (SAMAs)
19 to plant components, systems, procedures and training. A detailed cost-benefit analysis was
20 performed for each of the SAMAs.

1 DEK removed all but 64 of the SAMAs from further consideration because they are not
2 applicable at KPS due to design differences, have already been effectively implemented at KPS,
3 have estimated costs that would exceed the dollar value associated with completely eliminating
4 all severe accident risk at KPS, or have a very low benefit because they are associated with a
5 non-risk-significant system. A detailed cost-benefit analysis was performed for each of the
6 remaining SAMAs.

7 The staff concludes that DEK used a systematic and comprehensive process for identifying
8 potential plant improvements for KPS, and that the set of potential plant improvements identified
9 by DEK is reasonably comprehensive and, therefore, acceptable.

10 **5.2.4 Evaluation of Risk Reduction and Costs of Improvements**

11 DEK evaluated the risk reduction potential of the remaining 64 SAMAs. The SAMA evaluations
12 were performed using generally conservative assumptions.

13 DEK estimated the costs of implementing the candidate SAMAs through the application of
14 engineering judgment, the use of other licensee's estimates for similar improvements, and the
15 use of KPS actual experience for similar improvements. The cost estimates conservatively did
16 not include the cost of replacement power during extended outages required to implement the
17 modifications, nor did they include contingency costs associated with unforeseen
18 implementation obstacles.

19 The staff reviewed DEK's bases for calculating the risk reduction for the various plant
20 improvements and concludes that the rationale and assumptions for estimating risk reduction
21 are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what
22 would actually be realized). Accordingly, the staff based its estimates of averted risk for the
23 various SAMAs on DEK's risk reduction estimates.

24 The staff reviewed the bases for the applicant's cost estimates. For certain improvements, the
25 staff also compared the cost estimates to estimates developed elsewhere for similar
26 improvements, including estimates developed as part of other licensee's analyses of SAMAs for
27 operating reactors and advanced light-water reactors. The staff found the cost estimates to be
28 reasonable and generally consistent with estimates provided in support of other plants analyses.

29 The staff concludes that the risk reduction and the cost estimates provided by DEK are sufficient
30 and appropriate for use in the SAMA evaluation.

31 **5.2.5 Cost Benefit Comparison**

32 The cost benefit analysis performed by DEK was based primarily on NUREG/BR-0184 (NRC,
33 1997) and was executed consistent with this guidance. NUREG/BR-0058 has recently been
34 revised to reflect the agency's revised policy on discount rates. Revision 4 of NUREG/BR-0058
35 states that two sets of estimates should be developed—one at three percent and one at seven
36 percent (NRC, 2004). DEK provided both sets of estimates (DEK, 2008a).

37 DEK identified 14 potentially cost-beneficial SAMAs in the ER's baseline analysis:

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- 1 • SAMA 66 - Install a new feedwater source. (The evaluated SAMA actually involved
2 proceduralizing use of existing water sources)
- 3 • SAMA 80 - Add redundant ventilation systems. (The evaluated SAMA actually involved
4 staging temporary equipment and providing procedures and power source
5 connections)
- 6 • SAMA 82, 83, 170, 171 – Add switchgear room ventilation response. (The evaluated
7 SAMA actually involved staging backup fans in switchgear rooms, adding switchgear
8 room high temperature alarm, staging temporary fans and ducts along with power
9 cords for safeguards alley room cooling, and providing high temperature alarms for the
10 safeguards alley)
- 11 • SAMA 169 - Provide flood protection for MCC-52E, -62E, and -62H.
- 12 • SAMA 172 - Provide additional alarm for extremely low condensate storage tank level.
- 13 • SAMA 173 - Protect auxiliary building mezzanine cooling units from spray.
- 14 • SAMA 174 - Protect boric acid transfer pumps from spray.
- 15 • SAMA 175 - Protect a-train closed cooling water pump from spray.
- 16 • SAMA 176 - Install larger sump pumps in safeguards alley.
- 17 • SAMA 177 - Install watertight barrier between 480 VAC switchgear rooms.
- 18 • SAMA 181 - Install break-away mechanisms on emergency diesel generator (EDG)
19 room doors.

20 DEK performed additional analyses to evaluate the impact of parameter choices and
21 uncertainties on the results of the SAMA assessment (DEK, 2008a). Based on this, DEK
22 concluded that no additional SAMAs would be cost beneficial even at the 95 percentile risk
23 values.

24 DEK also considered the impact of simultaneous implementation of several of the SAMAs from
25 both a benefit and a cost standpoint. DEK concluded that while the simultaneous
26 implementation of several SAMAs would not increase the total benefit beyond that for each
27 SAMA individually, the implementation cost could be reduced. Based on the evaluation of
28 similar SAMAs involving improvements in room cooling and ventilation, DEK concluded that the
29 following three additional SAMAs involving diesel room cooling improvements would be cost
30 beneficial:

- 31 • SAMA 81 - Add a diesel building high temperature alarm or redundant louver and
32 thermostat
- 33 • SAMA 166 - Open doors for alternate (diesel generator (DG) room cooling)
- 34 • SAMA 167 - Proceduralize actions to open EDG room doors on loss of heating,
35 ventilation, and air conditioning (HVAC) and implement portable fans

36 Finally, DEK reviewed the analysis of the K107Aa PRA, prepared subsequent to the SAMA
37 evaluation documented in the ER, and found one new contributor to risk that could be impacted
38 by a candidate SAMA. DEK concluded that a new SAMA addressing this contributor, loss of

1 screenhouse ventilation, could be cost-effectively combined with similar SAMAs 81, 82, 83, 160,
2 166, 167, 170, and 171.

- 3 • Implementation of temporary screenhouse ventilation, including installing additional
4 temperature detectors

5 DEK committed to further review these SAMAs for implementation as part of DEK's ongoing
6 performance improvement program (DEK 2008a; 2009a).

7 The staff concludes that, with the exception of the potentially cost-beneficial SAMAs discussed
8 above, the costs of the SAMAs evaluated would be higher than the associated benefits.

9 **5.2.6 Conclusions**

10 The staff reviewed DEK's analysis and concluded that the methods used and the
11 implementation of those methods are sound. The treatment of SAMA benefits and costs support
12 the general conclusion that the SAMA evaluations performed by DEK are reasonable and
13 sufficient for the license renewal submittal.

14 Based on its review of the SAMA analysis, the staff concurs with DEK's identification of areas in
15 which risk can be further reduced in a cost-beneficial manner through the implementation of all
16 or a subset of potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk
17 reduction, the staff considers that further evaluation of these SAMAs by DEK is warranted.
18 However, none of the potentially cost-beneficial SAMAs relate to adequately managing the
19 effects of aging during the period of extended operation. Therefore, they need not be
20 implemented as part of the license renewal pursuant to 10 CFR Part 54.

21 **5.3 REFERENCES**

22 10 CFR 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic Licensing of
23 Production and Utilization Facilities."

24 10 CFR 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection
25 Regulations for Domestic Licensing and Related Regulatory Functions."

26 10 CFR 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal
27 of Operating Licenses for Nuclear Power Plants."

28 10 CFR 100. *Code of Federal Regulations*, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

29 Dominion Energy Kewaunee, Inc. (DEK). 2008a. Kewaunee Power Station, Licensee's
30 Environmental Report-Operating License Renewal Stage, August, 2008. Agencywide
31 Documents Access and Management System (ADAMS) Accession No. ML082341039.

32 Dominion Energy Kewaunee, Inc. (DEK). 2009a. Letter from Leslie N. Hartz, Dominion, to U.S.
33 Nuclear Regulatory Commission Document Control Desk. Subject: Kewaunee Power Station,
34 Response to Request Additional Information Regarding Severe Accident Mitigation Alternative
35 for Kewaunee Power Station License Renewal Application, March 9, 2009. ADAMS Accession
36 No. ML090690458.

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- 1 U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement*
2 *for License Renewal of Nuclear Plants*. NUREG-1437, Washington, D.C. Accessible at
3 <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/>
- 4 U.S. Nuclear Regulatory Commission (NRC). 1997. *Regulatory Analysis Technical Evaluation*
5 *Handbook*. NUREG/BR-0184, Washington, D.C., January 1997.
- 6 U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement*
7 *for License Renewal of Nuclear Plants, Main Report, Section 6.3 - Transportation, Table 9.1,*
8 *Summary of findings on NEPA issues for license renewal of nuclear power plants*. NUREG-
9 1437, Vol. 1, Addendum 1, Washington, D.C. Accessible at: [http://www.nrc.gov/reading-rm/doc-](http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/)
10 [collections/nuregs/staff/sr1437/](http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/)
- 11 U.S. Nuclear Regulatory Commission (NRC). 2004. *Regulatory Analysis Guidelines of the U.S.*
12 *Nuclear Regulatory Commission*. NUREG/BR-0058, Revision 4, Washington, D.C., September
13 2004.
- 14 Wisconsin Public Service Corporation (WPSC). 1992. Letter from C. R. Steinhardt, WPSC to
15 U.S. Nuclear Regulatory Commission Document Control Desk. Subject: Docket No. 50-305,
16 Operating License No. DPR-43, Kewaunee Nuclear Power Plant, Response to Generic Letter
17 88-20, Individual Plant Examination, December 1, 1992. ADAMS Accession No. ML080170462.
- 18 Wisconsin Public Service Corporation (WPSC). 1994. Letter from C. R. Steinhardt, WPSC to
19 U.S. Nuclear Regulatory Commission Document Control Desk. Subject: Docket No. 50-305,
20 Operating License No. DPR-43, Kewaunee Nuclear Power Plant, Response to Generic Letter
21 88-20, Supplement 4. Individual Plant Examination of External Events, June 28, 1994. ADAMS
22 Accession No. ML080170459.

1 **6.0 ENVIRONMENTAL IMPACTS OF THE URANIUM FUEL CYCLE,**
 2 **SOLID WASTE MANAGEMENT, AND GREENHOUSE GAS**

3 **6.1 THE URANIUM FUEL CYCLE**

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

17 The staff of the U.S. Nuclear Regulatory Commission (NRC) did not identify any new and
 18 significant information related to the uranium fuel cycle during the review of the Dominion
 19 Energy Kewaunee, Inc. (DEK) environmental report (ER) (DEK, 2008a), the site audit, and the
 20 scoping process. Therefore, there are no impacts related to these issues beyond those
 21 discussed in the GEIS. For these Category 1 issues, the GEIS concludes that the impacts are
 22 designated as SMALL, except for the collective offsite radiological impacts from the fuel cycle
 23 and from high-level waste and spent fuel disposal.

24 **Table 6-1. Issues Related to the Uranium Fuel Cycle and Solid Waste Management** *Nine*
 25 *generic issues are related to the fuel cycle and solid waste management. There are no site-*
 26 *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

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Issues	GEIS Section	Category
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, 6.4.5.6.1, 6.4.5.6.2, 6.4.5.6.3, 6.4.5.6.4, 6.6	1
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

1

2 **6.2 GREENHOUSE GAS EMISSIONS**

3 This section provides a discussion of potential impacts from greenhouse gases (GHGs) emitted
 4 during the nuclear fuel cycle. The GEIS does not directly address these emissions, and its
 5 discussion is limited to an inference that substantial carbon dioxide (CO₂) emissions may occur
 6 if coal- or oil-fired alternatives to license renewal are implemented.

7 **6.2.1 Existing Studies**

8 Since the development of the GEIS, the relative volumes of GHGs emitted by nuclear and other
 9 electricity generating methods have been widely studied. However, estimates and projections of
 10 the carbon footprint of the nuclear power lifecycle vary depending on the type of study
 11 conducted. Additionally, considerable debate also exists among researchers regarding the
 12 relative impacts of nuclear and other forms of electricity generation on GHG emissions. Existing
 13 studies on GHG emissions from nuclear power plants generally take two different forms:

- 14 (1) Qualitative discussions of the potential to use nuclear power to reduce GHG emissions
 15 and mitigate global warming; and

1 (2) Technical analyses and quantitative estimates of the actual amount of GHGs generated
2 by the nuclear fuel cycle or entire nuclear power plant life cycle and comparisons to the
3 operational or life cycle emissions from other energy generation alternatives.

4 6.2.1.1 *Qualitative Studies*

5 The qualitative studies consist primarily of broad, large-scale public policy or investment
6 evaluations of whether an expansion of nuclear power is likely to be a technically, economically,
7 and/or politically feasible means of achieving global GHG reductions. Examples of the studies
8 identified by the NRC staff during the subsequent literature search include:

- 9 • Evaluations to determine whether investments in nuclear power in developing
10 countries should be accepted as a flexibility mechanism to assist industrialized
11 nations in achieving their GHG reduction goals under the Kyoto Protocols
12 (Schneider, 2000; IAEA, 2000; NEA, 2002; NIRS/WISE, 2005). Ultimately, the
13 parties to the Kyoto Protocol did not approve nuclear power as a component under
14 the Clean Development Mechanism (CDM) due to safety and waste disposal
15 concerns (NEA, 2002).
- 16 • Analyses developed to assist governments, including the United States, in making
17 long-term investment and public policy decisions in nuclear power (Keepin, 1988;
18 Hagen et al., 2001; MIT, 2003).

19 Although the qualitative studies sometimes reference and critique the existing quantitative
20 estimates of GHGs produced by the nuclear fuel cycle or life cycle, their conclusions generally
21 rely heavily on discussions of other aspects of nuclear policy decisions and investment such as
22 safety, cost, waste generation, and political acceptability. Therefore, these studies are typically
23 not directly applicable to an evaluation of GHG emissions associated with the proposed license
24 renewal for a given nuclear power plant.

25 6.2.1.2 *Quantitative Studies*

26 A large number of technical studies, including calculations and estimates of the amount of
27 GHGs emitted by nuclear and other power generation options, are available in the literature and
28 were useful to the NRC staff's efforts in addressing relative GHG emission levels. Examples of
29 these studies include – but are not limited to – Mortimer (1990), Andseta et al. (1998), Spadaro
30 (2000), Storm van Leeuwen and Smith (2005), Fritsche (2006), Parliamentary Office of Science
31 and Technology (POST) (2006), Atomic Energy Authority (AEA) (2006), Weisser (2006),
32 Fthenakis and Kim (2007), and Dones (2007).

33 Comparing these studies and others like them is difficult because the assumptions and
34 components of the lifecycles the authors evaluate vary widely. Examples of areas in which
35 differing assumptions make comparing the studies difficult include:

- 36 • Energy sources that may be used to mine uranium deposits in the future;
- 37 • Reprocessing or disposal of spent nuclear fuel;

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- 1 • Current and potential future processes to enrich uranium and the energy sources
2 that will power them;
- 3 • Estimated grades and quantities of recoverable uranium resources;
- 4 • Estimated grades and quantities of recoverable fossil fuel resources;
- 5 • Estimated GHG emissions other than CO₂, including the conversion to CO₂
6 equivalents per unit of electric energy produced;
- 7 • Performance of future fossil fuel power systems;
- 8 • Projected capacity factors for alternatives means of generation; and
- 9 • Current and potential future reactor technologies.

10 In addition, studies may vary with respect to whether all or parts of a power plant's lifecycle are
11 analyzed, i.e., a full lifecycle analysis will typically address plant construction, operations,
12 resource extraction (for fuel and construction materials), and decommissioning, whereas a
13 partial lifecycle analysis primarily focuses on operational differences.

14 In the case of license renewal, a GHG analysis for that portion of the plant's lifecycle (operation
15 for an additional 20 years) would not involve GHG emissions associated with construction
16 because construction activities have already been completed at the time of relicensing. In
17 addition, the proposed action of license renewal would also not involve additional GHG
18 emissions associated with facility decommissioning, because that decommissioning must occur
19 whether the facility is relicensed or not. However, in some of the aforementioned studies, the
20 specific contribution of GHG emissions from construction, decommissioning, or other portions of
21 a plant's lifecycle cannot be clearly separated from one another. In such cases, an analysis of
22 GHG emissions would overestimate the GHG emissions attributed to a specific portion of a
23 plant's lifecycle. Nonetheless, these studies provide some meaningful information with respect
24 to the relative magnitude of the emissions among nuclear power plants and other forms of
25 electric generation, as discussed in the following sections.

26 In Tables 6-2, 6-3, and 6-4 the NRC staff presents the results of the aforementioned quantitative
27 studies to provide a weight-of-evidence evaluation of the relative GHG emissions that may
28 result from the proposed license renewal as compared to the potential alternative use of coal-
29 fired, natural gas-fired, and renewable generation. Most studies from Mortimer (1990) onward
30 suggest that uranium ore grades and uranium enrichment processes are leading determinants
31 in the ultimate GHG emissions attributable to nuclear power generation. These studies indicate
32 that the relatively lower order of magnitude of GHG emissions from nuclear power when
33 compared to fossil-fueled alternatives (especially natural gas) could potentially disappear if
34 available uranium ore grades drop sufficiently while enrichment processes continued to rely on
35 the same technologies.

1 *Summary of Nuclear Greenhouse Gas Emissions Compared to Coal*

2 Considering that coal fuels the largest share of electricity generation in the United States and
 3 that its burning results in the largest emissions of GHGs for any of the likely alternatives to
 4 nuclear power generation, including Kewaunee Power Station (KPS), most of the available
 5 quantitative studies focused on comparisons of the relative GHG emissions of nuclear to coal-
 6 fired generation. The quantitative estimates of the GHG emissions associated with the nuclear
 7 fuel cycle (and, in some cases, the nuclear lifecycle), as compared to an equivalent coal-fired
 8 plant, are presented in Table 6-2. The following chart does not include all existing studies, but
 9 provides an illustrative range of estimates developed by various researchers.

10 **Table 6-2. Nuclear Greenhouse Gas Emissions Compared to Coal**

Source	GHG Emission Results
Mortimer (1990)	Nuclear—230,000 tons CO ₂ Coal—5,912,000 tons CO ₂ Note: Future GHG emissions from nuclear to increase because of declining ore grade.
Andseta et al. (1998)	Nuclear energy produces 1.4 percent of the GHG emissions compared to coal. Note: Future reprocessing and use of nuclear-generated electrical power in the mining and enrichment steps are likely to change the projections of earlier authors, such as Mortimer (1990).
Spadaro (2000)	Nuclear—2.5 to 5.7 g Ceq/kWh Coal—264 to 357 g Ceq/kWh
Storm van Leeuwen and Smith (2005)	Authors did not evaluate nuclear versus coal.
Fritsche (2006) (Values estimated from graph in Figure 4)	Nuclear—33 g Ceq/kWh Coal—950 g Ceq/kWh
POST (2006) (Nuclear calculations from AEA, 2006)	Nuclear—5 g Ceq/kWh Coal—>1000 g Ceq/kWh Note: Decrease of uranium ore grade to 0.03 percent would raise nuclear to 6.8 g Ceq /kWh. Future improved technology and carbon capture and storage could reduce coal-fired GHG emissions by 90 percent.
Weisser (2006) (Compilation of results from other studies)	Nuclear—2.8 to 24 g Ceq/kWh Coal—950 to 1250 g Ceq/kWh
Fthenakis and Kim (2007)	Authors did not evaluate nuclear versus coal.
Dones (2007)	Author did not evaluate nuclear versus coal.

11 *Summary of Nuclear Greenhouse Gas Emissions Compared to Natural Gas*

12 The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle (and, in
 13 some cases, the nuclear lifecycle), as compared to an equivalent natural gas-fired plant, are

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1 presented in Table 6-3. The following chart does not include all existing studies, but provides an
 2 illustrative range of estimates developed by various researchers.

3 **Table 6-3. Nuclear Greenhouse Gas Emissions Compared to Natural Gas**

Source	GHG Emission Results
Mortimer (1990)	Author did not evaluate nuclear versus natural gas.
Andseta (1998)	Author did not evaluate nuclear versus natural gas.
Spadaro (2000)	Nuclear—2.5 to 5.7 g Ceq/kWh Natural Gas—120 to 188 g Ceq/kWh
Storm van Leeuwen and Smith (2005)	Nuclear fuel cycle produces 20 to 33 percent of the GHG emissions compared to natural gas (at high ore grades). Note: Future nuclear GHG emissions to increase because of declining ore grade.
Fritsche (2006) (Values estimated from graph in Figure 4)	Nuclear—33 g Ceq/kWh Cogeneration Combined Cycle Natural Gas—150 g Ceq/kWh
POST (2006) (Nuclear calculations from AEA, 2006)	Nuclear—5 g Ceq/kWh Natural Gas—500 g Ceq/kWh Note: Decrease of uranium ore grade to 0.03 percent would raise nuclear to 6.8 g Ceq/kWh. Future improved technology and carbon capture and storage could reduce natural gas GHG emissions by 90 percent.
Weisser (2006) (Compilation of results from other studies)	Nuclear—2.8 to 24 g Ceq/kWh Natural Gas—440 to 780 g Ceq/kWh
Fthenakis and Kim (2007)	Authors did not evaluate nuclear versus natural gas.
Dones (2007)	Author critiqued methods and assumptions of Storm van Leeuwen and Smith (2005), and concluded that the nuclear fuel cycle produces 15 to 27 percent of the GHG emissions of natural gas.

4
 5 *Summary of Nuclear Greenhouse Gas Emissions Compared to Renewable Energy Sources*
 6 The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle, as
 7 compared to equivalent renewable energy sources, are presented in Table 6-4. Calculation of
 8 GHG emissions associated with these sources is more difficult than the calculations for nuclear
 9 energy and fossil fuels because of the large variation in efficiencies due to their different
 10 sources and locations. For example, the efficiency of solar and wind energy is highly dependent
 11 on the location in which the power generation facility is installed. Similarly, the range of GHG
 12 emissions estimates for hydropower varies greatly depending on the type of dam or reservoir
 13 involved (if used at all). Therefore, the GHG emissions estimates for these energy sources have
 14 a greater range of variability than the estimates for nuclear and fossil fuel sources. The following
 15 chart does not include all existing studies, but provides an illustrative range of estimates
 16 developed by various researchers.

1 **Table 6-4. Nuclear Greenhouse Gas Emissions Compared to Renewable Energy Sources**

Source	GHG Emission Results
Mortimer (1990)	Nuclear—230,000 tons CO ₂ Hydropower—78,000 tons CO ₂ Wind power—54,000 tons CO ₂ Tidal power—52,500 tons CO ₂ Note: Future GHG emissions from nuclear to increase because of declining ore grade.
Andseta (1998)	Author did not evaluate nuclear versus renewable energy sources.
Spadaro (2000)	Nuclear—2.5 to 5.7 g Ceq/kWh Solar PV—27.3 to 76.4 g Ceq/kWh Hydroelectric—1.1 to 64.6 g Ceq/kWh Biomass—8.4 to 16.6 g Ceq/kWh Wind—2.5 to 13.1 g Ceq/kWh
Storm van Leeuwen and Smith (2005)	Author did not evaluate nuclear versus renewable energy sources.
Fritsche (2006) (Values estimated from graph in Figure 4)	Nuclear—33 g Ceq/kWh Solar PV—125 g Ceq/kWh Hydroelectric—50 g Ceq/kWh Wind—20 g Ceq/kWh
POST (2006) (Nuclear calculations from AEA, 2006)	Nuclear—5 g Ceq/kWh Biomass—25 to 93 g Ceq/kWh Solar PV—35 to 58 g Ceq/kWh Wave/Tidal—25 to 50 g Ceq/kWh Hydroelectric—5 to 30 g Ceq/kWh Wind—4.64 to 5.25 g Ceq/kWh Note: Decrease of uranium ore grade to 0.03 percent would raise nuclear to 6.8 g Ceq/kWh.
Weisser (2006) (Compilation of results from other studies)	Nuclear—2.8 to 24 g Ceq/kWh Solar PV—43 to 73 g Ceq/kWh Hydroelectric—1 to 34 g Ceq/kWh Biomass—35 to 99 g Ceq/kWh Wind—8 to 30 g Ceq/kWh
Fthenakis and Kim (2007)	Nuclear—16 to 55 g Ceq/kWh Solar PV—17 to 49 g Ceq/kWh
Dones (2007)	Author did not evaluate nuclear versus renewable energy sources.

1

2 **6.2.2 Conclusions: Relative GHG Emissions**

3 The sampling of data presented in Tables 6-2, 6-3, and 6-4 above demonstrates the challenges
4 of any attempt to determine the specific amount of GHG emission attributable to nuclear energy
5 production sources, as different assumptions and calculation methodology will yield differing
6 results. The differences and complexities in these assumptions and analyses will further
7 increase when they are used to project future GHG emissions. Nevertheless, several
8 conclusions can be drawn from the information presented.

9 First, the various studies indicate a general consensus that nuclear power currently produces
10 fewer GHG emissions than fossil-fuel-based electrical generation, e.g., the GHG emissions from
11 a complete nuclear fuel cycle currently range from 2.5 to 55 g C_{eq} /kWh, as compared to the use
12 of coal plants (264 to 1250 g C_{eq} /kWh) and natural gas plants (120 to 780 g C_{eq} /kWh). The
13 studies also provide estimates of GHG emissions from five renewable energy sources based on
14 current technology. These estimates included solar-photovoltaic (17 to 125 g C_{eq} /kWh),
15 hydroelectric (1 to 64.6 g C_{eq} /kWh), biomass (8.4 to 99 g C_{eq} /kWh), wind (2.5 to 30 g C_{eq} /kWh),
16 and tidal (25 to 50 g C_{eq} /kWh). The range of these estimates is wide, but the general conclusion
17 is that current GHG emissions from the nuclear fuel cycle are of the same order of magnitude as
18 from these renewable energy sources.

19 Second, the studies indicate no consensus on future relative GHG emissions from nuclear
20 power and other sources of electricity. There is substantial disagreement among the various
21 authors regarding the GHG emissions associated with declining uranium ore concentrations,
22 future uranium enrichment methods, and other factors, including changes in technology. Similar
23 disagreement exists regarding future GHG emissions associated with coal and natural gas for
24 electricity generation. Even the most conservative studies conclude that the nuclear fuel cycle
25 currently produces fewer GHG emissions than fossil-fuel-based sources, and is expected to
26 continue to do so in the near future. The primary difference between the authors is the projected
27 cross-over date (the time at which GHG emissions from the nuclear fuel cycle exceed those of
28 fossil-fuel-based sources) or whether cross-over will occur at all.

29 Considering the current estimates and future uncertainties, it appears that GHG emissions
30 associated with the proposed KPS relicensing action are likely to be lower than those
31 associated with fossil-fuel-based energy sources. The NRC staff based this conclusion on the
32 following rationale:

- 33 1. As shown in Tables 6-2 and 6-3, the current estimates of GHG emissions from the
34 nuclear fuel cycle are far below those for fossil-fuel-based energy sources;
- 35 2. KPS license renewal will involve continued GHG emissions due to uranium mining,
36 processing, and enrichment, but will not result in increased GHG emissions associated
37 with plant construction or decommissioning (as the plant will have to be decommissioned
38 at some point whether the license is renewed or not); and
- 39 3. Few studies predict that nuclear fuel cycle emissions will exceed those of fossil fuels
40 within a timeframe that includes the KPS periods of extended operation. Several studies

1 suggest that future extraction and enrichment methods, the potential for higher grade
2 resource discovery, and technology improvements could extend this timeframe.

3 In comparing GHG emissions among the proposed KPS license renewal action and renewable
4 energy sources, it appears likely that there will be future technology improvements and changes
5 in mining, processing, and constructing facilities of all types. Currently, the GHG emissions
6 associated with the nuclear fuel cycle and renewable energy sources are within the same order
7 of magnitude. Because nuclear fuel production is the most significant contributor to possible
8 future increases in GHG emissions from nuclear power, and because most renewable energy
9 sources lack a fuel component, it is likely that GHG emissions from renewable energy sources
10 would be lower than those associated with KPS at some point during the period of extended
11 operation.

12 The NRC staff provides an additional discussion about the contribution of GHGs to cumulative
13 air quality impacts in Chapter 4.11.5 of this SEIS.

15 6.3 REFERENCES

16 10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental
17 Protection Regulations for Domestic Licensing and Related Regulatory Functions."

18 10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for
19 Renewal of Operating Licenses for Nuclear Power Plants."

20 10 CFR Part 63. *Code of Federal Regulations*, Title 10, *Energy*, Part 63, "Disposal of High-Level
21 Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

22 40 CFR Part 191. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 191,
23 "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear
24 Fuel, High-Level and Transuranic Radioactive Waste."

25 AEA Technology (AEA). 2006. "Carbon Footprint of the Nuclear Fuel Cycle, Briefing Note."
26 Prepared for British Energy. March 2006.

27 Andseta, S., M.J. Thompson, J.P. Jarrell, and D.R. Pendergast. 1998. "CANDU Reactors and
28 Greenhouse Gas Emissions." Canadian Nuclear Association, 11th Pacific Basin Nuclear
29 Conference, Banff, Alberta, Canada. May 1998.

30 Dominion Energy Kewaunee (DEK). 2008. *Kewaunee Power Station, Applicant's*
31 *Environmental Report, Operating License Renewal Stage*, Glen Allen, Virginia. ADAMS
32 Accession Nos. ML082341020, ML082341038, and ML082341039.

33 Dones, R. 2007. "Critical Note on the Estimation by Storm Van Leeuwen J.W., and Smith P. of
34 the Energy Uses and Corresponding CO₂ Emissions for the Complete Nuclear Energy Chain."
35 Paul Sherer Institute. April 2007.

36 Fritsche, U.R. 2006. "Comparison of Greenhouse-Gas Emissions and Abatement Cost of
37 Nuclear and Alternative Energy Options from a Life-Cycle Perspective." Oko-Institut, Darmstadt
38 Office. January 2006.

Environmental Impacts of the Uranium Fuel Cycle

- 1 Fthenakis, V.M. and H.C. Kim. 2007. Greenhouse-gas emissions from solar-electric and nuclear
2 power: A life cycle study. *Energy Policy*, Volume 35, Number 4.
- 3 International Atomic Energy Agency (IAEA). 2000. "Nuclear Power for Greenhouse Gas
4 Mitigation under the Kyoto Protocol: The Clean Development Mechanism (CDM)." November
5 2000.
- 6 Mortimer, N. 1990. "World Warms to Nuclear Power." *SCRAM Safe Energy Journal*. December
7 1989 and January 1990. Available URL:
8 http://www.no2nuclearpower.org.uk/articles/mortimer_se74.php (accessed February 29, 2007).
- 9 Organization for Economic Co-Operation and Development, Nuclear Energy Agency (NEA).
10 2002. *Nuclear Energy and the Kyoto Protocol*.
- 11 Parliamentary Office of Science and Technology (POST). 2006. "Carbon Footprint of Electricity
12 Generation." Postnote, Number 268. October 2006.
- 13 Schneider, M. 2000. *Climate Change and Nuclear Power*. World Wildlife Fund for Nature. April
14 2000.
- 15 Spadaro, J.V., L. Langlois and B. Hamilton. 2000. "Greenhouse Gas Emissions of Electricity
16 Generation Chains: Assessing the Difference." IAEA Bulletin 42/2/2000, Vienna, Austria.
- 17 Storm van Leeuwen, J.W. and P. Smith 2005. *Nuclear Power—The Energy Balance*. August
18 2005.
- 19 U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement*
20 *for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C,
21 1996. ADAMS Accession Nos. ML040690705 and ML040690738.
- 22 U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement*
23 *for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1,
24 Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final
25 Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.
- 26 Weisser, D. 2006. "A Guide to Life-Cycle Greenhouse Gas (GHG) Emissions from Electric
27 Supply Technologies." Available URL:
28 [http://www.iaea.org/OurWork/ST/NE/Pess/assets/GHG_manuscript_pre-](http://www.iaea.org/OurWork/ST/NE/Pess/assets/GHG_manuscript_pre-print_versionDanielWeisser.pdf)
29 [print_versionDanielWeisser.pdf](http://www.iaea.org/OurWork/ST/NE/Pess/assets/GHG_manuscript_pre-print_versionDanielWeisser.pdf) (accessed May 19, 2009).

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 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 did not identify any new and significant information during the review of the Dominion Energy Kewaunee, Inc. (DEK) environmental report (DEK, 2008a), 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 all of these issues, the GEIS concluded that the impacts are SMALL.

Table 7-1. Issues Related to Decommissioning. *Decommissioning would occur regardless if Kewaunee Power Station (KPS) is shut down at the end of its current operating license or at the end of the period of extended operation. There are no site-specific issues related to decommissioning.*

Issues	GEIS Sections	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

Dominium Energy Kewaunee, Inc. (DEK). 2008a. Kewaunee Power Station, Applicant's Environmental Report, Operating License Renewal Stage, Glen Allen, Virginia. ADAMS Accession Nos. ML082341020, ML082341038, and ML082341039.

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

U.S. Nuclear Regulatory Commission (NRC). 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. ADAMS Accession No. ML040690720.

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1

2 U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement*
3 *for Decommissioning of Nuclear Facilities*: Supplement 1, Regarding the Decommissioning of
4 Nuclear Power Reactors. NUREG-0586, Supplement 1, Washington, D.C. ADAMS Accession
5 Nos. ML023500228 and ML023500412.

8.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The National Environmental Policy Act of 1969 (NEPA) mandates that each environmental impact statement (EIS) consider alternatives to any proposed major Federal action. U.S. Nuclear Regulatory Commission (NRC) regulations implementing NEPA for license renewal require that a supplemental environmental impact statement (SEIS) considers and weighs the environmental effects of the proposed action [license renewal]; the environmental impacts of alternatives to the proposed action; and alternatives available for reducing or avoiding adverse environmental impacts, per 10 CFR 51.71(d). In this case, the proposed Federal action is issuing a renewed license for the Kewaunee Power Station (KPS), which will allow the plant to operate for 20 years beyond its current license expiration date.

In this chapter, the staff examines the potential environmental impacts of alternatives to issuing a renewed operating license for KPS.

While the *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants*, NUREG-1437 (NRC 1996, 1999), reached generic conclusions regarding many environmental issues associated with license renewal, it did not determine which alternatives are reasonable or reach conclusions about site-specific environmental impact levels. Therefore, the staff must evaluate environmental impacts of alternatives on a site-specific basis.

In accordance with the GEIS, alternatives to the proposed action of issuing renewed KPS operating license must meet the purpose and need for issuing a renewed license; they must 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, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers (10 CFR 51.71(f)).

The staff ultimately makes no decision regarding whether an alternative or the proposed action is implemented, since that decision falls to utility, State, or other Federal officials. Comparing the environmental effects of these alternatives will assist the staff in deciding whether the environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable (10 CFR 51.95(c)(4)). If the NRC acts to issue a renewed license, all of the alternatives, including the proposed action, will be available to energy-planning decision makers. If the NRC decides not to renew the license (or takes no action at all), then energy-planning decision makers may no longer elect to continue operating KPS and will have to resort to another alternative, which may or may not be one of the alternatives the staff considers in this section, in order to meet their energy needs.

In addition to evaluating alternatives to the proposed action, when appropriate the staff also examines alternatives that may reduce or avoid environmental impacts of the proposed action; the staff does so to illustrate how such alternatives may act to mitigate potential impacts of license renewal.

In evaluating alternatives to license renewal, the staff first selects energy technologies or options currently in commercial operation as well as some technologies not currently in commercial operation but likely to be commercially available by the time the current KPS

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2 operating license expires. Given that only four years
4 remain before the KPS license expires, the options staff
6 considers in this section are generally commercially
8 available today.

10 Second, the staff screens the alternatives to remove those
12 that cannot meet future system needs. Then, the staff
14 screens the remaining options to remove those for which
16 the cost or benefits do not justify inclusion in the range of
18 reasonable alternatives. Any alternatives remaining
20 constitute alternatives to the proposed action that the staff
22 evaluates in-depth throughout this section. In Section 8.5,
24 the staff briefly addresses each alternative that was
26 removed during screening.

28 The staff initially considered 14 discrete potential
30 alternatives to the proposed action and narrowed the list to
32 the two single-source alternatives and two combination
34 alternatives considered in this chapter.

36 Once the staff identified the in-depth alternatives, it
38 referred to generic environmental impact evaluations in the
40 GEIS. The GEIS provides overviews of some energy
42 technologies available at the time of its publishing in 1996,
44 though it does not reach any conclusions regarding which
46 alternatives are most appropriate, nor does it precisely
48 categorize impacts for each site. Since 1996, many energy
50 technologies have evolved significantly in capability and
52 cost-effectiveness, while regulatory structures have
54 changed to either promote or impede development of
56 particular alternatives.

58 Where applicable, the staff uses information in the GEIS
59 and includes updated information from the Energy Information Administration (EIA), other
60 organizations within the Department of Energy (DOE), the Environmental Protection Agency
61 (EPA), industry sources and publications, and information submitted by Dominion Energy
62 Kewaunee, Inc. (DEK) in the KPS environmental report (ER).

63 For each in-depth analysis, the staff analyzes environmental impacts across seven impact
64 categories: air quality, groundwater use and quality, surface water use and quality, ecology,
65 human health, socioeconomics, and waste management. As in earlier chapters of this draft
66 SEIS, the staff uses the NRC's three-level standard of significance—SMALL, MODERATE, or
67 LARGE—to indicate the intensity of environmental effects for each alternative that the staff
68 evaluates in-depth.

In-Depth Alternatives:

- **Natural gas-fired combined-cycle**
- **Coal-fired alternative**
- **Combination including gas-fired, conservation, and wind (Combination Option 1) or wood-fired (Combination Option 2)**

Other Alternatives Considered:

- **Wind power**
- **Wood-fired**
- **Conservation**
- **Solar power**
- **Conventional hydroelectric power**
- **Geothermal power**
- **Biofuels**
- **New nuclear**
- **Oil-fired power**
- **Fuel cells**
- **Municipal solid waste**
- **Delayed retirement**

1 By placing the detailed alternatives analyses in
 2 this order, the staff does not imply which
 3 alternative would have the least impact, or which
 4 alternative an energy planning decision maker
 5 would be most likely to implement. Whenever
 6 possible, the staff considers effects from locating
 7 the alternative at the existing site, as well as at
 8 an alternate site. In general, impacts are smaller
 9 at an existing site because infrastructure
 10 necessary to support a power plant already
 11 exists, nearby populations are accustomed to
 12 power plant operations, and the site has already
 13 been disturbed to some degree.

14 Sections 8.1 through 8.3 include the staff's
 15 analyses of environmental impacts of alternatives
 16 to license renewal. These include a gas-fired
 17 alternative located both at the KPS site and at a
 18 different site (8.1), a coal-fired alternative at the
 19 KPS site and an alternate site (8.2), and two
 20 combination alternatives that include gas-fired
 21 capacity onsite as well as conservation and either
 22 wind power or wood-fired power (8.3). In section
 23 8.4, the staff briefly discusses purchased power.
 24 In Section 8.5, the staff addresses alternatives
 25 excluded from in-depth analysis and addresses
 26 why they were excluded. Finally, in Section 8.6,
 27 the staff considers the environmental effects that
 28 may occur if NRC takes no action and does not
 29 issue renewed licenses for KPS.

30 **8.1 GAS-FIRED GENERATION**

31 In this section, the staff evaluates the
 32 environmental impacts of natural gas-fired generation at both the KPS site and at an alternate
 33 site.

34 Natural gas fueled 21 percent of electric generation in the United States in 2008, accounting for
 35 the second greatest share of electrical power after coal (EIA, 2009b). Like coal-fired power
 36 plants, natural gas-fired plants may be affected by perceived or actual action to limit greenhouse
 37 gas (GHGs) emissions, though they produce markedly fewer GHGs per unit of electrical output
 38 than coal-fired plants. Natural gas-fired power plants are feasible, commercially-available
 39 options for providing electrical generating capacity beyond the current license terms for KPS.
 40 EIA projects that gas-fired generation will account for the largest share of capacity additions in
 41 the United States through 2030 (EIA, 2009a).

42 Combined-cycle power plants differ significantly from power plants that generate electricity
 43 solely from a steam cycle, as almost all coal-fired and all existing domestic nuclear power plants

Energy Outlook: Each year the EIA, part of the DOE, issues its updated *Annual Energy Outlook (AEO)*. *AEO 2009* indicates that natural gas will account for most new electrical capacity through 2030, with significant contributions from new renewable sources and coal, as well as some growth in nuclear capacity (EIA, 2009a)

“Natural-gas-fired plants account for 53 percent of capacity additions in the reference case [2008-2030], as compared with 22 percent for renewables, 18 percent for coal-fired plants, and 5 percent for nuclear. Escalating construction costs have the largest impact on capital-intensive technologies, including renewables, coal, and nuclear []; but Federal tax incentives, State energy programs, and rising prices for fossil fuels increase the cost-competitiveness of renewable and nuclear capacity. In contrast, uncertainty about future limits on GHG [greenhouse gas] emissions and other possible environmental regulations ... reduces the competitiveness of coal.”

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1 do. Combined-cycle power plants derive the majority of their electrical output from a gas-turbine
2 cycle, and then generate additional power—without burning any additional fuel—through a
3 second, steam-turbine cycle. The first, gas-turbine stage (similar to a large jet engine) burns
4 natural gas that turns a driveshaft to power an electric generator. Ducts carry the hot exhaust
5 from the turbine to a heat recovery steam generator, which then produces steam to drive
6 another turbine and produce additional electrical power. The combined-cycle approach is
7 significantly more efficient than any one cycle on its own; efficiencies can reach or exceed 60
8 percent. Natural gas combined-cycle generation requires significantly less cooling water and
9 smaller cooling towers than the existing KPS, partly because of greater thermal efficiency and
10 partly because gas turbines do not require condenser cooling like steam turbines do.

11 In order to replace the 556 megawatts-electric (MWe) output that KPS currently supplies, the
12 NRC staff selected a gas-fired alternative that uses two General Electric Company (GE)
13 MS7001FB combined cycle units, which together produce a net of 560 MWe (roughly 4 percent
14 of gross plant output would power auxiliary systems, so the gross output is approximately
15 585 MWe). While any number of commercially-available combined-cycle units could be installed
16 in a variety of combinations to replace the power currently produced by KPS, the MS7001FB is
17 an efficient model that operates at a heat rate of 5,950 British thermal units per kilowatt hour
18 (Btu/kWh), or 57.3 percent thermal efficiency (GE, 2007). GE and other manufacturers, like
19 Siemens, offer similar high efficiency models, including several that slightly exceed the thermal
20 efficiency of this model. Cooling towers for this alternative would likely be mechanical draft-type
21 towers approximately 65 feet (20 m) in height.

22 In addition to cooling towers, other visible structures onsite would include the turbine buildings
23 and heat recovery steam generators (which may be enclosed in the turbine building), two
24 exhaust stacks, an electrical switchyard, and, possibly, equipment associated with a natural gas
25 pipeline, like a compressor station. The GEIS estimated that a 1,000 MWe gas-fired alternative
26 would require 110 acres (40 ha), meaning this 560-MWe plant would require 64 acres (26 ha).
27 In their ER, DEK (2008) indicated that the plant would require 26 acres (11 ha), a number more
28 consistent with minimum utility needs as demonstrated by existing power plants (including
29 Dominion Resources' Fairless Energy Works located in Falls Township, Pennsylvania). The
30 staff uses DEK's estimate for the purposes of the following analysis. According to DEK, a gas-
31 fired plant constructed onsite would also require 272 acres (110 ha) for a natural gas pipeline. A
32 gas-fired plant constructed at an alternate site would likely require a new pipeline spur, as well.
33 For the purpose of this analysis, the staff assumes that a gas-fired alternative at an alternate
34 site would require a similar amount of land for a pipeline and associated right of way (ROW).

35 This 560-MWe power plant would consume 25.3 billion ft³ (718 million m³) of natural gas
36 annually, assuming an average heat content of 1,021 British thermal units per cubic feet (Btu/ft³)
37 (EIA, 2008). Natural gas would be extracted from the ground through wells in another region of
38 the United States, then treated to remove impurities (like hydrogen sulfide), and blended to
39 meet pipeline gas standards, before being piped through the interstate pipeline system to the
40 power plant site. This gas-fired alternative would produce relatively little waste, which would
41 primarily be in the form of spent catalysts used for emissions controls.

42 Environmental impacts from the gas-fired alternative will be greatest during construction. Site
43 crews will clear vegetation from the site, prepare the site surface, and begin excavation before
44 other crews begin actual construction on the plant and any associated infrastructure, including a

1 pipeline spur to serve the plant and electricity transmission infrastructure connecting the plant to
 2 existing transmission lines.

3 Constructing the gas-fired alternative on the KPS site would allow the gas-fired alternative to
 4 make use of the site’s existing transmission system, as well as take advantage of partially
 5 cleared areas of the site.

6 A gas-fired unit constructed offsite may cause additional construction-related impacts depending
 7 on the nature of the site selected. A site that has never been developed will likely experience
 8 greater impacts than a site that was previously industrial; a site near other power plants or
 9 industrial facilities will likely experience smaller impacts than a site surrounded by farmland or
 10 relatively natural surroundings.

11 **Table 8-1. Summary of Environmental Impacts of Gas-Fired Combined-Cycle Generation**
 12 **Compared to Continued Kewaunee Power Station Operation**

	Gas-fired combined-cycle		Continued KPS Operation
	At KPS site	At alternate site	
Air Quality	MODERATE	MODERATE	SMALL
Groundwater	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL to MODERATE	SMALL
Ecology	SMALL to MODERATE	SMALL to MODERATE	SMALL
Human Health	SMALL	SMALL	SMALL
Socioeconomics	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	SMALL

13 **8.1.1 Air Quality**

14 Kewaunee County, Wisconsin, where KPS is located, is in EPA Region 5 and is in attainment
 15 for all criteria pollutants, except ozone. Kewaunee County is a maintenance area for 8-hour
 16 ozone (EPA, 2009a).

17 A new gas-fired generating plant in Kewaunee County would qualify as a new major-emitting
 18 industrial facility and require New Source Review (NSR) and Prevention of Significant
 19 Deterioration of Air Quality review under the Clean Air Act (CAA), as adopted by Wisconsin
 20 Department of Natural Resources (WDNR) in the Wisconsin Administrative Code and its
 21 Statutes (EPA, 2008a; Wis. Adm. Code chapters NR400-499; Wis. Stats. Chapter 285). The
 22 EPA delegated the authority of regulating the issuance of construction and operating permits to
 23 the WDNR, which coordinates the Wisconsin air pollution control permit program for new and
 24 existing pollution sources. A natural gas-fired plant would also need to comply with the
 25 standards of performance for electric utility steam generating units set forth in Title 40 of the
 26 *Code of Federal Regulations* (CFR) Part 60 Subpart Da.

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1 Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future and
2 remedying existing impairment of visibility in mandatory Class I Federal areas when impairment
3 results from man-made air pollution. The EPA issued a regional haze rule in 1999 (64 FR
4 35714; EPA, 1999). The rule specifies that for each mandatory Class I Federal area located
5 within a State, the State must establish goals that provide for reasonable progress toward
6 achieving natural visibility conditions through developing and implementing air quality protection
7 plans to reduce the pollution that causes visibility impairment. There are five regional planning
8 organizations (RPO) that are collaborating on the visibility impairment issue and developing the
9 technical basis for these plans. Wisconsin, Illinois, Indiana, Michigan and Ohio belong to the
10 Midwest Regional Planning Organization (Midwest RPO) that along with tribes, Federal
11 agencies and other interested parties identifies regional haze and visibility issues and develops
12 strategies to address them. The visibility protection regulatory requirements, contained in 40
13 CFR Part 51, Subpart P, include the review of the new sources that would be constructed in the
14 attainment or unclassified areas and may affect visibility in any Federal Class I area (40 CFR
15 51.307). If a coal-fired plant were located close to a mandatory Class I area, additional air
16 pollution control requirements would be imposed.

17 There are no Mandatory Class I Federal areas in the State of Wisconsin or in close proximity to
18 KPS. The closest Mandatory Class I Federal Areas to KPS are Seney Wilderness Area,
19 Michigan, located 149 miles northeast from KPS, and Isle Royale National Park, Michigan,
20 located 255 miles northwest of KPS.

21 The emissions from the natural gas-fired alternative at the KPS site, based on published EIA
22 data, EPA emission factors and on performance characteristics for this alternative and
23 implemented emission controls, would be:

- 24 ● Sulfur oxides (SO_x) – 43.98 tons (39.90 Metric ton(s) (MT)) per year
- 25 ● Nitrogen oxides (NO_x) – 141.00 tons (127.91 MT) per year
- 26 ● Carbon monoxide (CO) – 29.31 tons (26.59 MT) per year
- 27 ● Total suspended particles (TSP) – 24.58 tons (22.30 MT) per year
- 28 ● Particulate matter (PM) PM₁₀ – 24.58 tons (22.30 MT) per year
- 29 ● Carbon dioxide (CO₂) – 1,513,164.22 tons (1,372,719.49 MT) per year

30 The new natural gas-fired plant would have to comply with Title IV of the CAA reduction
31 requirements for sulfur dioxide (SO₂) and NO_x, which are the main precursors of acid rain and a
32 major cause of reduced visibility. Title IV establishes maximum SO₂ and NO_x emission rates for
33 existing plants and a system of SO₂ emission allowances that can be used, sold or saved for
34 future use by new plants. On March 10, 2005, the EPA issued the Clean Air Interstate Rule
35 (CAIR), which would create large permanent reductions in SO₂ and NO_x across 28 eastern
36 states and the District of Columbia. However, petitions for review of the CAIR and CAIR Federal
37 Implementation Plans (FIPs), including the provisions establishing the CAIR NO_x annual and
38 ozone season and SO₂ trading programs, were filed in the U.S. Court of Appeals for the D.C.
39 Circuit.

40 On July 11, 2008, the Court issued an opinion vacating and remanding the CAIR and CAIR
41 FIPs. After requested rehearing of the Court's decision, the Court granted rehearing only to the
42 extent that it remanded the rules to EPA without vacating them on December 23, 2008. This
43 ruling leaves CAIR and the CAIR FIPs, including the CAIR trading programs, in place until EPA

1 issues a new rule to replace CAIR in accordance with the July 11, 2008 decision. Wisconsin is
2 among the States covered by this rule (EPA, 2009b). WDNR adopted the rule and is allocating
3 annual NOx allowances for new electricity generating units subject to CAIR as specified in
4 chapter NR 432 of the Wisconsin Administrative Code starting 2009. The NOx allowances are
5 allocated from a "new unit set-aside" reserved pool of allowances, which represents 7 percent of
6 Wisconsin's total budget of NOx allowances.

7 As stated above, the new natural gas-fired alternative would produce 43.98 tons (39.90 MT) per
8 year of SOx and 141.00 tons (127.91 MT) per year of NOx based on the use of the dry low NOx
9 combustion technology and use of the selective catalytic reduction (SCR) in order to
10 significantly reduce NOx emissions.

11 The new plant would be subjected to the continuous monitoring requirements of SO₂, NOx and
12 CO₂ specified in 40 CFR Part 75. The natural gas-fired plant would emit approximately
13 1,513,164.22 tons (1,372,719.49 MT) per year of unregulated CO₂ emissions. As of today, there
14 is no required reporting of GHG emissions. In response to the Consolidated Appropriations Act
15 of 2008, the EPA proposed a rule that would require mandatory reporting of GHG emissions
16 from large sources, such as the presented alternative. The rule would allow for the collection of
17 accurate and comprehensive emissions data to inform future policy decisions. The EPA
18 proposes that suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles
19 and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions
20 submit annual reports to the EPA. The gases covered by the proposed rule are CO₂, methane
21 (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulfur
22 hexafluoride (SF₆), and other fluorinated gases including nitrogen trifluoride (NF₃) and
23 hydrofluorinated ethers (HFE).

24 In 1993, WDNR conducted the "Wisconsin Greenhouse Gas Emissions Inventory and Emission
25 Reduction Cost Study," and, in 1998, developed the Climate Change Action Plan. The
26 Wisconsin GHG emissions inventory is periodically updated. In 2007, following the signing of
27 Executive Order (E.O.) 191 by the governor of Wisconsin, the Governor's Task Force on Global
28 Warming was created. The Task Force outlined its mission, goals and recommendations in the
29 2008 final report to the governor, "Wisconsin's Strategy for Reducing Global Warming" (WDNR,
30 2009).

31 The gas-fired alternative would emit 24.58 tons (22.30 MT) per year of particulate matter having
32 an aerodynamic diameter less than or equal to 10 micrometer (µm) (PM₁₀) (40 CFR 50.6a). All
33 emitted particulates are PM₁₀.

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

40 Activities associated with the construction of a new natural gas-fired plant onsite or offsite would
41 cause some additional air effects as a result of equipment emissions and fugitive dust from the
42 operation of the earth moving and material handling equipment. Exhaust emissions from

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1 workers' vehicles and motorized construction equipment would be temporary. Construction
2 crews would employ dust-control practices in order to control and reduce fugitive dust, which
3 would be temporary in nature. The staff concludes that the impact of vehicle exhaust emissions
4 and fugitive dust from operation of the earth-moving and material handling equipment would be
5 SMALL.

6 The overall air-quality impacts of a new natural gas-fired plant located at the KPS site or at an
7 alternate site would be MODERATE, primarily due to emissions released during plant operation.

8 **8.1.2 Groundwater Use and Quality**

9 The use of groundwater for a natural gas-fired combined-cycle plant (onsite or offsite) would
10 likely be limited to supply wells for drinking water and possibly filtered service water for system
11 cleaning purposes. For an onsite alternative, total usage would likely be much less than KPS
12 because fewer workers would be onsite and because the gas-fired alternative would have fewer
13 auxiliary systems requiring service water.

14 No effects on groundwater quality would be apparent except during the construction phase due
15 to temporary dewatering (if necessary) and run-off control measures. Because of the temporary
16 nature of construction and the likelihood of reduced groundwater usage during operation as
17 compared to KPS, the impact of the gas-fired alternative (onsite or offsite) would be SMALL.

18 **8.1.3 Surface Water Use and Quality**

19 Total withdrawals of surface water from Lake Michigan would be much less for an onsite gas-
20 fired plant than the 401,200 gallons per minute (gpm) (894 cubic feet per second (cfs) or 25.3
21 cubic meter per second (m³/s)) average currently used by KPS. However, by switching from the
22 open-cycle cooling system currently used by KPS to a closed-cycle cooling system used by the
23 proposed alternative, consumptive water losses will increase. Because the onsite gas-fired plant
24 would draw water from Lake Michigan and not a small river with reduced flow, the NRC
25 concludes the impact of surface water use from the onsite alternative would be SMALL. If the
26 alternate offsite location is also adjacent to Lake Michigan, the NRC concludes that the impact
27 of surface water use will also be SMALL, but could be MODERATE if the plant withdrew cooling
28 water from a small river with low flow.

29 A new gas-fired plant (onsite or offsite) would be required to obtain a Wisconsin Pollutant
30 Discharge and Elimination System (WPDES) permit from the WDNR for regulation of industrial
31 wastewater, storm water, and other discharges. Assuming the plant operates within the limits of
32 this permit, the impact from any possible site runoff and effluent discharges on surface water
33 quality would be SMALL.

34 **8.1.4 Aquatic and Terrestrial Ecology**

35 Aquatic Ecology

36 A new gas-fired plant would require a source of water for the plant's closed-cycle cooling
37 system, and a discharge point for cooling tower blowdown. Locating the plant on the existing
38 KPS site will enable some already-existing buildings and infrastructure to be used; however,
39 impacts to aquatic ecology are likely during construction regardless of where the plant is

1 located. Site disturbance will likely increase erosion and sedimentation runoff into Lake
2 Michigan and nearby streams, increasing turbidity. While site procedures and management
3 practices, as well as using already-existing structures on the KPS site when possible, may limit
4 this effect, the impact will likely be noticeable. Overall construction effects are expected to be
5 less significant for the gas-fired alternative than the coal-fired alternative because the amount of
6 site disturbance is less and many of the major plant components are smaller and require less
7 onsite fabrication.

8 During operations, the gas-fired alternative would require significantly less water for cooling than
9 either the coal-fired alternative or the existing KPS unit, which would minimize the potential for
10 impingement and entrainment and lessen the thermal discharge from the plant. Spills occurring
11 during onsite activities will need to be appropriately handled, and runoff from new, impervious
12 surfaces (e.g., roads and rooftops) may affect aquatic ecology, as could deposition of airborne
13 pollutants to surface water, though these impacts are likely to be less pronounced than those
14 from the coal-fired alternative.

15 Overall impacts to aquatic ecology from a gas-fired alternative are expected to be SMALL.

16 Terrestrial Ecology

17 Constructing the natural gas alternative, if the location is off site, will require approximately
18 32 acres (13 ha) of land. Land requirements would be minimal if the location is on the current
19 KPS site. These land disturbances form the basis for impacts to terrestrial ecology. (Gas
20 extraction and collection will also affect terrestrial ecology in offsite gas fields, although, as
21 noted in Section 8.1, much of this land is likely already disturbed by gas extraction, and the
22 incremental effects of this alternative on gas field terrestrial ecology are difficult to gauge.)

23 Impacts to terrestrial ecology will be minor if the selected site is the current KPS site because
24 the site has been previously disturbed. Impacts to terrestrial ecology could be adverse if the
25 location is off site; however, locating an offsite gas-fired plant on a previously disturbed site
26 would minimize impacts. There is potential for disturbance of some areas with trees, Lake
27 Michigan shoreline, or wetlands, and possible habitat fragmentation would occur. Construction
28 of any additional transmission line ROWs, a lengthy pipeline, or additional roads on undisturbed
29 or less-disturbed areas could adversely impact terrestrial ecology by fragmenting or destroying
30 habitats. However, a pipelined fuel source and a small workforce would help to minimize the
31 need for additional transportation infrastructure.

32 In addition, construction onsite, if some shorelines are impacted, or some of the forested lands
33 and/or wetlands are converted to building facilities may eliminate onsite habitats and alter the
34 site for a long period of time. Some areas onsite, such as any buffer areas, may remain
35 undeveloped and could still harbor habitat for terrestrial species, though site lighting, noise, and
36 activities may degrade the value of any remaining ecosystems. Deposition of air pollutants from
37 this alternative may affect terrestrial ecology, but it is unlikely to be noticeable. Impacts to
38 terrestrial resources from a natural gas combined-cycle alternative at both the KPS site and an
39 alternate site would like be SMALL to MODERATE. Some of these impacts could be mitigated if
40 the location of the gas-fired alternative is either placed on the current KPS site or on a
41 previously disturbed location.

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8.1.5 Human Health

The effects of gas-fired generation on human health are generally low, although in Table 8-2 of the GEIS (NRC, 1996), the staff identified cancer and emphysema as potential health risks from gas-fired plants. These risks are likely attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. It is expected that appropriate emission controls installed on the gas-fired alternative option would maintain NO_x emissions well below EPA air quality standards established for the protection of human health. In addition, the use of emissions trading or offset requirements would ensure that the overall NO_x in the region will not increase. There are potential health risks to plant workers from handling spent catalysts used to filter the emissions, because they may contain toxic heavy metals. However, the use of protective equipment and adherence to safety requirements would minimize the danger to the workers. It is expected that the facility would operate in compliance with Federal and State safety and emission standards.

Overall, the impacts on human health of the natural gas-fired alternative are likely to be SMALL.

8.1.6 Socioeconomics

Land Use

The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a two unit natural gas-fired combined-cycle power plant at the KPS site and an alternative site. Land-use impacts would vary depending on where the plant would be located and whether construction would take place on undeveloped land or within a previously disturbed industrial (brownfield) area.

DEK indicated that over 298 acres (121 ha) of land would be needed to support a natural gas-fired alternative capable of replacing the KPS (DEK, 2008) including pipeline. The GEIS, however, estimates 110 acres (45 ha) of land would be needed to support a 1,000-MWe generating station (NRC, 1996). DEK estimated that 272 acres would be needed for a natural gas pipeline connection to KPS. This amount of land use would include other plant structures and associated infrastructure. By scaling the GEIS estimate, the 590-MWe KPS plant could require up to 336 acres (136 ha) of land.

However, if additional land would be necessary for a buffer around plant structures or to support transmission lines at an alternate site and gas pipelines at both KPS and at an alternate site, the staff believes the DEK estimate to be reasonable, although additional land may be used for buffer around plant structures or to support transmission lines. Even assuming additional land use for these purposes, total land required by the natural gas-fired alternative is unlikely to exceed 298 acres (121 ha) for all uses, excluding land for natural gas wells and collection stations. Land use impacts from construction would be SMALL, and could be further reduced if the power plant is collocated at an alternate site with another generating station or on a previously industrial site like KPS. Impacts could be further mitigated at an alternate site by constructing new transmission lines in existing ROWs.

In addition to onsite land requirements, land would be required off site for natural gas wells and collection stations. The GEIS estimates that 3,600 acres (1,457 ha) would be required for wells, collection stations, and pipelines to bring the gas to a 1,000-MWe generating facility. If this land

1 requirement were scaled with generating capacity, a natural gas-fired power plant at the KPS
2 could require 2,124 acres (860 ha). Most of this land requirement would occur on land where
3 gas extraction already occurs. In addition, some natural gas could come from outside of the
4 United States and be delivered as liquefied gas.

5 The elimination of uranium fuel for the KPS could partially offset offsite land requirements. In the
6 GEIS, the NRC staff estimated that approximately 1,000 acres (405 ha) would not be needed for
7 mining and processing uranium during the operating life of a 1,000-MWe nuclear power plant.
8 For KPS, roughly 590 acres (239 ha) of uranium mining area would no longer be needed.
9 Overall land use impacts from a gas-fired power plant would be SMALL to MODERATE,
10 depending on local land use and the availability of land near the proposed site.

11 Socioeconomics

12 Socioeconomic impacts are defined in terms of changes to the demographic and economic
13 characteristics and social conditions of a region. For example, the number of jobs created by the
14 construction and operation of a new natural gas-fired power plant could affect regional
15 employment, income, and expenditures. Two types of job creation may occur: (1) construction-
16 related jobs, which are transient, short in duration, and less likely to have a long-term
17 socioeconomic impact; and (2) operation-related jobs in support of power plant operations,
18 which have the greater potential for permanent, long-term socioeconomic impacts. Staff
19 estimated workforce requirements of power plant construction and operations for the natural
20 gas-fired power plant alternative in order to determine their possible effect on current
21 socioeconomic conditions.

22 The GEIS projects a workforce of 1,200 for a 1,000-MWe plant, which means a workforce of
23 approximately 708 for a 590-MWe plant. During construction, the communities surrounding the
24 power plant site would experience increased demand for rental housing and public services,
25 although these effects would be moderated if the alternate construction site is located near an
26 urban area with many skilled workers. The relative economic effect of construction workers on
27 local economy and tax base would vary over time.

28 After construction, local communities may be temporarily affected by the loss of construction
29 jobs and associated loss in demand for business services, and the rental housing market could
30 experience increased vacancies and decreased prices. As noted in the GEIS, the
31 socioeconomic impacts at a rural construction site could be larger than at an urban site,
32 because the workforce would have to move to be closer to the construction site. The impact of
33 construction on socioeconomic conditions could range from SMALL to MODERATE depending
34 on whether the new power plant would be located at KPS or an alternate site. The
35 socioeconomic impacts of power plant construction could be further reduced if the power plant
36 is located near an urban area with many skilled workers.

37 DEK estimated a power plant operations workforce of 20 (DEK, 2008), while scaled GEIS
38 estimates indicate up to 89 workers (150 operations workers for a 1,000-MWe plant). The DEK
39 estimate appears to be low, but is consistent with trends toward lowering labor costs by
40 reducing the size of power plant operations workforces. Nevertheless, depending on location,
41 the small number of operations workers would not likely have a noticeable effect on

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1 socioeconomic conditions in the region. Therefore, socioeconomic impacts associated with the
2 operation of a gas-fired power plant could be SMALL at KPS or an alternate site.

3 Transportation

4 During construction, approximately 700 workers would be commuting to the site. In addition to
5 commuting workers, trucks would transport construction materials and equipment to the
6 worksite increasing the amount of traffic on local roads. The increase in vehicular traffic would
7 peak during shift changes resulting in temporary levels of service impacts and delays at
8 intersections. Pipeline construction and modification to existing natural gas pipeline systems
9 could also have an impact.

10 During plant operations, transportation impacts would almost disappear. As noted in this
11 section, relatively few workers are required to operate the gas-fired alternative. Since fuel is
12 transported by pipeline, most transportation infrastructure would experience little increased use
13 from plant operations.

14 Overall, the gas-fired alternative would have a SMALL impact on transportation conditions in the
15 region around the KPS or at an alternate site. Transportation impacts at an alternate site would
16 depend on road capacity and average daily volume.

17 Aesthetics

18 Aesthetic resources are the natural and manmade features that give a particular landscape its
19 character and aesthetic quality. The aesthetics impact analysis focuses on the degree of
20 contrast between the power plant and the surrounding landscape and the visibility of the power
21 plant.

22 The two gas-fired units could be approximately 100 feet (30 m) tall, with two exhaust stacks up
23 to 175 feet (53 m) tall or taller depending on the topography at an alternate site. Some
24 structures may require aircraft warning lights. Power plant infrastructure would generally be
25 smaller and less noticeable than the KPS. Mechanical draft cooling towers would generate
26 condensate plumes and operational noise. Noise during power plant operations would be limited
27 to industrial processes and communications. Pipelines delivering natural gas fuel could be
28 audible off site near compressors.

29 In addition to new power plant structures, the alternate plant site may require the construction of
30 transmission lines and natural gas pipelines. The transmission lines would have a lasting visual
31 effect on the landscape.

32 In general, aesthetic changes would be limited to the immediate vicinity of the KPS or an
33 alternate site. Impacts would likely to be SMALL to MODERATE at KPS or an alternate site and
34 would depend on the amount of new transmission line required.

35 Historic and Archaeological Resources

36 Cultural resources are the indications of human occupation and use of the landscape as defined
37 and protected by a series of Federal laws, regulations, and guidelines. Prehistoric resources are
38 physical remains of human activities that predate written records; they generally consist of
39 artifacts that may alone or collectively yield information about the past. Historic resources

1 consist of physical remains that postdate the emergence of written records; in the United States,
2 they are architectural structures or districts, archaeological objects, and archaeological features
3 dating after 1492. Ordinarily, sites less than 50 years old are not considered historic, but
4 exceptions can be made for such properties if they are of particular importance, such as
5 structures associated with the development of nuclear power (e.g., Shippingport Atomic power
6 Station) or Cold War themes. American Indian resources are sites, areas, and materials
7 important to American Indians for religious or heritage reasons. Such resources may include
8 geographic features, plants, animals, cemeteries, battlefields, trails, and environmental features.
9 The cultural resource analysis encompassed the power plant site and adjacent areas that could
10 potentially be disturbed by the construction and operation of alternative power plants.

11 The potential for historic and archaeological resources can vary greatly depending on the
12 location of the proposed site. To consider a project's effects on historic and archaeological
13 resources, any proposed areas will need to be surveyed to identify and record historic and
14 archaeological resources, identify cultural resources (e.g., traditional cultural properties), and
15 develop possible mitigation measures to address any adverse effects from ground disturbing
16 activities. Studies will be needed for all areas of potential disturbance at the proposed plant site
17 and along associated corridors where new construction will occur (e.g., roads, transmission
18 corridors, rail lines, or other ROWs). In most cases, project proponents should avoid areas with
19 the greatest sensitivity.

20 The impact for a gas-fired alternative at the KPS site would be SMALL. As noted in Section
21 4.9.6, DEK conducted a survey of the KPS site in 2007 and is developing a Cultural Resources
22 Management Plan. This plan includes pre-job briefings for workers and an inadvertent discovery
23 (stop work) provision. Depending on the resource richness of an alternative site ultimately
24 chosen for the gas-fired alternative, impacts could range from SMALL to MODERATE.

25 Environmental Justice

26 The environmental justice impact analysis evaluates the potential for disproportionately high and
27 adverse human health and environmental effects on minority and low-income populations that
28 could result from the construction and operation of a new natural gas-fired power plant. Adverse
29 health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on
30 human health. Disproportionately high and adverse human health effects occur when the risk or
31 rate of exposure to an environmental hazard for a minority or low-income population is
32 significant and exceeds the risk or exposure rate for the general population or for another
33 appropriate comparison group. The minority and low-income populations are subsets of the
34 general public residing around the site, and all are exposed to the same hazards generated
35 from various power plant operations.

36 Minority and low-income populations could be affected by the construction and operation of a
37 new natural gas-fired power plant. Some of these effects have been identified in resource areas
38 discussed in this section. The extent of disproportionate effect is difficult to determine since it
39 would depend on the location of the natural gas-fired power plant. For example, increased
40 demand for rental housing during construction could disproportionately affect low-income
41 populations. However, demand for rental housing could be mitigated if the alternate plant site is
42 constructed near a metropolitan area.

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1 Impacts on minority and low-income populations from the construction and operation of a
2 natural gas-fired power plant alternative could range from SMALL to MODERATE, due to the
3 small number of workers needed to construct and operate the natural gas-fired power plant.

4 **8.1.7 Waste Management**

5 During the construction stage of this alternative, land clearing and other construction activities
6 would generate waste that can be recycled, disposed onsite or shipped to an offsite waste
7 disposal facility. If the alternative were constructed at the KPS site or any previously disturbed
8 site, the amounts of wastes produced during land-clearing would be reduced.

9 During the operational stage, spent SCR catalysts, which are used to control NOx emissions
10 from the natural gas-fired plants, would make up the majority of the waste generated by this
11 alternative.

12 The staff concluded in the GEIS (NRC, 1996) that a natural gas-fired plant would generate
13 minimal waste and the waste impacts would be SMALL for a natural gas-fired alternative
14 located at the KPS site or offsite.

15 **8.2 COAL-FIRED GENERATION**

16 Coal-fired generation accounts for a greater share of U.S. electrical power generation than any
17 other fuel (EIA, 2009b). While coal-fired power plants are widely used and are likely to remain
18 widely used, the staff notes that future coal capacity additions may be affected by perceived or
19 actual efforts to limit greenhouse gas emissions. For now, the staff considers a coal-fired
20 alternative to be a feasible, commercially available option that could provide electrical
21 generating capacity after KPS's current license expires.

22 Supercritical technologies are increasingly common in new coal-fired plants. Supercritical plants
23 operate at higher temperatures and pressures than most existing coal-fired plants (beyond
24 water's "critical point", where boiling no longer occurs and no clear phase change occurs
25 between steam and liquid water). Operating at higher temperatures and pressures allows this
26 coal-fired alternative to operate at a higher thermal efficiency than many existing coal-fired
27 power plants do. While supercritical facilities are more expensive to construct, they consume
28 less fuel for a given output, reducing environmental impacts. Based on technology forecasts
29 from EIA, the staff expects that a new, supercritical coal-fired plant beginning operation in 2014
30 would operate at a heat rate of 9,069 Btu/kWh, or approximately 38 percent thermal efficiency
31 (EIA, 2009c).

32 In a supercritical coal-fired power plant, burning coal heats pressurized water. As the
33 supercritical steam/water mixture moves through plant pipes to a turbine generator, the
34 pressure drops and the mixture flashes to steam. The heated steam expands across the turbine
35 stages, which then spin and turn the generator to produce electricity. After passing through the
36 turbine, any remaining steam is condensed back to water in the plant's condenser.

37 In most modern U.S. facilities, condenser cooling water circulates through cooling towers or a
38 cooling pond system (either of which are closed-cycle cooling systems). Older plants often
39 withdraw cooling water directly from existing rivers or lakes and discharge heated water directly

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1 to the same body of water (called open-cycle cooling). In this case, a coal-fired alternative
2 constructed on the KPS site would withdraw makeup water from and discharge blowdown
3 (water containing concentrated dissolved solids and biocides) from cooling towers back to Lake
4 Michigan. As KPS currently uses a once-through cooling system, it is possible that a new coal-
5 fired plant on the KPS site could continue to use the existing KPS intake for a once-through
6 cooling system. The staff will evaluate a closed-cycle option, as it results in lower operational
7 impacts to aquatic life. At the same time, a closed-cycle option may increase aesthetic impacts
8 as well as construction-stage impacts.

9 In order to replace the 556 net MWe that KPS currently supplies, the coal-fired alternative would
10 need to produce roughly 618 gross MWe, using about 6 percent of power output for onsite
11 power usage. Onsite electricity demands include scrubbers, cooling towers, coal-handling
12 equipment, lights, communication, and other onsite needs. A supercritical coal-fired power plant
13 equivalent in capacity to KPS and using the same cooling system would require less cooling
14 water than KPS because the alternative operates at a higher thermal efficiency.

15 The coal-fired power plant would consume 2.27 million tons (2.06 million MT) of coal annually
16 assuming an average heat content of 8,967 British thermal units per pound (Btu/lb) (EIA, 2008).
17 EIA reported that most coal consumed in Wisconsin originates in Wyoming. Given current coal
18 mining operations in the State of Wyoming, the coal used in this alternative would likely be
19 mined in surface mines, then mechanically processed and washed, before being transported—
20 via an existing rail spur—to the power plant site. Limestone for scrubbers would also arrive by
21 rail. This coal-fired alternative would then produce roughly 123,400 tons (112,000 MT) of ash,
22 and roughly 42,300 tons (38,400 MT) scrubber sludge annually. As noted above, much of the
23 coal ash and scrubber sludge could be reused depending on local recycling and reuse markets.

24 Environmental impacts from the coal-fired alternative will be greatest during construction. Site
25 crews will clear the plant site of vegetation, prepare the site surface, and begin excavation
26 before other crews begin actual construction on the plant and any associated infrastructure.

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1 **Table 8-2. Summary of Environmental Impacts of the Coal-Fired Alternative Compared to**
 2 **Continued Kewaunee Power Station Operation**

	Coal-fired Alternative		Continued KPS Operation
	At the KPS Site	At an Alternative Site	
Air Quality	MODERATE	MODERATE	SMALL
Groundwater	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL to MODERATE	SMALL
Ecology	MODERATE	MODERATE	SMALL
Human Health	SMALL	SMALL	SMALL
Socioeconomics	SMALL to LARGE	SMALL to LARGE	SMALL TO MODERATE
Waste Management	MODERATE	MODERATE	SMALL

3 **8.2.1 Air Quality**

4 The coal-fired generation air quality impacts can be substantial because of the significant
 5 quantity of SO_x, NO_x, particulates, CO emissions, hazardous air pollutants (HAPs) such as
 6 mercury, and naturally occurring radioactive materials resulting from the process. However,
 7 many of these pollutants can be effectively controlled by various technologies.

8 KPS is located in Kewaunee County, Wisconsin, which is a maintenance area for 8-hour ozone
 9 and in attainment for all other criteria air pollutants. A new coal-fired generating plant would
 10 qualify as a new major-emitting industrial facility and would require new source review (NSR)
 11 and Prevention of Significant Deterioration of Air Quality review under the under CAA (EPA,
 12 2008a). The NSR program requires that a permit be obtained before construction of the new
 13 major-emitting industrial facility (42 USC 7475(a)). The EPA delegated the authority of
 14 regulating the issuance of the construction and operating permits to the WDNR, which
 15 coordinates the Wisconsin air pollution control permit program for new and existing pollution
 16 sources. The new coal-fired generating plant would also have to comply with the new source
 17 performance standards for coal-fired plants set forth in 40 CFR 60 Subpart Da. The standards
 18 establish limits for particulate matter and opacity (40 CFR 60.42(a)), SO₂ (40 CFR 60.43(a)),
 19 and NO_x (40 CFR 60.44(a)).

20 Section 169A of the CAA (42 USC 7401) establishes a national goal of preventing future and
 21 remedying existing impairment of visibility in mandatory Class I Federal areas when impairment
 22 results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (64 FR
 23 35714; EPA, 1999). The rule specifies that for each mandatory Class I Federal area located
 24 within a State, the State must establish goals that provide for reasonable progress toward
 25 achieving natural visibility conditions through developing and implementing air quality protection
 26 plans to reduce the pollution that causes visibility impairment. As noted in 8.1.1, there are
 27 Regional Planning Organizations (RPOs) collaborating on the visibility impairment issue,
 28 developing the technical basis for these plans. Wisconsin, Illinois, Indiana, Michigan, and Ohio
 29 belong to the Midwest RPO that along with tribes, Federal agencies and other interested parties

1 identifies regional haze and visibility issues and develops strategies to address them. The
 2 visibility protection regulatory requirements, contained in 40 CFR Part 51, Subpart P, include the
 3 review of the new sources that would be constructed in the attainment or unclassified areas and
 4 may affect visibility in any Federal Class I area (40 CFR 51.307). If a coal-fired plant were
 5 located close to a mandatory Class I area, additional air pollution control requirements would be
 6 imposed. There are no Mandatory Class I Federal areas in the State of Wisconsin or in the
 7 close proximity to KPS. The closest Mandatory Class I Federal Areas to KPS are Seney
 8 Wilderness Area, Michigan, located 149 miles northeast from KPS, and Isle Royale National
 9 Park, Michigan, located 255 miles northwest from KPS.

10 The emissions from the coal-fired alternative at KPS site, based on published Energy
 11 Information Administration (EIA) data, EPA emission factors, and on performance
 12 characteristics for this alternative and implemented emission controls, would likely be:

- 13 • Sulfur oxides (SO_x) – 775.81 tons (703.80 MT) per year
- 14 • Nitrogen oxides (NO_x) – 567.11 tons (514.47 MT) per year
- 15 • Total suspended particles (TSP) – 61.70 tons (55.97 MT) per year
- 16 • Particulate matter (PM) PM₁₀ – 123.40 tons (111.95 MT) per year
- 17 • Particulate matter (PM) PM_{2.5} – 61.70 tons (55.97 MT) per year
- 18 • Carbon monoxide (CO) – 567.11 tons (514.47 MT) per year
- 19 • Mercury (Hg) – 0.09 tons (0.08 MT) per year

20 Sulfur oxides emissions and nitrogen oxides emissions. The coal-fired alternative at the KPS
 21 site would likely use wet, limestone-based scrubbers to remove SO_x. The EPA indicates that
 22 this technology can remove more than 95 percent of SO_x from flue gases. NRC staff projects
 23 total SO_x emissions would be 775.81 tons (703.80 MT) per year.

24 On March 10, 2005, the EPA issued the Clean Air Interstate Rule (CAIR), which would create
 25 large permanent reductions in SO₂ and NO_x across 28 eastern states and the District of
 26 Columbia. However, petitions for review of the CAIR and CAIR Federal Implementation Plans
 27 (FIPs), including the provisions establishing the CAIR NO_x annual and ozone season and SO₂
 28 trading programs, were filed in the U.S. Court of Appeals for the D.C. Circuit. On July 11, 2008,
 29 the Court issued an opinion vacating and remanding the CAIR and CAIR FIPs. After requested
 30 rehearing of the Court's decision, the Court granted rehearing only to the extent that it
 31 remanded the rules to the EPA without vacating them on December 23, 2008. This ruling leaves
 32 CAIR and the CAIR FIPs, including the CAIR trading programs, in place until the EPA issues a
 33 new rule to replace CAIR in accordance with the July 11, 2008 decision. Wisconsin is among
 34 the States covered by this rule (EPA, 2009b). WDNR adopted the rule and is allocating annual
 35 NO_x allowances for new electricity generating units subject to CAIR as specified in chapter NR
 36 432 of the Wisconsin Administrative Code starting in 2009. The NO_x allowances are allocated
 37 from a "new unit set-aside" reserved pool of allowances, which represents 7 percent of
 38 Wisconsin's total budget of NO_x allowances.

39 SO_x emissions from a new coal-fired power plant would be subject to the requirements of Title
 40 IV of the CAA. Title IV was enacted to reduce emissions of SO₂ and NO_x, the two principal
 41 precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV
 42 caps aggregate annual power plant SO₂ emissions and imposes controls on SO₂ emissions
 43 through a system of marketable allowances. The EPA issues one allowance for each ton of SO₂

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1 that a unit is allowed to emit. New units do not receive allowances, but are required to have
2 allowances to cover their SO₂ emissions. Owners of new units must therefore purchase
3 allowances from owners of other power plants or reduce SO₂ emissions at other power plants
4 they own. Allowances can be banked for use in future years. Thus, provided a new coal-fired
5 power plant is able to purchase sufficient allowances to operate, it would not add to net regional
6 SO₂ emissions, although it might do so locally.

7 A coal-fired alternative constructed either at the KPS site or offsite would most likely employ
8 various available NO_x-control technologies, which can be grouped into two main categories:
9 combustion modifications and post-combustion processes. Combustion modifications include
10 low-NO_x burners, over fire air, flue gas recirculation and operational modifications. Post-
11 combustion processes include SCR, selective noncatalytic reduction and hybrid processes.
12 Effective combination of the combustion modifications and post-combustion processes can
13 reduce NO_x emissions by up to 95 percent. DEK would use the combination low-NO_x burners,
14 over fire air and SCR technologies in order to reduce NO_x emissions from this alternative.
15 Assuming the use of such technologies at KPS site, NO_x emissions after scrubbing are
16 estimated at 567.11 tons (514.47 MT) annually.

17 Section 407 of the CAA establishes technology-based NO_x emissions limitations. A new coal-
18 fired power plant would be subject to the new source performance standards for such plants as
19 indicated in 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR
20 49422), limits the discharge of any gases that contain NO_x to 200 nanograms (ng) per joule (J)
21 of gross energy output (equivalent to 1.6 lb/megawatt hours (MWh)), based on a 30-day rolling
22 average.

23 Particulate emissions. The new coal-fired power plant would use fabric filters to remove
24 particulates from flue gases. DEK indicates that fabric filters would remove 99.9 percent of
25 particulate matter (DEK, 2008). The EPA notes that filters are capable of removing in excess of
26 99 percent of particulate matter and that SO₂ scrubbers further reduce particulate matter
27 emissions (EPA, 2008b). As such, NRC staff believes DEK removal factor is appropriate. Based
28 on this, the new supercritical coal-fired plant would emit 123.40 tons (111.95 MT) per year of
29 PM₁₀ and approximately 61.70 tons (55.97 MT) per year of PM_{2.5}. In addition, coal-handling
30 equipment would introduce fugitive dust emissions when fuel is being transferred to onsite
31 storage and then reclaimed from storage for use in the plant.

32 During the construction of a coal-fired plant, onsite activities would also generate fugitive dust.
33 Also vehicles of the workers and motorized equipment would create exhaust emissions during
34 the construction process. However, these impacts would be intermittent and short-termed.
35 There would be dust-control measures implemented in order to minimize dust generation.

36 Carbon monoxide emissions. Based on EPA emission factors (EPA, 1998), NRC staff estimates
37 that the total CO emissions would be approximately 567.11 tons (514.47 MT) per year.

38 Hazardous Air Pollutants including mercury. The EPA is in the process of developing emissions
39 standards for power plants under the Clean Air Act (Section 112), including mercury emissions,
40 following the D.C. Circuit Court's February 8, 2008 ruling that vacated EPA's Clean Air Mercury
41 Rule (CAMR) (EPA, 2007). Before CAMR, the EPA determined that coal- and oil-fired electric
42 utility steam-generating units are significant emitters of HAPs (EPA, 2000a). The EPA

1 determined that coal plants emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen
2 chloride, hydrogen fluoride, lead, manganese, and mercury (EPA, 2000a). The EPA concluded
3 that mercury is the HAP of greatest concern and that (1) a link exists between coal combustion
4 and mercury emissions, (2) electric utility steam-generating units are the largest domestic
5 source of mercury emissions, and (3) certain segments of the U.S. population (e.g., the
6 developing fetus and subsistence fish-eating populations) are believed to be at potential risk of
7 adverse health effects resulting from mercury exposures caused by the consumption of
8 contaminated fish (EPA, 2000a). In light of the court's decision, the EPA will revisit mercury
9 regulation, although it is possible that the agency will continue to regulate mercury as a HAP,
10 thus requiring the use of best available control technology to prevent its release to the
11 environment. The Wisconsin Mercury Rule, revised in 2008, requires all new coal-fired power
12 plants to achieve Maximum Achievable Control Technology (MACT) in order to reduce
13 emissions of hazardous air pollutants, including mercury, and specifies that the permitted
14 mercury reduction shall not be less than 90 percent of the removal of mercury from combusted
15 coal (WDNR, 2008).

16 Carbon Dioxide. A coal-fired plant would also have unregulated CO₂ emissions during
17 operations as well as during mining, processing, and transportation. The coal-fired plant would
18 emit between 4,176,024.00 tons (3,788,425.25 MT) to 4,326,548.00 tons (3,924,978.32 MT) of
19 CO₂ per year, depending on the type and quality of the coal.

20 Summary of Air Quality

21 While the GEIS analysis mentions global warming from unregulated CO₂ emissions and acid
22 rain from SO_x and NO_x emissions as potential impacts, it does not quantify emissions from
23 coal-fired power plants. However, the GEIS analysis implies that air impacts would be
24 substantial (NRC, 1996). The above analysis shows that emissions of air pollutants, including
25 SO_x, NO_x, CO, and particulates, exceed those produced by the existing nuclear power plant, as
26 well as those of the other alternatives considered in this section. Operational emissions of CO₂
27 are also much greater under the coal-fired alternative. Adverse human health effects such as
28 cancer and emphysema have also been associated with air emissions from coal combustion,
29 and are discussed further in Section 8.2.5.

30 The NRC analysis for a coal-fired alternative at an alternate site indicates that impacts from the
31 coal-fired alternative would have clearly noticeable effects, but given existing regulatory
32 regimes, permit requirements, and emissions controls, the coal-fired alternative would not
33 destabilize air quality. Therefore, the appropriate characterization of air impacts from coal-fired
34 plant located at KPS site would be MODERATE. Existing air quality would result in varying
35 needs for pollution control equipment to meet applicable local and federal requirements, or
36 varying degrees of participation in emissions trading schemes.

37 **8.2.2 Groundwater Use and Quality**

38 If the onsite coal-fired alternative continued to use groundwater for drinking water and service
39 water, the need for groundwater at the plant would be minor, with supply wells used for potable
40 drinking water and various service water functions. Total usage would likely be much less than
41 KPS because fewer workers would be onsite and because the coal-fired unit would have fewer
42 auxiliary systems requiring service water. No effect on groundwater quality would be apparent. If

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1 an alternative site is chosen, the need for groundwater use for plant operations would likely be
2 minor.

3 Construction of a coal-fired plant (onsite or offsite) could have a localized effect on groundwater
4 due to temporary dewatering and run-off control measures. Because of the temporary nature of
5 construction and the likelihood of reduced groundwater usage during operation, the impact of
6 the coal-fired alternative would be SMALL.

7 **8.2.3 Surface Water Use and Quality**

8 Because the onsite alternative would draw water from Lake Michigan, most of the approximately
9 8,000 gpm (0.5 m³/s) needed for maximum withdrawal would be taken from the lake with an
10 average consumptive loss of about 10 million gallons per day (mgd) (0.4 m³/s). The alternative
11 would use a closed-cycle system with cooling towers, which would increase consumptive water
12 losses from the currently operating open-cycle cooling system used by KPS. However, because
13 the onsite coal-fired plant would draw water from Lake Michigan and not a small river, the NRC
14 concludes the impact of surface water use would be SMALL. If the chosen alternative site is
15 also adjacent to Lake Michigan, the NRC concludes that the impact of surface water use will
16 also be SMALL, but could increase to MODERATE if the plant relies on a small river with low
17 flow for cooling water.

18 Any new coal-fired plant in the area (onsite or offsite) would be required to obtain a WPDES
19 permit from the WDNR for regulation of industrial wastewater, storm water, and other
20 discharges. Assuming the plant operates within the limits of this permit, the impact from any
21 possible runoff from coal piles and effluent discharges on surface water quality would be
22 SMALL.

23 **8.2.4 Aquatic and Terrestrial Ecology**

24 A new coal-fired plant would require a source of water for the plant's cooling system, most likely
25 a closed-cycle cooling tower system, and a discharge point for cooling tower blowdown.
26 Locating the plant on the existing KPS site will enable some already-existing buildings and
27 infrastructure to be used; however, impacts to aquatic ecology are likely during construction
28 regardless of where the plant is located. Site disturbance will likely increase erosion and
29 sedimentation runoff into Lake Michigan and nearby streams, increasing turbidity. While site
30 procedures and management practices, as well as using already-existing structures on the KPS
31 site when possible, may limit this effect, the impact will likely be noticeable.

32 Surface mining of coal, which would occur offsite, is associated with degradation of aquatic
33 communities due to acid mine drainage, sedimentation, and diversion or destruction of streams,
34 lakes, and ponds. High sediment levels can kill fish directly, bury spawning beds, and alter
35 water temperature and flow. Federal law requires mining operations to meet standards for
36 protecting surface and groundwater from contamination, which would minimize sedimentation
37 and other contaminants to the extent possible. Transportation of coal and limestone would likely
38 occur via barge and would also contribute to erosion. Manitowoc, located 18 miles (29 km)
39 south-southwest of the KPS site, and Green Bay, located 27 miles (44 km) west-northwest of
40 the site, have coal docks, though no rail spur connects the site to either location. A new docking
41 facility would likely need to be constructed, which would require dredging bottom sediments and

1 construction of breakwaters and docks. Dredging of bottom sediments will disrupt aquatic
 2 communities and, depending on the extent of dredging, could impair benthic communities by
 3 removing suitable substrate.

4 Following construction, the greater thermal efficiency of the coal-fired alternative versus the
 5 existing KPS unit will result in slightly less consumptive water use for cooling and blowdown.
 6 During operations, disposal of waste materials will have to comply with local and State
 7 regulations, some of which are intended to prevent runoff into surface water. Management of
 8 runoff from coal piles will also be necessary. Spills occurring during onsite activities will need to
 9 be appropriately handled, and runoff from new, impervious surfaces (e.g., roads and rooftops)
 10 may affect aquatic ecology, as could deposition of acids or chemicals emitted through the
 11 plant's stacks. Given current regulations, as well as the emission controls discussed in the Air
 12 Quality section, these impacts may be noticeable, but are not likely to be destabilizing.

13 Overall impacts to aquatic ecology from a coal-fired alternative are expected to be MODERATE.

14 As indicated in previous sections, constructing the coal-fired alternative will require 129 acres
 15 (52 ha) of land if located offsite, and will not require additional land if located on the current KPS
 16 site. Coal-mining operation will also affect terrestrial ecology in offsite coal mining areas,
 17 although some of the land is likely already disturbed by mining operations. Onsite and offsite
 18 land disturbances form the basis for impacts to terrestrial ecology.

19 Impacts to terrestrial ecology will vary based on the degree to which the proposed plant site is
 20 already disturbed. On a previous industrial site, impacts to terrestrial ecology would be minor,
 21 unless substantial transmission line ROWs, railways, or roads would need to be constructed
 22 through less disturbed areas. These construction activities may have a cumulative effect of
 23 fragmenting or destroying habitats. Any onsite or offsite water disposal by landfilling will also
 24 affect terrestrial ecology at least through the time period when the disposal area is reclaimed.
 25 Some areas onsite, such as buffer areas, may remain undeveloped and could serve as habitat
 26 for terrestrial species, though site lighting, noise, and activities may degrade the value of these
 27 ecosystems. Deposition of acid rain or other emissions can also affect terrestrial ecology. Given
 28 the emission controls discussed in Section 8.2.1, air deposition impacts may be noticeable, but
 29 are not likely to be destabilizing. Impacts to terrestrial resources from a coal-fired alternative
 30 would be SMALL to MODERATE, and occur mostly during construction. Some of these impacts
 31 could be mitigated if the location of the coal-fired alternative is the current KPS site or on a
 32 previously disturbed location.

33 **8.2.5 Human Health**

34 Coal-fired power plants introduce worker risks from coal and limestone mining, from coal and
 35 limestone transportation, and from disposal of coal combustion and scrubber wastes. In
 36 addition, there are public risks from inhalation of stack emissions and the secondary effects of
 37 eating foods grown in areas subject to deposition from plant stacks.

38 In Table 8-2 of the GEIS (NRC, 1996), the staff stated that human health impacts (cancer and
 39 emphysema) could result from inhalation of toxins and particulates, but it did not identify the
 40 significance of these impacts. Enforcement by the EPA and/or State agencies of regulations
 41 restricting harmful emissions from coal-fired plants has significantly reduced the potential health

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1 effects, but has not eliminated them. These agencies also impose site-specific emission limits,
2 as needed, to protect human health. Even if the coal-fired alternative were located in a
3 designated nonattainment area, the use of emission trading or offset mechanisms could prevent
4 further regional degradation. However, localized effects could be visible. Many of the byproducts
5 of coal combustion responsible for health effects are largely controlled, captured, or converted
6 to a benign state in modern power plants, although some level of health effects may remain.

7 Aside from emission impacts, the coal-fired alternative introduces the risk of coal pile fires and
8 for those plants that use coal combustion liquid and sludge waste impoundments, the release of
9 the waste due to a failure of the impoundment. However, the occurrence of these types of
10 events is relatively rare.

11 It is expected that the facility would operate in compliance with Federal and State safety and
12 emission standards.

13 Overall, the impacts on human health of the coal-fired alternative are likely to be SMALL.

14 **8.2.6 Socioeconomics**

15 Land Use

16 As discussed in 8.1.6, the analysis of land use impacts focuses on the amount of land area that
17 would be affected by the construction and operation of a coal-fired power plant at the KPS site
18 and an alternative site. Land-use impacts would vary depending on where the plant would be
19 located and whether construction would take place on undeveloped land or within a previously
20 disturbed industrial (brownfield) area.

21 DEK indicated that 136 acres (55 ha) of land would be needed to support a coal-fired alternative
22 capable of replacing the KPS. The GEIS estimates 1,700 acres (700 ha) would be needed to
23 support a 1,000-MWe generating station (NRC, 1996). This amount of land use includes power
24 plant structures and associated coal delivery and waste disposal infrastructure. By scaling GEIS
25 estimates, a 590-MWe plant could require approximately 1,000 acres (405 ha) of land.

26 However, if additional land would be necessary for a buffer around plant structures or to support
27 transmission lines at an alternate site and rail and barge offloading facilities at KPS and an
28 alternate site, the staff believes the DEK estimate to be low and additional land would be
29 needed to support a rail yard and coal offloading facility. Even assuming additional land use for
30 these purposes, total land required by the coal-fired alternative is unlikely to exceed 1,000 acres
31 (405 ha) for all uses, excluding coal mining. The coal-fired alternative would require
32 approximately 30 acres (12 ha) of land area for waste disposal. Land use impacts from
33 construction would be MODERATE to LARGE, and could be reduced if the power plant is
34 collocated at an alternate site with another generating station or on a previously industrial site
35 like KPS. Impacts could be further mitigated at an alternate site by constructing new
36 transmission lines in existing ROWs.

37 Offsite land use impacts would occur from coal mining in addition to land use impacts from the
38 construction and operation of the new power plant. The GEIS indicates that approximately
39 22,000 acres (8,903 ha) of land could be affected by mining coal and waste disposal to support
40 a 1,000-MWe coal plant during its operational life (NRC, 1996). Therefore, to replace KPS

1 approximately 12,980 acres (5,253 ha) of land could be affected by coal mining. However, most
 2 of the land in existing coal-mining areas has already experienced some level of disturbance.
 3 The elimination of the need for uranium mining to supply fuel for the KPS would partially offset
 4 this offsite land use impact. The GEIS estimates that approximately 1,000 acres (405 ha) of land
 5 would be affected by uranium mining and processing for a 1,000-MWe nuclear plant. For the
 6 KPS, roughly 590 acres (239 ha) of land used for uranium mining and processing would no
 7 longer be needed.

8 Based on this information, land use impacts could range from MODERATE to LARGE,
 9 depending on local land use and the availability of land near the proposed site. Some portion of
 10 this impact could be mitigated by constructing the rail spur in existing ROWs.

11 Socioeconomics

12 The GEIS projected a peak workforce of 1,200 to 2,500 workers for a 1,000-MWe plant, or a
 13 peak of 708 to 1,475 workers for a replacement for KPS. During construction, the communities
 14 surrounding the power plant site would experience increased demand for rental housing and
 15 public services, although these effects would be moderated if the alternate construction site is
 16 located near an urban area with many skilled workers. The relative economic effect of
 17 construction workers on local economy and tax base would vary over time.

18 After construction, local communities may be temporarily affected by the loss of construction
 19 jobs and associated loss in demand for business services, and the rental housing market could
 20 experience increased vacancies and decreased prices. As noted in the GEIS, the
 21 socioeconomic impacts at a rural construction site could be larger than at an urban site,
 22 because the workforce would need to relocate closer to the construction site. The impact of
 23 construction on socioeconomic conditions could range from MODERATE to LARGE depending
 24 on whether the new power plant would be located at KPS or an alternate site. The
 25 socioeconomic impacts of power plant construction could be further reduced if the power plant
 26 is located near an urban area with many skilled workers.

27 DEK estimated an operational workforce of 79 (DEK, 2008), while scaling estimates from the
 28 GEIS indicate the need for 148 workers (250 operations workers for a 1,000-MWe plant). The
 29 DEK estimate appears low, but is consistent with trends calling for decreased workforces at
 30 power facilities. Even at rural sites, impacts are unlikely to be large. The small number of
 31 operations workers would not likely have a noticeable effect on socioeconomic conditions in the
 32 region. Depending on location, operations impacts would likely be SMALL to MODERATE.

33 Transportation

34 During construction, approximately 1,500 workers would be commuting to the site. In addition to
 35 commuting workers, trucks would transport construction materials and equipment to the
 36 worksite increasing the amount of traffic on local roads. The increase in vehicular traffic would
 37 peak during shift changes resulting in temporary levels of service impacts and delays at
 38 intersections. Trains and/or barges could also be used to deliver large components to the KPS
 39 site or an alternate site. Transportation impacts are likely to be MODERATE to LARGE during
 40 construction.

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1 During operations, approximately 150 workers would be commuting to the coal-fired power
2 plant. Frequent deliveries of coal and limestone by rail and barge could add to the overall
3 transportation impact. Onsite coal storage would make it possible to receive several trains per
4 day. Limestone could also likely be delivered by rail and barge, which could add additional traffic
5 (though considerably less traffic than that generated by coal deliveries).

6 The coal-fired alternative would likely create SMALL to MODERATE transportation impacts
7 during plant operations depending on whether coal and limestone is delivered by rail and barge.
8 Transportation impacts at an alternate site would depend on road capacity and average daily
9 volume.

10 Aesthetics

11 The coal-fired alternative's boiler building would be up to 200 feet (61 m) tall and may be visible
12 offsite in daylight hours at KPS and depending on the topography at an alternate site. The
13 exhaust stack would be up to 500 feet (183 m) high. If the coal-fired alternative makes use of
14 natural-draft cooling towers, then additional impacts would occur from the towers, which may be
15 several hundred feet tall and topped with condensate plumes. Mechanical draft towers would
16 also generate condensate plumes but would be markedly shorter than natural-draft towers.
17 Other buildings onsite may also affect aesthetics. Noise and light from plant operations, as well
18 as lighting on plant structures, may be detectable offsite.

19 In addition to new power plant structures, the alternate plant site may require the construction of
20 transmission lines. The transmission lines would have a lasting visual effect on the landscape.

21 In general, aesthetic changes would be limited to the immediate vicinity of the KPS or an
22 alternate site. Impacts would likely to be SMALL to MODERATE at KPS and an alternate site
23 and would depend on the amount of new transmission line required.

24 Historic and Archaeological Resources

25 Cultural resources are the indications of human occupation and use of the landscape as defined
26 and protected by a series of Federal laws, regulations, and guidelines. Prehistoric resources are
27 physical remains of human activities that predate written records; they generally consist of
28 artifacts that may alone or collectively yield information about the past. Historic resources
29 consist of physical remains that postdate the emergence of written records; in the United States,
30 they are architectural structures or districts, archaeological objects, and archaeological features
31 dating after 1492. Ordinarily, sites less than 50 years old are not considered historic, but
32 exceptions can be made for such properties if they are of particular importance, such as
33 structures associated with the development of nuclear power (e.g., Shippingport Atomic power
34 Station) or Cold War themes. American Indian resources are sites, areas, and materials
35 important to American Indians for religious or heritage reasons. Such resources may include
36 geographic features, plants, animals, cemeteries, battlefields, trails, and environmental features.
37 The cultural resource analysis encompassed the power plant site and adjacent areas that could
38 potentially be disturbed by the construction and operation of alternative power plants.

39 The potential for historic and archaeological resources can vary greatly depending on the
40 location of the proposed site. To consider a project's effects on historic and archaeological
41 resources, any proposed areas will need to be surveyed to identify and record historic and

1 archaeological resources, identify cultural resources (e.g., traditional cultural properties), and
2 develop possible mitigation measures to address any adverse effects from ground disturbing
3 activities. Studies will be needed for all areas of potential disturbance at the proposed plant site
4 and along associated corridors where new construction will occur (e.g., roads, transmission
5 corridors, rail lines, or other ROWs). In most cases, project proponents should avoid areas with
6 the greatest sensitivity.

7 The impact for a coal-fired alternative at the KPS site would be SMALL. As noted in Section
8 4.9.6, DEK conducted a survey of the KPS site in 2007 and is developing a Cultural Resources
9 Management Plan. This plan includes pre-job briefings for workers and an inadvertent discovery
10 (stop work) provision. Depending on the resource richness of an alternative site ultimately
11 chosen for the coal-fired alternative, impacts could range from SMALL to MODERATE.

12 Environmental Justice

13 The environmental justice impact analysis evaluates the potential for disproportionately high and
14 adverse human health and environmental effects on minority and low-income populations that
15 could result from the construction and operation of a new coal-fired power plant. Adverse health
16 effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human
17 health. Disproportionately high and adverse human health effects occur when the risk or rate of
18 exposure to an environmental hazard for a minority or low-income population is significant and
19 exceeds the risk or exposure rate for the general population or for another appropriate
20 comparison group. The minority and low-income populations are subsets of the general public
21 residing around the site, and all are exposed to the same hazards generated from various
22 power plant operations.

23 Minority and low-income populations could be affected by the construction and operation of a
24 new coal-fired power plant. Some of these effects have been identified in resource areas
25 discussed in this section. The extent of disproportionate effect is difficult to determine since it
26 would depend on the location of the coal-fired power plant. For example, increased demand for
27 rental housing during construction could disproportionately affect low-income populations.
28 However, demand for rental housing could be mitigated if the alternate plant site is constructed
29 near a metropolitan area. Impacts on minority and low-income populations from the construction
30 and operation of a coal-fired power plant alternative could range from SMALL to MODERATE.

31 **8.2.7 Waste Management**

32 The coal-fired, supercritical power plant would be constructed either onsite or offsite. Waste
33 would be generated during construction of this alternative. During operation of this alternative,
34 ash (a dry solid) and sludge (a semi-solid by-product of emission control system operation)
35 waste streams would be generated. The staff estimates that 618-MW power plant would
36 generate annually total 60,823.94 tons (55,178.55 MT) of dry solid ash and scrubber sludge.
37 Disposal of the waste from the 40-year operation of this alternative would require approximately
38 136 acres (55 ha). Disposal of the waste could noticeably affect land use and groundwater
39 quality, but with proper siting and implementation of monitoring and management practices, it
40 would not destabilize resources. After closure of the waste site and revegetation, the land could
41 be available for other uses.

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1 The impacts from waste generated during operation of this coal-fired alternative would be
2 MODERATE; the impacts would be clearly visible, but would not destabilize any important
3 resource.

4 The impacts from waste generated during the construction stage would be short-term. The
5 amount of construction waste is small compared to the amount of waste generated during
6 operational stage and could be recycled. Overall, the impacts from waste generated during the
7 construction stage would be SMALL.

8 Therefore, the NRC staff concludes that impacts from construction and operation of this
9 alternative would be MODERATE.

10 **8.3 COMBINATION ALTERNATIVES**

11 In this section, the staff evaluates the environmental impacts that may occur from a combination
12 of alternatives, some of which may not be capable of individually replacing the power from KPS,
13 but which may have relatively low environmental impacts or rely on renewable fuel sources. In
14 this section, staff will evaluate two combination alternatives that include onsite gas-fired
15 generation, energy conservation, and either wind power (in option 1) or wood-fired power (in
16 option 2).

17 Combination Option 1:

- 18 • 280 MW gas-fired capacity on the KPS site
- 19 • 229 MW equivalent conservation
- 20 • 47 MW wind power (157 MW of wind turbines at several sites; 30 percent capacity
21 factor)

22 Combination Option 2:

- 23 • 280 MW gas-fired capacity on the KPS site
- 24 • 229 MW equivalent conservation
- 25 • 47 MW wood-fired plant

26 Wisconsin has substantial conservation resources, but a recent study commissioned by the
27 Wisconsin Public Service Commission (Energy Center of Wisconsin, 2009) indicates that it will
28 take several years to ramp programs to offset the power generated by KPS. By the start of 2014
29 (KPS license expires on December 21, 2013), Wisconsin could offset 4.8 percent of peak load
30 and 4.8 percent of total energy consumption. These estimates explicitly do not include the
31 potential for behavior-based programs to reduce consumption. Assuming that 50 percent of this
32 potential could offset a base load duty cycle, roughly 229 MW (on a total energy consumption
33 basis) or 360 MW (on a peak load basis) could be achieved by the time the KPS license
34 expires. Using the lower number, 229 MW, to be conservative, conservation/energy efficiency
35 could offset roughly 41 percent of KPS output. Most of the remaining output for both alternatives
36 would come from a 280 MW gas-fired combined cycle power plant at the current plant site (half
37 of the pure gas-fired alternative).

1 Some wind turbines could be located onsite or across nearby agricultural areas with little long-
 2 term land use impact. As noted in 8.5.1, this area is also home to Wisconsin’s best wind
 3 potential and existing transmission lines. The other option relies on offsite wood-fired power that
 4 would likely be located in the northern part of the State near steady wood supply streams.

5 **Table 8-3. Summary of Environmental Impacts of the Combination Alternative Compared**
 6 **to Continued Kewaunee Power Station Operation**

	Combination Alternative		Continued KPS Operation
	Option 1 – Gas, Conservation, Wind	Option 2 – Gas, Conservation, Wood	
Air Quality	MODERATE	MODERATE	SMALL
Groundwater	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL	SMALL
Ecology	SMALL to LARGE	SMALL to LARGE	SMALL
Human Health	SMALL to MODERATE	SMALL to MODERATE	SMALL
Socioeconomics	SMALL to MODERATE	SMALL to MODERATE	SMALL TO MODERATE
Waste Management	SMALL	SMALL	SMALL

7 **8.3.1 Air Quality**

8 Kewaunee County, Wisconsin, where KPS is located, belongs to EPA Region 5 and is in
 9 attainment for all criteria pollutants, except ozone. Kewaunee County is a maintenance area for
 10 8-hour ozone (EPA, 2009a).

11 This alternative is a combination of a 280-MW gas-fired combined cycle power plant,
 12 constructed onsite, and two options: option 1 relies on wind power for the remainder of the
 13 electrical energy produced; option 2 relies on offsite wood-fired power.

14 A new gas-fired generating plant, proposed to be built in Kewaunee County, would qualify as a
 15 new major-emitting industrial facility and require a new source review (NSR) and Prevention of
 16 Significant Deterioration of Air Quality review under the CAA, enforced by WDNR, along with
 17 other air pollution control requirements in the Wisconsin Administrative Code and its statutes
 18 (EPA, 2008a; Wis. Adm. Code chapters NR400-499). The EPA delegated the authority of
 19 regulating the issuance of construction and operating permits to the WDNR, which was codified
 20 in NR406 and NR407 of the Wisconsin Administrative Code. The natural gas-fired plant would
 21 also need to comply with the standards of performance for electric utility steam generating units
 22 set forth in 40 CFR Part 60 Subpart Da.

23 Section 169A of the CAA (42 USC 7401) establishes a national goal of preventing future and
 24 remedying existing impairment of visibility in mandatory Class I Federal areas when impairment
 25 results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (64 FR

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1 35714; EPA, 1999). The rule specifies that for each mandatory Class I Federal area located
2 within a State, the State must establish goals that provide for reasonable progress toward
3 achieving natural visibility conditions through developing and implementing air quality protection
4 plans to reduce the pollution that causes visibility impairment. As noted in 8.1.1 and 8.2.1, there
5 are five RPOs collaborating on the visibility impairment issue and developing the technical basis
6 for these plans. The Midwest RPO, along with tribes, Federal agencies and other interested
7 parties identifies regional haze and visibility issues and develops strategies to address them.
8 The visibility protection regulatory requirements, contained in 40 CFR Part 51, Subpart P,
9 include the review of the new sources that would be constructed in the attainment or
10 unclassified areas and may affect visibility in any Federal Class I area (40 CFR 51.307). If a
11 coal-fired plant were located close to a mandatory Class I area, additional air pollution control
12 requirements would be imposed. There are no Mandatory Class I Federal areas in the State of
13 Wisconsin or in the close proximity to KPS. The closest Mandatory Class I Federal Areas to
14 KPS are Seney Wilderness Area, Michigan, located 149 miles northeast from KPS, and Isle
15 Royale National Park, Michigan, located 255 miles northwest from KPS.

16 The emissions from the natural gas-fired alternative at KPS site, based on published Energy
17 Information Administration (EIA) data, EPA emission factors and on performance characteristics
18 for this alternative and implemented emission controls, would likely be:

- 19 • Nitrogen oxides (NO_x) – 70.50 tons (63.96 MT) per year
- 20 • Carbon monoxide (CO) – 14.66 tons (13.30 MT) per year
- 21 • Total suspended particles (TSP) – 12.29 tons (11.15 MT) per year
- 22 • Particulate matter (PM) PM₁₀ – 12.29 tons (11.15 MT) per year
- 23 • Carbon dioxide (CO₂) – 756,582.11 tons (686,359.75 MT) per year

24 The new natural gas-fired plant would have to comply with Title IV of the CAA reduction
25 requirements for SO₂ and NO_x, which are main precursors of acid rain and major causes of
26 reduced visibility. Title IV establishes maximum SO₂ and NO_x emission rates for existing plants
27 and a system of SO₂ emission allowances that can be used, sold or saved for future use by new
28 plants.

29 On March 10, 2005, the EPA issued the Clean Air Interstate Rule (CAIR), which would create
30 large permanent reductions in SO₂ and NO_x across 28 eastern states and the District of
31 Columbia. However, petitions for review of the CAIR and CAIR Federal Implementation Plans
32 (FIPs), including the provisions establishing the CAIR NO_x annual and ozone season and SO₂
33 trading programs, were filed in the U.S. Court of Appeals for the D.C. Circuit. On July 11, 2008,
34 the Court issued an opinion vacating and remanding the CAIR and CAIR FIPs. After requested
35 rehearing of the Court's decision, the Court granted rehearing only to the extent that it
36 remanded the rules to the EPA without vacating them on December 23, 2008. This ruling leaves
37 CAIR and the CAIR FIPs, including the CAIR trading programs, in place until the EPA issues a
38 new rule to replace CAIR in accordance with the July 11, 2008 decision. Wisconsin is among
39 the States covered by this rule (EPA, 2009b). WDNR adopted the rule and is allocating annual
40 NO_x allowances for new electricity generating units subject to CAIR as specified in chapter NR
41 432 of the Wisconsin Administrative Code starting in 2009. The NO_x allowances are allocated
42 from a "new unit set-aside" reserved pool of allowances, which represents 7 percent of
43 Wisconsin's total budget of NO_x allowances.

1 As stated above, the new natural gas-fired alternative would produce 21.99 tons (19.95 MT) per
2 year of SO_x and 70.50 tons (63.96 MT) per year of NO_x based on the use of the dry low NO_x
3 combustion technology and use of the selective catalytic reduction (SCR) in order to
4 significantly reduce NO_x emissions.

5 The new plant would be subjected to the continuous monitoring requirements of SO₂, NO_x and
6 CO₂ specified in 40 CFR Part 75. The natural gas-fired plant would emit approximately
7 756,582.11 tons (686,359.75 MT) per year of unregulated CO₂ emissions. As of today, there is
8 no required reporting of GHG emissions. In response to the Consolidated Appropriations Act of
9 2008, the EPA proposed a rule that would require mandatory reporting of GHG emissions from
10 large sources, such as the presented alternative. The rule would allow for the collection of
11 accurate and comprehensive emissions data to inform future policy decisions. The EPA
12 proposes that suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and
13 engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions submit
14 annual reports to the EPA. The gases covered by the proposed rule are CO₂, CH₄, N₂O, HFC,
15 PFC, SF₆, and other fluorinated gases including NF₃ and HFE.

16 The natural gas-fired portion of this alternative would emit 12.29 tons (11.15 MT) of particulate
17 matter per year having an aerodynamic diameter less than or equal to 10 μm (PM₁₀) (40 CFR
18 50.6(a)), based on the assumption that effective fabric filters or electrostatic precipitators would
19 be used to minimize emissions.

20 In December 2000, the EPA issued regulatory findings (EPA, 2000a) on emissions of hazardous
21 air pollutants from electric utility steam-generating units, which indicated that natural gas-fired
22 plants emit hazardous air pollutants such as arsenic, formaldehyde and nickel and stated that:

23 “. . . the impacts due to HAP emissions from natural gas-fired electric utility steam generating
24 units were negligible based on the results of the study. The Administrator finds that regulation of
25 HAP emissions from natural gas-fired electric utility steam generating units is not appropriate or
26 necessary.”

27 The new natural gas-fired alternative would produce 12.29 tons (11.15 MT) per year of the TSP
28 as PM₁₀ emissions.

29 There would be no emissions from the wind-powered portion of option 1 for this alternative.

30 When fossil fuels are burned in the production of electricity, a variety of gases and particulates
31 are formed and, if not captured by pollution control equipment, will be released into the
32 atmosphere. The pollutants released during electricity production depend upon complex
33 relationships between factors such as fuel type and mix (sulfur content of coal, gas utilization),
34 operational mode (combustion temperatures), technologies employed (combustion processes,
35 environmental equipment), and regulatory constraints (non-attainment and maintenance areas).

36 The emissions from the wood-fired component of option 2, based on published EIA data, EPA
37 emission factors, performance characteristics for this alternative, and implemented emission
38 controls, would likely be:

- 39 • Sulfur oxides (SO_x) – 58.33 tons (52.92 MT) per year

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- 1 • Nitrogen oxides (NO_x) (with SCR) – 285.80 tons (259.27 MT) per year
- 2 • Carbon monoxide (CO) – 349.96 tons (317.48 MT) per year
- 3 • TSP (filtered) – 233.31 tons (211.66 MT) per year
- 4 • PM₁₀ (filtered) – 172.65 tons (156.63MT) per year
- 5 • PM_{2.5} (filtered) – 151.65 tons (137.58 MT) per year
- 6 • Carbon dioxide (CO₂) – 454,950.60 tons (412,724.24 MT) per year

7 The wood-fired combustion facility would be subject to the Federal and State air emissions
8 regulations described above for the natural gas-fired component of this alternative. Option 2
9 would also produce 172.65 tons (156.63 MT) per year of particulate matter having an
10 aerodynamic diameter less than or equal to 10 µm (PM₁₀) (40 CFR 50.6(a)) and 151.65 tons
11 (137.58 MT) per year of the particulate matter less than 2.5 µm in diameter (PM_{2.5}) which have
12 to meet the national primary and secondary ambient air quality standards (40 CFR 50.7a).

13 Activities associated with the construction of the new natural gas-fired plant onsite or offsite
14 KPS would cause some additional air effects as a result of equipment emissions and fugitive
15 dust from operation of the earth-moving and material handling equipment. Vehicles of workers
16 and construction motorized equipment exhaust emissions would be temporary. The construction
17 crews would employ dust-control practices in order to control and reduce fugitive dust, which
18 would be temporary in nature. The staff concludes that the impact of vehicle exhaust emissions
19 and fugitive dust from operation of the earth-moving and material handling equipment would be
20 SMALL.

21 The overall air-quality impacts of the combination alternative consisting of a natural gas-fired
22 plant located at the KPS site and wind power (option 1), or of a natural gas-fired plant located at
23 the KPS site and wood-fired power (option 2) would be MODERATE.

24 **8.3.2 Groundwater Use and Quality**

25 Impacts to groundwater use and quality from the gas-fired portion of the combination alternative
26 would be similar to those identified for the wholly gas-fired alternative in 8.1.2, though roughly
27 half as large in magnitude. These impacts would be SMALL.

28 An onsite or offsite wind alternative would likely use much less groundwater than KPS uses for
29 its operations. The current average withdrawal rate at KPS is less than 100 gpm (0.01 m³/s),
30 and pumping tests indicate this rate will not cause an effect on nearby supply wells. A reduction
31 in this withdrawal rate means that impacts of the combination alternative would remain SMALL.

32 An offsite wood-fired alternative would likely rely on a minimal amount of groundwater for its
33 operations because not many workers would be onsite and because the wood-fired unit would
34 be relatively small and would have few auxiliary systems requiring service water. This
35 combination alternative would use less groundwater than KPS. A reduction in the current KPS
36 withdrawal rate means that impacts of the combination alternative would remain SMALL.

1 **8.3.3 Surface Water Use and Quality**

2 Impacts to surface water use and quality from the gas-fired portion of the combination
3 alternative would be similar to those identified for the wholly gas-fired alternative in 8.1.2,
4 though roughly half as large in magnitude. These impacts would be SMALL.

5 An onsite or offsite wind alternative would consume significantly less surface water than the
6 amount consumed by KPS for cooling purposes. The maximum consumptive use would be
7 reduced to a fraction of the surface water withdrawn by the open-cycle cooling system currently
8 in use by KPS. A reduction in this withdrawal rate means that impacts of the combination
9 alternative would be SMALL.

10 An offsite wood-fired alternative would likely consume only a small amount of surface water as
11 compared to the amount consumed by KPS for cooling purposes because the wood-fired unit is
12 relatively small and would have few auxiliary systems requiring service water. This combination
13 alternative would use less surface water than KPS. Assuming that the offsite location utilizes
14 water from a large enough body of water to support its operations, the impacts of the
15 combination alternative would be SMALL.

16 **8.3.4 Aquatic and Terrestrial Ecology**

17 The conservation portion of the combination alternative will have positive impacts on aquatic
18 communities because less power would need to be generated. Requiring less power will
19 decrease the cooling water requirements and pollutant deposition of the gas-fired alternative.
20 The gas-fired portion of the combination alternative would have similar effects to those
21 discussed in Section 8.2.4 Terrestrial and Aquatic Ecology; however, because the gas-fired
22 portion of this alternative would only produce 280 MW, rather than 560 MW for the gas-fired
23 alternative, the imprint of the plant may be smaller, and therefore, erosion and sedimentation
24 during construction, and pollutant deposition during operation are expected to be less. Impacts
25 from wind-powered and wood-fired portions of this alternative would vary depending on the
26 location and ecology of the site, but would likely be minimal. Construction in a previously
27 disturbed area would have lower impacts to aquatic communities than construction in an
28 undisturbed area. Impacts during operation are expected to be minimal as neither option
29 requires a source of cooling water. Some deposition of carbon compounds and particulate
30 matter would occur on nearby waterways as a result of burning wood waste.

31 Overall impacts to aquatic ecology from a combination alternative are expected to be SMALL.

32 The largest potential impact to terrestrial resources would occur from the wind turbines. Wind
33 turbines have the potential to require large amounts of undisturbed land. There would be a
34 potential to mitigate some of these impacts by locating the turbines offshore on Lake Michigan.
35 ROW maintenance would continue, although no additional transmission lines would be
36 necessary. The only construction activities that would occur for the combination alternative are
37 the construction of a combined-cycle gas-fired power plant and any retrofit-related construction.
38 These activities would be confined to previously disturbed areas at the KPS site. Some habitat
39 fragmentation impacts on the KPS site may occur. Impacts to terrestrial ecology would be
40 SMALL to LARGE.

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1 **8.3.5 Human Health**

2 The human health risks from a combination of alternatives include the combined cycle gas-fired
3 plant already discussed in 8.1.5. The GEIS (NRC, 1996) notes that the environmental impacts
4 of the conservation/demand-side management alternative are likely to be centered on indoor air
5 quality. This is due to increased weatherization of the home in the form of extra insulation and
6 reduced air turnover rates from the reduction in air leaks. However, the actual impact from the
7 conservation alternative is highly site specific and not yet well-established. For wind power, the
8 GEIS notes that, except for a potentially small number of occupational injuries associated with
9 the construction and routine maintenance of the units, human health would not be affected by
10 routine operations. The occupational human health impacts for the operation of a wood-fired
11 facility would be comparable to that of agriculture, which is high. This is primarily due to the
12 routine movement and handling of large amounts of wood waste that would be needed to fuel
13 the plant. The use of protective equipment and adherence to safety requirements would
14 minimize the danger to workers. The burning of the wood would generate air emissions that can
15 impact human health. The most significant would involve the release of particulate matter.
16 However, these emissions can be controlled effectively with existing technology. It is expected
17 that the facilities would operate in compliance with Federal and State safety and emission
18 standards.

19 The human health risks from the combination of alternatives are uncertain, but considered to be
20 SMALL to MODERATE.

21 **8.3.6 Socioeconomics**

22 Land Use

23 The GEIS generically evaluates the impacts of nuclear power plant operations on land use both
24 on and off each power plant site. The analysis of land use impacts for the combination
25 alternative focuses on the amount of land area that would be affected by the construction and
26 operation of a single natural gas-fired unit power plant at the KPS, an offsite wind energy
27 generating power, and demand-side energy conservation.

28 Approximately 285 acres (115 ha) would be needed to support a single natural gas-fired unit
29 combination alternative including the gas pipeline, according to staff scaling of DEK estimates.
30 By scaling the GEIS estimate, a 292-MWe (gross capacity) plant could require up to
31 approximately 304 acres (123 ha) of land including pipeline. The NRC staff believes that the
32 DEK estimate is reasonable. Nevertheless, land use impacts from construction of the natural
33 gas-fired power plant at KPS would be SMALL.

34 In addition to onsite land requirements, land would be required off site for natural gas wells and
35 collection stations. The GEIS estimates that 3,600 acres (1,457 ha) would be required for wells,
36 collection stations, and pipelines to bring the gas to a 1,000-MWe generating facility. If this land
37 requirement were scaled with a 292-MWe generating capacity, the natural gas-fired power plant
38 at the KPS could require 1,051 acres (425 ha). Most of this land requirement would occur on
39 land where gas extraction already occurs. In addition, some natural gas could come from
40 outside of the United States and be delivered as liquefied gas.

1 The wind farm option of the combination alternative producing 47 MWe of electricity would
2 require approximately 10,000 acres (4,050 ha) spread over several locations with approximately
3 40 acres (16 ha) in actual use. The wood-fired option of the combination alternative producing
4 47 MWe of electricity would require approximately 90 acres (36 ha).

5 Since existing transmission lines would be used, land use impacts from the energy conservation
6 alternative would be SMALL. Quickly replacing and disposing of old inefficient appliances could
7 generate waste material and potentially increase the size of landfills. Given the time for program
8 development and implementation, the replacement process would need to begin as soon as
9 possible. Some older appliances would simply be replaced by more efficient appliances as they
10 fail (especially in the case of frequently replaced items, like light bulbs). In addition, many items
11 (like home appliances or industrial equipment) have substantial recycling value and would likely
12 not be disposed of in landfills.

13 The elimination of uranium fuel for KPS could partially offset offsite land requirements. In the
14 GEIS, the staff estimated that approximately 1,000 acres (405 ha) would not be needed for
15 mining and processing uranium during the operating life of a 1,000-MWe nuclear power plant.
16 For the KPS, roughly 590 acres (239 ha) of uranium mining area would no longer be needed.
17 Overall land use impacts from the combination alternative would be SMALL to MODERATE.

18 Socioeconomics

19 As previously discussed, socioeconomic impacts are defined in terms of changes to the
20 demographic and economic characteristics and social conditions of a region. For example, the
21 number of jobs created by the construction and operation of a new single natural gas-fired
22 power plant at the KPS site and wind farm or wood-fired power generating plant could affect
23 regional employment, income, and expenditures. Two types of job creation would occur: (1)
24 construction-related jobs, which are transient, short in duration, and less likely to have a long-
25 term socioeconomic impact; and (2) operation-related jobs in support of power generating
26 operations, which have the greater potential for permanent, long-term socioeconomic impacts.
27 Construction and operations workforce requirements for the combination alternative were
28 determined in order to measure their possible effect on current socioeconomic conditions.

29 Based on GEIS projections and a workforce of 1,200 for a 1,000-MWe plant, a single 292-MWe
30 unit at KPS would require a peak estimated construction workforce of 350 workers. Additional
31 estimated construction workforce requirements for this combination alternative would include
32 300 construction workers for the wind farm option and 131 construction workers for the wood-
33 fired option. The number of additional workers would cause a short-term increase in the demand
34 for services and temporary (rental) housing in the region around the construction site.

35 After construction and depending on the size of the community, some local communities may be
36 temporarily affected by the loss of the construction jobs and associated loss in demand for
37 business services. The rental housing market could also experience increased vacancies and
38 decreased prices. The impact of construction on socioeconomic conditions for each of the three
39 power generating facilities would be SMALL.

40 Following construction, a single unit gas-fired power plant at the KPS could provide up to 10
41 jobs, based on scaled DEK estimates, or up to 44 jobs based on GEIS estimates. Additional

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1 estimated operations workforce requirements for this combination alternative would include 50
2 operations workers for the wind farm option and 13 operations workers for the wood-fired
3 option. Given the small numbers of operations workers at these facilities, socioeconomic
4 impacts associated with the operation of the natural gas-fired power plant at the KPS, wind
5 farm, and wood-fired power generating plant would be SMALL.

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

10 Transportation

11 Transportation impacts would be SMALL, because the number of employees commuting to the
12 KPS, wind farm, and wood-fired power generating plant would be small. Any transportation
13 effects from the energy efficiency alternative would be widely distributed across the State and
14 would not be noticeable.

15 Construction and operation of a natural gas-fired power plant, wind farm, and wood-fired power
16 generating plant would increase the number of vehicles on roads in the vicinity of these
17 facilities. During construction, cars and trucks would deliver workers, materials, and equipment
18 to the worksite. The increase in vehicular traffic would peak during shift changes resulting in
19 temporary levels of service impacts and delays at intersections. Pipeline construction and
20 modification to existing natural gas pipeline systems could also have an impact.

21 During plant operations, transportation impacts would almost disappear. Given the small
22 number of workers at these facilities, impacts on local roads from the operation of the natural
23 gas-fired power plant at the KPS, the wind farm, and wood-fired power generating plant would
24 be SMALL. Transportation impacts at the wind farm and wood-fired power generating plant
25 would also depend on current road capacities and average daily traffic volumes.

26 Aesthetics

27 As previously discussed, aesthetic resources are the natural and manmade features that give a
28 particular landscape its character and aesthetic quality. The aesthetics impact analysis focuses
29 on the degree of contrast between the power plant and the surrounding landscape and the
30 visibility of the power plant.

31 A single natural gas-fired unit located at the KPS could be approximately 100 feet (30 m) tall,
32 with an exhaust stack up to 175 feet (53 m) tall. The impact would be moderated by higher
33 elevations and vegetation. Power plant infrastructure would generally be smaller and less
34 noticeable than the KPS containment and turbine buildings. Mechanical draft cooling towers
35 would generate condensate plumes and operational noise. Noise during power plant operations
36 would be limited to industrial processes and communications. In addition to the power plant
37 structures, construction of natural gas pipelines would have a short-term impact. Noise from the
38 pipelines could be audible offsite near compressors.

39 In general, aesthetic changes would be limited to the immediate vicinity of the KPS and the wind
40 farm facilities. The wind farm would have the greatest aesthetic effect. Compared to a fossil-

1 fueled power plant unit on 46 to 1,400 acres, the 32,000-acre (13,000 ha) wind farm (with wind
2 turbines over 300 feet (100 m) tall) would dominate the view and would be the major focus of
3 viewer attention. Therefore, overall aesthetic impacts from the construction and operation of
4 combination alternative would be SMALL to MODERATE.

5 In addition to seeing new power plant structures at KPS, the wind farm and wood-fired power
6 generating plant may require the construction of transmission lines. The transmission lines
7 would have a lasting visual effect on the landscape.

8 Impacts from energy efficiency programs would be SMALL. American Transmission Corporation
9 (ATC) would continue to use the existing transmission lines. Some noise impacts could occur in
10 instances of energy efficiency upgrades to major building systems, though this impact would be
11 intermittent and short-lived.

12 In general, aesthetic changes would be limited to the immediate vicinity of the KPS, the wind
13 farm, and wood-fired power generating plant. Impacts would likely be SMALL to MODERATE at
14 KPS and other sites and would depend on the amount of new transmission line required.

15 Historic and Archaeological Resources

16 Cultural resources are the indications of human occupation and use of the landscape as defined
17 and protected by a series of Federal laws, regulations, and guidelines. Prehistoric resources are
18 physical remains of human activities that predate written records; they generally consist of
19 artifacts that may alone or collectively yield information about the past. Historic resources
20 consist of physical remains that postdate the emergence of written records; in the United States,
21 they are architectural structures or districts, archaeological objects, and archaeological features
22 dating after 1492. Ordinarily, sites less than 50 years old are not considered historic, but
23 exceptions can be made for such properties if they are of particular importance, such as
24 structures associated with the development of nuclear power (e.g., Shippingport Atomic power
25 Station) or Cold War themes. American Indian resources are sites, areas, and materials
26 important to American Indians for religious or heritage reasons. Such resources may include
27 geographic features, plants, animals, cemeteries, battlefields, trails, and environmental features.
28 The cultural resource analysis encompassed the power plant site and adjacent areas that could
29 potentially be disturbed by the construction and operation of alternative power plants.

30 The analysis of land use impacts for the combination alternative focuses on the amount of land
31 that would be affected by the construction and operation of a single natural gas-fired unit power
32 plant at KPS, an offsite wind energy generating plant, a wood-fired facility, and demand-side
33 energy conservation. The impact of constructing and operating a combination alternative at the
34 KPS site would be SMALL, due to previous onsite survey work and Dominion's commitment to
35 develop a Cultural Resources Management Plan. As discussed in Section 8.2.6, depending on
36 the resource richness of an alternative site ultimately chosen for the wind power alternative,
37 impacts will range from SMALL to MODERATE.

38 Impacts to historic and archaeological resources from implementing the energy efficiency
39 programs would be SMALL. A conservation alternative would not affect land use or historical or
40 cultural resources onsite or elsewhere in the State.

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Environmental Justice

1
2 The environmental justice impact analysis evaluates the potential for disproportionately high and
3 adverse human health and environmental effects on minority and low-income populations that
4 could result from the construction and operation of a new natural gas-fired power plant, wind
5 farm, and wood-fired power generating plant. Adverse health effects are measured in terms of
6 the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high
7 and adverse human health effects occur when the risk or rate of exposure to an environmental
8 hazard for a minority or low-income population is significant and exceeds the risk or exposure
9 rate for the general population or for another appropriate comparison group. The minority and
10 low-income populations are subsets of the general public residing around the site, and all are
11 exposed to the same hazards generated from various power plant operations.

12 Minority and low-income populations could be affected by the construction and operation of a
13 new natural gas-fired power plant, wind farm, and wood-fired power generating plant. The
14 extent of disproportionate effect is difficult to determine since it would depend on the location of
15 these power generating facilities. Some of these effects have been identified in resource areas
16 discussed in this section. For example, increased demand for rental housing during construction
17 could disproportionately affect low-income populations. However, demand for rental housing
18 could be mitigated if the power generating facilities are constructed near a metropolitan area.

19 Impacts on minority and low-income populations under the combination alternative could range
20 from SMALL to MODERATE, due to the small number of workers needed to construct and
21 operate the natural gas-fired power plant, wind farm, and wood-fired power generating plant.

22 Weatherization programs could target low-income residents as a cost-effective energy efficiency
23 option since low-income populations tend to spend a larger proportion of their incomes paying
24 utility bills (according to the Office of Management and Budget, low income populations
25 experience energy burdens more than four times as large as those of average households
26 (OMB, 2007)). Impacts to minority and low-income populations from energy efficiency programs
27 would be SMALL, depending on program design and enrollment.

8.3.7 Waste Management

28
29 During the construction stage of this alternative, land clearing and other construction activities
30 would generate waste that can be recycled, disposed onsite or shipped to an offsite waste
31 disposal facility. If the alternative were constructed at the KPS site or any previously disturbed
32 site, the amounts of wastes produced during land-clearing would be reduced.

33 During operational stage, spent SCR catalysts, which are used to control NO_x emissions from
34 the natural gas-fired plants, would make up the majority of the waste generated by this
35 alternative.

36 There would be a small amount of waste generated during the construction of the wind power
37 facilities and minimal waste associated with its maintenance.

38 As stated in the GEIS (NRC, 1996), wood-fired component of this alternative would produce
39 considerable amount of fly ash, which can be successfully used as beneficial fertilizer and soil
40 conditioner.

1 The NRC staff concludes that overall waste impacts of the combination alternative consisting of
2 natural gas-fired plant located at the KPS site and the wind power (option 1), or of the natural
3 gas-fired plant located at KPS and wood-fired power (option 2) would be SMALL.

4 **8.4 PURCHASED POWER**

5 In the ER (DEK, 2008), DEK indicated that it was unlikely that purchased power would be
6 available in sufficient capacity over the 20-year period of extended operation in order to serve
7 as an alternative to license renewal. DEK further indicated that it was likely that relying on
8 purchased power would simply shift the responsibility to construct new facilities to replace KPS
9 to other generators. In addition, DEK indicated that transmission constraints in northeastern
10 Wisconsin make it unlikely that out-of-State purchased power could be imported in sufficient
11 quantity to offset KPS's capacity. The staff has reviewed these assertions and finds them to be
12 reasonably reflective of the challenges facing purchased power as an alternative to license
13 renewal. As a result, the staff has not separately evaluated purchased power as an alternative
14 to license renewal.

15 **8.5 ALTERNATIVES CONSIDERED BUT DISMISSED**

16 In this section, the staff discusses the energy alternatives that it determined either would not
17 individually meet the purpose and need identified in the GEIS or whose costs preclude
18 consideration in greater depth. The staff considered several of these alternatives in the
19 combination alternatives in Sections 8.2 and 8.3.

20 **8.5.1 Wind Power**

21 The American Wind Energy Association and the U.S. Department of Energy indicate that
22 Wisconsin currently has 449 MW of installed wind capacity (AWEA Undated;
23 http://www.windpoweringamerica.gov/wind_installed_capacity.asp). The greatest potential for
24 wind power generation in Wisconsin is in the east-central and northeast part of the State, which
25 includes the KPS site. Wind power potential ranges from class 3 to class 4 in this area,
26 according to wind speed maps published by the Wisconsin Office of Energy Independence
27 (2008).

28 Despite Wisconsin's good wind power potential, wind power is not yet suitable for stand-alone
29 large base load capacity. When paired with energy storage or a readily dispatchable power
30 source like hydropower, wind could serve as a means of providing base load power. Even if
31 suitable, additional backup capacity could be found to support a completely wind-powered
32 option, replacing KPS with wind turbines would require more than a doubling of Wisconsin's
33 current capacity by 2013.

34 Given wind power's intermittency and the lack of available backup, as well as the current level
35 of implementation in Wisconsin, the NRC staff will not consider wind power as a stand-alone
36 alternative to license renewal. However, given Wisconsin's significant wind resource, the staff
37 will consider wind power as a portion of a combination alternative.

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1 **8.5.2 Wood-Fired Power**

2 Two generating stations in Wisconsin currently rely on wood for a portion of their fuel. In 2007,
3 these facilities burned 315,811 tons of wood with a heat output of 3,437 billion British thermal
4 units (Btu) (Wisconsin Office of Energy Independence, 2008). Further, wood currently
5 constitutes the primary renewable energy source in the State.

6 In 1999, DOE researchers estimated that Wisconsin has biomass fuel resources consisting of
7 urban, mill, agricultural, and forest residues, as well as speculative potential for energy crops.
8 Excluding potential energy crops, DOE researchers projected that Wisconsin had
9 7,149,128 tons (6,485,579 MT) of plant-based biomass available at \$50 per ton delivered
10 (Walsh et al., 2000; costs are in 1995 dollars). Wood-fired power plants in Wisconsin report an
11 average heat content of 5441.5 Btu/lb of wood fuel. Assuming a 33 percent conversion
12 efficiency, using all plant-based biomass available in Wisconsin at \$50 or less per ton (the
13 maximum price the researchers considered) would generate roughly 7.6 terawatt-hours (TWh)
14 of electricity. This is roughly two-thirds more electricity than KPS generated in 2008. However,
15 most of this potential comes from agricultural residues, almost all of which (97 percent) are from
16 corn production. Excluding agricultural residues (many of which are traditionally left on fields
17 following harvest and provide fertilization for the following years crops), the total potential is 2
18 TWh, or less than half of KPS's 2008 production.

19 Walsh et al. (2000) go on to note that these estimates of biomass capacity contain substantial
20 uncertainty and that potential availability does not mean biomass will actually be available at the
21 prices indicated or that resources will be useably free of contamination. Some of these plant
22 wastes already have reuse value and would likely be more costly to deliver because of
23 competition. Others, such as forest residues, may prove unsafe and unsustainable to harvest on
24 a regular basis.

25 As a result of limited resource availability, staff will not consider wood-fired as a stand-alone
26 alternative to license renewal. The staff will, however, consider wood-fired as a portion of a
27 combination alternative.

28 **8.5.3 Energy Conservation**

29 The Public Service Commission of Wisconsin commissioned a Statewide study of energy
30 efficiency and customer-sited renewable energy potential in 2009 (Energy Center of Wisconsin,
31 2009). The study's base case results indicated that by 2018, the achievable potential of
32 efficiency savings could amount to 13 percent of total electricity sales, 12.9 percent of peak
33 demand, and 8.7 percent of natural gas sales in the State. These estimates are a small fraction
34 of the total economic potential identified in the State. The study estimates that by 2012, the
35 State could save 1200 gigawatt hours (GWh) or 250 MW in peak electricity demand. KPS's
36 operating license will expire in 2013, by which time an additional 1.6 percent of electricity
37 demand and total energy could be saved. This amount is less than the power produced by KPS
38 in the course of a year, and so energy efficiency will not be considered as a stand-alone
39 alternative to license renewal.

1 The energy efficiency potential in the State is significant, however, and energy efficiency
2 measures tend to have low environmental consequences. As a result, the staff will consider
3 energy efficiency as a portion of a combination alternative.

4 **8.5.4 Solar Power**

5 Solar technologies use the sun's energy to produce electricity. Wisconsin receives between 4
6 and 4.5 kilowatt-hours (kWh) per square meter per day, or approximately 0.4 kWh of solar
7 radiation per square foot per day, for solar collectors oriented at an angle equal to the
8 installation's latitude (NREL, 2009). At this level of incident solar radiation, photovoltaics are
9 likely to be more effective than solar thermal power plants. Because flat-plate photovoltaics tend
10 to be roughly 25 percent efficient, a solar-powered alternative would require roughly 3,200 acres
11 (1,300 ha) of collectors to provide an amount of electricity equivalent to that generated by KPS
12 in 2008. Space between collectors and associated infrastructure increase this land requirement.
13 This amount of land, while large, is consistent with the land required for coal and natural gas
14 fuel cycles. This amount of power generation, however, would occur only during the day and
15 would necessitate some sort of power storage, introducing additional efficiency losses. As noted
16 in the wind energy section, 8.4.1, energy storage technologies are in the early stages of
17 development and are not yet large enough to provide enough backup capacity to replace KPS.

18 Given the challenges in meeting base load requirements, the staff did not evaluate solar power
19 as an alternative to license renewal of KPS.

20 **8.5.5 Hydroelectric Power**

21 According to researchers at Idaho National Energy and Environmental Laboratory, Wisconsin
22 has an estimated 452.9 MWe of technically available, undeveloped hydroelectric resources at
23 102 project sites throughout the State (INEEL, 1996). As such, the average potential project is
24 small, with no potential sites having greater than 20-MW potential.

25 The staff notes that the total available hydroelectric potential is smaller than the capacity of
26 KPS, and thus will not consider hydroelectric power as an alternative to license renewal.

27 **8.5.6 Geothermal Power**

28 Geothermal energy has an average capacity factor of 90 percent and can be used for base load
29 power where available. However, geothermal electric generation is limited by the geographical
30 availability of geothermal resources (NRC, 1996). As illustrated by Figure 8.4 in the GEIS, no
31 feasible location for geothermal capacity exists to serve as an alternative to KPS. The NRC staff
32 concluded that geothermal energy is not a reasonable alternative to license renewal of KPS.

33 **8.5.7 Biofuels**

34 In addition to wood and municipal solid-waste fuels, discussed in 8.5.11, there are other
35 concepts for biomass-fired electric generators, including direct burning of energy crops (crops
36 grown specifically as fuel or feedstock for fuel), conversion to liquid biofuels, and biomass
37 gasification. In the GEIS, the staff indicated that none of these technologies had progressed to
38 the point of being competitive on a large scale or of being reliable enough to replace a base

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1 load plant such as KPS. After reevaluating current technologies, the staff finds that other
2 biomass-fired alternatives are still unable to reliably serve as an alternative to the continued
3 operation of KPS and does not consider biofuels to be a viable alternative to KPS license
4 renewal.

5 **8.5.8 New Nuclear Power**

6 Sources in the nuclear industry have recently indicated that reactor projects currently under
7 development are likely eight or nine years from completion, or possibly online in the 2016–2017
8 timeframe (Nucleonics Week, 2008). This is three to four years after the expiration of the license
9 for KPS. Further, potential plant owners or operators wishing to submit a new proposal
10 specifically to offset the capacity of KPS would require additional time to develop an application.
11 Given the relatively short time remaining on the current KPS operating license compared to the
12 time to license and construct a new nuclear power plant, the staff has not evaluated new
13 nuclear generation as an alternative to license renewal.

14 **8.5.9 Oil-fired Power**

15 EIA's 2009 *Annual Energy Outlook* indicates that oil-fired power will not account for any
16 additions to capacity in the United States (EIA, 2009a). The variable costs of oil-fired generation
17 tend to be greater than those of the nuclear or coal-fired options, and oil-fired generation tends
18 to have greater environmental impacts than natural gas-fired generation. The high cost of oil
19 (even prior to the record-high prices of 2008) has prompted a steady decline in its use for
20 electricity generation. Thus the staff did not consider oil-fired generation as an alternative KPS
21 license renewal.

22 **8.5.10 Fuel Cells**

23 Fuel cells oxidize fuels without combustion and related environmental side effects. Power is
24 produced electrochemically by passing a hydrogen-rich fuel over an anode and air (or oxygen)
25 over a cathode and separating the two by an electrolyte. The only byproducts (depending on
26 fuel characteristics) are heat, water, and CO₂. Hydrogen fuel can come from a variety of
27 hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically
28 used as the source of hydrogen.

29 At the present time, fuel cells are not economically or technologically competitive with other
30 alternatives for base load electricity generation. EIA projects that fuel cells may cost \$5,360 per
31 installed kilowatts (kW) (total overnight costs), or 2.5 times the construction cost of new coal-
32 fired generating capacity and 5.7 times the cost of new, advanced gas-fired, combined-cycle
33 capacity (EIA, 2009c). In addition, fuel cell units are likely to be small in size (the EIA reference
34 plant is 10 MWe). While it may be possible to use a distributed array of fuel cells to provide an
35 alternative to KPS, it would be extremely costly to do so and would require 56 reference-size
36 units. Accordingly, the staff does not consider fuel cells as an alternative to KPS license
37 renewal.

1 **8.5.11 Municipal Solid Waste**

2 Municipal solid waste combustors incinerate waste to produce steam, hot water, or electricity.
3 Combustors use three types of technologies—mass burn, modular, and refuse-derived fuel.

4 Mass burning is currently the method used most frequently in the United States and involves
5 little to no sorting, shredding, or separation. Consequently, toxic or hazardous components
6 present in the waste stream are combusted, and toxic constituents are exhausted to the air or
7 become part of the resulting solid wastes. Currently, approximately 89 waste-to-energy plants
8 operate in the United States. These plants generate approximately 2,700 MWe, or an average
9 of approximately 30 MWe per plant (IWSA, 2007). Approximately 19 average-sized plants will
10 be necessary to provide the same level of output as the other alternatives to KPS license
11 renewal.

12 The GEIS indicates that the overall level of construction impact from a waste-fired plant will be
13 similar to that for a coal-fired power plant. The GEIS also indicates that waste-fired plants have
14 the same or greater operational impacts than coal-fired technologies (including impacts on the
15 aquatic environment, air, and waste disposal). The initial capital costs for municipal solid-waste
16 plants are greater than for comparable steam-turbine technology at coal-fired facilities or at
17 wood-fired facilities because of the need for specialized waste separation and handling
18 equipment (NRC, 1996).

19 Regulatory structures that once supported municipal solid waste incineration no longer exist.
20 For example, the Tax Reform Act of 1986 made capital-intensive projects such as municipal
21 waste combustion facilities more expensive relative to less capital-intensive waste disposal
22 alternatives such as landfills. Also, the 1994 Supreme Court decision *C&A Carbone, Inc. v.*
23 *Town of Clarkstown, New York*, struck down local flow control ordinances that required waste to
24 be delivered to specific municipal waste combustion facilities rather than landfills that may have
25 had lower fees. Additionally, environmental regulations have increased the capital cost
26 necessary to construct and maintain municipal waste combustion facilities.

27 Given the small average installed size of municipal solid waste plants and the unfavorable
28 regulatory environment, the staff does not consider municipal solid waste combustion to be a
29 feasible alternative to KPS license renewal.

30 **8.5.12 Delayed Retirement**

31 In the KPS ER, DEK indicated that few base load plants are likely to retire in the near future in
32 Wisconsin. DEK identified roughly 315 MW of capacity operated by other generators in the
33 State, which is significantly less than the 590 MW currently produced by KPS. Further, delaying
34 retirement of older, coal-fired plants is likely to carry additional environmental impacts, as they
35 typically have less-advanced emissions controls. As a result, the staff will not consider delayed
36 retirement as an alternative to KPS license renewal.

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1 **8.6 NO-ACTION ALTERNATIVE**

2 This section will examine the environmental effects that will occur if the NRC takes no action.
3 No action in this case means that the NRC does not issue a renewed operating license for KPS
4 and its license simply expires at the end of the current license term, in 2013. If the NRC takes
5 no action, the plant will shutdown at or before the end of the current license. After shutdown,
6 plant operators will initiate decommissioning according to 10 CFR 50.82.

7 The staff notes that no action is the only alternative considered in-depth that does not satisfy the
8 purpose and need for this draft SEIS, as it does not meet system needs beyond the term of the
9 current license. The no-action alternative would not meet the energy needs currently met by
10 KPS or that the alternatives evaluated in sections 8.1 through 8.3 would satisfy. Assuming that a
11 need currently exists for the power generated by KPS, the no-action alternative would require
12 the appropriate energy planning decision makers to rely on another alternative or conservation
13 to replace or offset KPS's capacity.

14 In this section, the staff addresses only those impacts that arise directly as a result of plant
15 shutdown. The staff has already addressed environmental impacts from decommissioning and
16 related activities in several other documents. These documents include the *Final Generic*
17 *Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586,
18 Supplement 1 (NRC, 2002); the license renewal GEIS (Chapter 7; NRC, 1996); and Chapter 7
19 of this draft SEIS. These analyses either directly address or bound the environmental impacts of
20 decommissioning whenever DEK ceases operating KPS.

21 The staff notes that, even with a renewed operating license, KPS will eventually shut down, and
22 the environmental effects addressed in this section will occur at that time. Since these effects
23 have not otherwise been addressed in this draft SEIS, the staff will address the impacts in this
24 section. As with decommissioning effects, it is likely that shutdown effects will be similar whether
25 they occur at the end of the current license or at the end of a renewed license. The only
26 difference is that the impacts will occur 20 years sooner if no action is taken.

27 **Table 8-4. Summary of Environmental Impacts of No Action Compared to Continued**
28 **Kewaunee Power Station Operation**

	No Action	Continued KPS Operation
Air Quality	SMALL	SMALL
Groundwater	SMALL	SMALL
Surface Water	SMALL	SMALL
Ecology	SMALL	SMALL
Human Health	SMALL	SMALL
Socioeconomics	SMALL	SMALL TO MODERATE
Waste Management	SMALL	SMALL

1 **8.6.1 Air Quality**

2 When the plant stops operating, there would be a reduction in emissions from activities related
3 to plant operation such as the use of diesel generators and employees' vehicles. In Chapter 4,
4 NRC staff determined that these emissions would have a SMALL impact on air quality during
5 the renewal term. Therefore, if the emissions decrease, the impact to air quality would also
6 decrease and would be SMALL.

7 **8.6.2 Groundwater Use and Quality**

8 The use of groundwater would diminish as plant personnel are removed from the site and
9 operations cease. Some consumption of groundwater may continue as a small staff remains
10 onsite to maintain facilities prior to decommissioning. Overall impacts would be smaller than
11 during operations, but would remain SMALL.

12 **8.6.3 Surface Water Use and Quality**

13 The rate of consumptive use of surface water would decrease as the plant is shut down and the
14 reactor cooling system continues to remove the heat of decay. Wastewater discharges would
15 also be reduced considerably. Shutdown would reduce the already SMALL impact on surface
16 water resources and quality.

17 **8.6.4 Aquatic and Terrestrial Resources**

18 Plant shutdown will minimally affect aquatic resources. In Chapter 4 of this draft SEIS, the NRC
19 staff concludes that the impacts of continued operation on aquatic resources will be SMALL. No
20 additional land disturbances on or offsite would occur. Maintenance of transmission line ROWs
21 will continue, regardless of plant operation. Shutdown will reduce the already SMALL impacts to
22 aquatic ecology. As such, the staff concludes that impacts to aquatic resources as a result of
23 plant shutdown will be SMALL.

24 Shutdown will minimally affect terrestrial resources. In Chapter 4 of this draft SEIS, the staff
25 concluded that the impacts of continued operation on terrestrial resources will be SMALL. No
26 additional land disturbances onsite or offsite would occur. Maintenance of transmission line
27 ROWs would continue through 20 years, regardless of plant operation. Shutdown would reduce
28 the already SMALL impacts to terrestrial ecology. Accordingly, the staff concludes that impacts
29 to terrestrial resources as a result of plant shutdown would be SMALL.

30 **8.6.5 Human Health**

31 Human health risks would decrease following plant shutdown. The plant, which is currently
32 operating within regulatory limits, would release less radioactive gaseous and liquid material into
33 the environment. Thus, members of the public would receive less radiation exposure. Also, after
34 shutdown, the variety of potential accidents (radiological and industrial) at the plant would be
35 reduced to a limited set associated with shutdown events and fuel handling and storage. In
36 Chapter 4 of this draft SEIS, the staff concluded that the impacts of continued plant operation on
37 human health would be SMALL. In Chapter 5, the staff concluded that the impacts of accidents
38 during operation would be SMALL. Therefore, shutdown of the plant at the end of its license will

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1 decrease radioactive emissions and the variety of potential accidents. The staff concludes that
2 the impacts to human health following plant shutdown would be SMALL.

3 The no-action alternative would cause KPS to enter the decommissioning phase. Environmental
4 impacts from the decommissioning activities of any reactor before or at the end of an initial or
5 renewed license are evaluated in the *Generic Environmental Impact Statement for*
6 *Decommissioning of Nuclear Facilities*: Supplement 1, Regarding the Decommissioning of
7 Nuclear Power Reactors, NUREG-0586, Supplement 1 (NRC, 2002). The document concluded
8 that the human health impacts from decommissioning a power reactor are SMALL. In Chapter 7
9 of this draft SEIS, the staff used information contained in NUREG-0586, Supplement 1, its
10 review of the applicant's environmental report, the site audit, and the public scoping process to
11 conclude that the impacts to human health during the decommissioning phase of KPS would be
12 SMALL.

13 The staff concludes that the impacts to human health for the no action alternative would be
14 SMALL.

15 **8.6.6 Socioeconomics**

16 Land Use

17 Plant shutdown would not affect onsite land use. Plant structures and other facilities would
18 remain in place until decommissioning. Most transmission lines connected to KPS would remain
19 in service after the plant stops operating. Maintenance of most existing transmission lines would
20 continue as before. Impacts on land use from plant shutdown would be SMALL.

21 Socioeconomics

22 Plant shutdown would have an impact on socioeconomic conditions in the region around KPS.
23 Plant shutdown would eliminate up to 735 jobs and would reduce tax revenue in the region. The
24 loss of these contributions, which may not entirely cease until after decommissioning, would
25 have a SMALL to MODERATE impact. See Appendix J to NUREG 0586, Supplement 1
26 (NRC, 2002), for additional discussion of the potential socioeconomic impacts of plant
27 decommissioning.

28 Transportation

29 Traffic volumes on the roads in the vicinity of KPS would be reduced after plant shutdown. Most
30 of the reduction in traffic volume would be associated with the loss of jobs at the plant.
31 Deliveries to the plant would be reduced until decommissioning. Transportation impacts would
32 be SMALL as a result of plant shutdown.

33 Aesthetics

34 Plant structures and other facilities would remain in place until decommissioning, and plumes
35 from the plant's cooling towers would disappear entirely. Noise caused by plant operation would
36 cease. Aesthetic impacts of plant closure would be SMALL.

1 Historic and Archaeological Resources

2 Plant shutdown will likely have no noticeable immediate impacts on historic and archaeological
3 resources. Decommissioning methods would be described in a post-shutdown decommissioning
4 activities report, which is required to be submitted to NRC within two years following cessation
5 of operations. NRC requirements ensure that the decommissioning activities would be subject to
6 a Section 106 review in accordance with the National Historic Preservation Act (NHPA). It is
7 unlikely that plant staff will begin deconstruction or remediation before decommissioning.
8 Because existing transmission lines will remain energized, transmission line ROW maintenance
9 would continue. In Chapter 4 of this draft SEIS, the NRC concluded that the impacts of
10 continued plant operation on historic and archaeological resources could be SMALL.

11 Impacts from the no-action alternative would also be SMALL, since KPS would be
12 decommissioned with no alternative power plant to replace it. A separate environmental and
13 Section 106 review would be conducted for decommissioning. That assessment will address the
14 protection of historic and archaeological resources.

15 Environmental Justice

16 Termination of power plant operations would not disproportionately affect minority and low-
17 income populations outside of the immediate vicinity of KPS, because minority and low-income
18 populations are generally concentrated in urban areas. Impacts to all other resource areas
19 would be SMALL to MODERATE. Thus, impacts from plant shutdown would be SMALL. See
20 Appendix J of NUREG 0586, Supplement 1 (NRC, 2002), for additional discussion of these
21 impacts.

22 **8.6.7 Waste Management**

23 If the no-action alternative were implemented the generation of high-level waste would stop and
24 the generation of low-level and mixed waste would decrease. Impacts from implementation of
25 the no-action alternative are expected to be SMALL.

26 **8.7 ALTERNATIVES SUMMARY**

27 In this chapter, we considered the following alternatives to KPS license renewal:

- 28 • A gas-fired combined-cycle plant at the KPS site and an undetermined alternate site;
- 29 • A coal-fired plant at the KPS site and an undetermined alternative site, and;
- 30 • Two combinations of alternatives including gas-fired capacity, energy conservation and
31 either wind power (option 1), or wood-fired power (option 2).

32 Finally, the staff considered the effects of no action by the NRC. Impacts for all alternatives are
33 summarized in Table 8.5. The impacts of license renewal for KPS are similar to or smaller than
34 the impacts of the alternatives considered in this chapter in all resource areas, with the
35 exception of no action. No action, however, would necessitate additional action on the part of
36 other entities to either replace or offset the power produced by KPS, and thus would result in
37 additional impacts similar to those discussed in the other sections of this chapter.

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1 **Table 8-5. Summary of Environmental Impacts of Proposed Action and Alternatives**

	KPS License Renewal	Gas-fired at KPS Site	Gas-fired at Alternate Site	Coal-Fired at KPS Site	Coal-Fired at Alternate Site	Combination Option 1	Combination Option 2	No-Action Alternative
Air Quality	SMALL	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	SMALL
Groundwater	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL
Ecology	SMALL	SMALL to MODERATE	SMALL to MODERATE	MODERATE	MODERATE	SMALL to LARGE	SMALL to LARGE	SMALL
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL
Socioeconomics	SMALL TO MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL to LARGE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	SMALL	MODERATE	MODERATE	SMALL	SMALL	SMALL

2 **8.8 REFERENCES**

3 10 CFR 51. *U.S. Code of Federal Regulations*, Title 10, *Energy*, Part 50, “Environmental
4 Protection Regulations for Domestic Licensing and Related Regulatory Functions.”

5 40 CFR 50. *U.S. Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 50,
6 “Domestic Licensing of Production and Utilization Facilities.”

7 40 CFR 51. *U.S. Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 51,
8 “Requirements for Preparation, Adoption, and Submittal of Implementation Plans.”

9 40 CFR 60. *U.S. Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 60,
10 “Standards of Performance for New Stationary Sources.”

11 40 CFR 75. *U.S. Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 75,
12 “Continuous Emission Monitoring.”

13 64 FR 35714, *Federal Register*, Volume 64, No. 126, pp. 35714-35774. Washington, D.C. (July
14 1, 1999)

15 American Wind Energy Association (AWEA). Undated. “Resources: Wind Energy Projects (As
16 of 12/31/2008).” Available URL: <http://www.awea.org/projects/> (accessed September 12, 2009).

17 *Clean Air Act*. 42 USC 7401, et seq. (CAA). *United States Code*, Title 42, *The Public Health and*
18 *Welfare*, Chapter 85, “Air Pollution Prevention and Control.”

19 Dominion Energy Kewaunee, Inc. (DEK). 2008. “Applicant’s Environmental Report – Operating
20 License Renewal Stage.” Appendix E of Application for Renewed Operating License,
21 Kewaunee Power Station. Docket No. 50-305. August 2008. ADAMS Accession No.
22 ML082341039.

23 Energy Center of Wisconsin. 2009. *Energy Efficiency and Customer-Sited Renewable Resource*
24 *Potential in Wisconsin for the Years 2012 and 2018*. Available URL:

- 1 <http://www.ecw.org/ecwresults/WI-Potential-Aug09.pdf> (Alternate URL:
2 <http://psc.wi.gov/aboutus/pscreports/reports-index.htm>) (accessed September 12, 2009).
- 3 Energy Information Administration (EIA). 2008. *Cost and Quality of Fuels for Electric Plants*
4 *2006 and 2007*. DOE/EIA-0191(2007). Washington, D.C. Available URL:
5 <http://tonto.eia.doe.gov/FTPROOT/electricity/019107.pdf> (accessed September 14, 2009).
- 6 Energy Information Administration (EIA). 2009a. *Annual Energy Outlook 2009 with Projections*
7 *to 2030*. DOE/EIA-0383(2009). Washington, D.C. Available URL:
8 [http://tonto.eia.doe.gov/FTPROOT/forecasting/0383\(2009\).pdf](http://tonto.eia.doe.gov/FTPROOT/forecasting/0383(2009).pdf) (accessed September 12, 2009).
- 9 Energy Information Administration (EIA). 2009b. "Net Generation by Energy Source." Table 1.1
10 from Electric Power Monthly for June 2009. Accessed at:
11 http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html (accessed September 14, 2008).
- 12 Energy Information Administration (EIA). 2009c. *Assumptions to the Annual Energy Outlook*
13 *2009 with Projections to 2030*. DOE/EIA 0554 (2009). Washington, D.C. Available URL:
14 [http://tonto.eia.doe.gov/FTPROOT/forecasting/0554\(2009\).pdf](http://tonto.eia.doe.gov/FTPROOT/forecasting/0554(2009).pdf) (accessed September 14, 2009).
- 15 Environmental Protection Agency (EPA). 1998. Compilation of Air Pollutant Emission Factors,
16 Volume 1: Stationary Point and Area Sources: AP 42, Fifth Edition. "Section 1.1: Bituminous
17 and Subbituminous Coal Combustion: Final Section Supplement E." Washington, D.C.
- 18 Environmental Protection Agency (EPA). 1999. "Regional Haze Regulations." 40 CFR 51,
19 *Federal Register*, Volume 64, No. 126, pp. 35714-35774. Washington, D.C. (July 1, 1999)
- 20 Environmental Protection Agency (EPA). 2000a. "Regulatory Finding on Emissions of
21 Hazardous Air Pollutants from Electric Utility Steam Generating Units." *Federal Register*,
22 Volume 65, No. 245, pp. 79825-79831. Washington, D.C. (December 20, 2000).
- 23 Environmental Protection Agency (EPA). 2000b. "Notice of Regulatory Determination on Wastes
24 from the Combustion of Fossil Fuels." *Federal Register*, Volume 65, pp.32214-32237.
25 Washington, D.C. (May 22, 2000).
- 26 Environmental Protection Agency (EPA). 2007. "Clean Air Mercury Rule." Available URL:
27 <http://www.epa.gov/air/mercuryrule/> (accessed June, 2009). ADAMS Accession No.
28 ML082880732.
- 29 Environmental Protection Agency (EPA). 2008a. New Source Review. Available URL:
30 <http://www.epa.gov/nsr/>. ADAMS Accession No. ML083450073.
- 31 Environmental Protection Agency (EPA). 2008b. "Basic concepts of Environmental Science.
32 *Module 6: Fabric filters*". Available URL:
33 <http://www.epa.gov/apti/bces/module6/matter/control/control.htm#fabric> (accessed June 2009).
34 ADAMS Accession No. ML091760654.
- 35 Environmental Protection Agency (EPA). 2009a. *EPA Green Book Nonattainment Areas for*
36 *Criteria Pollutants*. Available URL: <http://www.epa.gov/air/oagps/greenbk/index.html> (accessed
37 May 2009).
- 38 Environmental Protection Agency (EPA). 2009b *Clean Air Interstate Rule*, Wisconsin. Available
39 URL: <http://www.epa.gov/CAIR/wi.html> (accessed June 2009). ADAMS Accession No.
40 ML092010055.

Environmental Impacts of Alternatives

- 1 General Electric Company (GE). 2007. "Gas Turbine and Combined Cycle Products." May
2 2007. Available URL: [http://www.gepower.com/prod_serv/products/gas_turbines_cc/
3 en/downloads/gasturbine_cc_products.pdf](http://www.gepower.com/prod_serv/products/gas_turbines_cc/en/downloads/gasturbine_cc_products.pdf) (accessed January 6, 2009). ADAMS Accession No.
4 ML082880731.
- 5 Idaho National Engineering and Environmental Laboratory (INEEL). 1996. "U.S. Hydropower
6 Resource Assessment for Wisconsin." DOE/ID-10430(WI). Idaho Falls, ID. Available URL:
7 <http://hydropower.inl.gov/resourceassessment/pdfs/states/wi.pdf> (accessed September 12,
8 2009).
- 9 Integrated Waste Services Association (IWSA). 2007. "Waste-to-Energy and the Production Tax
10 Credit." Washington, D.C. Available URL: <http://www.wte.org/docs/FactSheetPTC.pdf> (accessed
11 May 24, 2007). ADAMS Accession No. ML083050223.
- 12 U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement
13 for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C.
14 ADAMS Accession Nos. ML040690705 and ML040690738.
- 15 U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement
16 for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1,
17 Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report."
18 NUREG-1437, Volume 1, Addendum 1, Washington, D.C.
- 19 U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement
20 on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of
21 Nuclear Power Reactors*. NUREG-0586, Supplement 1, Volumes 1 and 2. Washington, D.C.
- 22 National Renewable Energy Laboratory (NREL). 2009. "United States Atlas of Renewable
23 Resources." Interactive Map. Available URL: [http://mapserve2.nrel.gov/website/Resource_Atlas/
24 viewer.htm](http://mapserve2.nrel.gov/website/Resource_Atlas/viewer.htm) (accessed September 12, 2009).
- 25 Nucleonics Week. 2008. *U.S. New Reactors More Likely Online in 2016 and Beyond, NEI
26 Official Says*. Volume 49, No. 15. April 10, 2008.
- 27 U.S. Office of Management and Budget (OMB). 2007. "Detailed Information on the Low Income
28 Home Energy Assistance Program Assessment." Available URL: [http://www.whitehouse.gov/
29 omb/expectmore/detail/10001059.2003.html](http://www.whitehouse.gov/omb/expectmore/detail/10001059.2003.html) (accessed July 10, 2007). ADAMS Accession No.
30 ML082880730.
- 31 Oak Ridge National Laboratory (ORNL). 2007. "Bioenergy Conversion Factors." Available URL:
32 http://bioenergy.ornl.gov/papers/misc/energy_conv.html (accessed November 6, 2007). ADAMS
33 Accession No. ML0830502.
- 34 Walsh, M.E., R.L. Perlack, A. Turhollow, D. de la Torre Ugarte, D.A. Becker, R.L. Graham, S.A.
35 Slinsky, and D.E. Ray. 2000. "Biomass Feedstock Availability in the United States: 1999 State
36 Level Analysis." Available URL: <http://bioenergy.ornl.gov/resourcedata/index.html> (accessed
37 May 22, 2007). ADAMS Accession No. ML083050223.
- 38 Wisconsin Department of Natural Resources (WDNR). 2008. *Factsheet on Rule to Control
39 Mercury Emissions from Coal-Fired Power Plants*. ADAMS Accession No. ML092010055.
- 40 Wisconsin Department of Natural Resources (WDNR). 2009. "Global Climate Change. Reports
41 and Documents." Available URL: <http://dnr.wi.gov/air/aq/global/climatechange/reports.html>
42 (accessed June, 2009).

- 1 Wisconsin Office of Energy Independence. 2008. *Wisconsin Energy Statistics*. Available URL:
- 2 [http://energyindependence.wi.gov/subcategory.asp?linksubcatid=2825&linkcatid=2847&linkid=1](http://energyindependence.wi.gov/subcategory.asp?linksubcatid=2825&linkcatid=2847&linkid=1451&locid=160)
- 3 [451&locid=160](http://energyindependence.wi.gov/subcategory.asp?linksubcatid=2825&linkcatid=2847&linkid=1451&locid=160) (accessed September 12, 2009).

9.0 CONCLUSION

This supplemental environmental impact statement (SEIS) contains the preliminary environmental review of Dominion Energy Kewaunee, Inc. (DEK) application for the renewed operating license for Kewaunee Power Station (KPS) as required by Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51) that implement the National Environmental Policy Act (NEPA). This chapter presents the conclusions and recommendations from the site-specific environmental review of KPS and summarizes site-specific environmental issues of license renewal that were identified during the review. The environmental impacts of license renewal are summarized in Section 9.1; a comparison of the environmental impacts of license renewal and energy alternatives is presented in Section 9.2; unavoidable impacts of license renewal and energy alternatives and resource commitments are discussed in Section 9.3; and conclusions and U.S. Nuclear Regulatory Commission (NRC) recommendations are presented in Section 9.4.

9.1 ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL

Our review of site-specific environmental issues in this SEIS leads the staff to conclude that issuing a renewed license would have SMALL impacts for the 23 Category 2 issues applicable to license renewal of KPS.

The requirements for the assessment of refurbishing in a license renewal of operating nuclear power plants include the preparation of an integrated plant assessment (IPA) under 10 CFR 54.21. The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings, as well as those that are not subject to periodic replacement. In the case of KPS, the IPA did not identify the need of major refurbishment or replacement actions to maintain the functionality of important systems, structures, and components during the KPS license renewal period. Also, the IPA did not identify the need for modifications to any of the KPS facilities associated with the license renewal.

Currently, no threatened or endangered aquatic species are known to occur within Lake Michigan on or in the vicinity of the KPS site or within any streams crossed by in-scope transmission line right of ways (ROWs); therefore, license renewal of KPS would have no effect on any Federally or State-listed aquatic species, and mitigation measures need not be considered.

Operation of the KPS site and its associated transmission lines is not expected to adversely affect any threatened or endangered species during the license renewal term; therefore, the staff concludes that adverse impacts to threatened or endangered species during the period of extended operation would be SMALL. There are several mitigation measures currently in place at the KPS site and along its associated transmission lines which NRC finds to be adequate. Mitigation measures include: nest construction and placement for the peregrine falcon, environmental review checklists, environmental evaluation forms, and best management practices.

Conclusion

1 **9.2 COMPARISON OF THE ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL**
2 **AND ALTERNATIVES**

3 In the conclusion to Chapter 8, the staff determined that impacts from license renewal are
4 generally similar to, or smaller than the impacts of alternatives to license renewal. In comparing
5 likely environmental impacts from gas-fired, coal-fired, two combinations of alternatives
6 including gas-fired capacity, energy conservation and either wind power (option 1), or
7 wood-fired power (option 2), and environmental impacts from license renewal, the staff found
8 that the no action alternative would result in the lowest environmental impact. The no action
9 alternative, however, would necessitate additional action on the part of other entities to either
10 replace or offset the power produced by KPS, and thus would result in additional impacts similar
11 to those discussed in Chapter 8. On the basis of its analysis, the staff found that the impacts of
12 license renewal are reasonable in light of the impacts from alternatives to the license renewal.

13 **9.3 RESOURCE COMMITMENTS**

14 **9.3.1 Unavoidable Adverse Environmental Impacts**

15 Unavoidable adverse environmental impacts are impacts that would occur after implementation
16 of all feasible mitigation measures. Implementing any of the energy alternatives considered in
17 this SEIS, including the proposed action, would result in some unavoidable adverse
18 environmental impacts.

19 Minor unavoidable adverse impacts on air quality would occur due to the emission and release
20 of various chemical and radiological constituents from power plant operations. Nonradiological
21 emissions resulting from power plant operations are expected to comply with Environmental
22 Protection Agency (EPA) emissions standards, though the alternative of operating a
23 fossil-fueled power plant in some areas may worsen existing attainment issues. Chemical and
24 radiological emissions would not exceed the National Emission Standards for Hazardous Air
25 Pollutants.

26 During nuclear power plant operations, workers and members of the public would face
27 unavoidable exposure to radiation and hazardous and toxic chemicals. Workers would be
28 exposed to radiation and chemicals associated with routine plant operations and the handling of
29 nuclear fuel and waste material. Workers would have higher levels of exposure than members
30 of the public, but doses would be administratively controlled and would not exceed any
31 standards or administrative control limits. Construction and operation of non-nuclear power
32 generating facilities would also result in unavoidable exposure to hazardous and toxic chemicals
33 to workers and the general public.

34 Also unavoidable would be the generation of spent nuclear fuel and waste material, including
35 low-level radioactive waste, hazardous waste, and nonhazardous waste. Hazardous and
36 nonhazardous wastes would also be generated at non-nuclear power generating facilities.
37 Wastes generated during plant operations would be collected, stored, and shipped for suitable
38 treatment, recycling, or disposal in accordance with applicable Federal and State regulations.
39 Due to the costs of handling these materials, power plant operators would be expected to
40 conduct all activities and optimize all operations in a way that would generate the smallest
41 amount of waste practical.

1 **9.3.2 Relationship Between Local Short-Term Uses of the Environment and the**
2 **Maintenance and Enhancement of Long-Term Productivity**

3 The operation of power generating facilities would result in short-term uses of the environment
4 as described in Chapters 4, 5, 6, 7, and 8. "Short term" is the period of time during which
5 continued power generating activities would take place.

6 Power plant operations would necessitate short-term use of the environment and commitments
7 of resources, and would also commit certain resources (e.g., land and energy) indefinitely or
8 permanently. Certain short-term resource commitments would be substantially greater under
9 most energy alternatives, including license renewal, than under the No Action alternative due to
10 the continued generation of electrical power, as well as continued use of generating sites and
11 associated infrastructure. During operations, all energy alternatives would entail similar
12 relationships between local short-term uses of the environment and the maintenance and
13 enhancement of long-term productivity.

14 Air emissions from power plant operations would introduce small amounts of radiological and
15 nonradiological constituents to the region around the plant site. Over time, these emissions
16 would result in increased concentrations and exposure, but are not expected to impact air
17 quality or radiation exposure to the extent that public health and long-term productivity of the
18 environment would be impaired.

19 Continued employment, expenditures, and tax revenues generated during power plant
20 operations would directly benefit local, regional, and state economies over the short term. Local
21 governments investing project-generated tax revenues into infrastructure and other required
22 services could enhance economic productivity over the long term.

23 The management and disposal of spent nuclear fuel, low-level radioactive waste, hazardous
24 waste, and nonhazardous waste would require an increase in energy and would consume
25 space at treatment, storage, or disposal facilities. Regardless of the location, the use of land to
26 meet waste disposal needs would reduce the long-term productivity of the land.

27 Power plant facilities would be committed to electricity production over the short term. After
28 decommissioning these facilities and restoring the area, the land could be available for other
29 future productive uses.

30 **9.3.3 Irreversible and Irretrievable Commitments of Resources**

31 Irreversible and irretrievable commitments of resources for electrical power generation would
32 include the commitment of land, water, energy, raw materials, and other natural and manmade
33 resources required for power plant operations. This section describes the irreversible and
34 irretrievable commitments of resources that have been identified in this SEIS. A commitment of
35 resources is irreversible when primary or secondary impacts limit the future options for a
36 resource. An irretrievable commitment refers to the use or consumption of resources neither
37 renewable nor recoverable for future use. In general, the commitment of capital, energy, labor,
38 and material resources would also be irreversible.

Conclusion

1 The implementation of any of the energy alternatives considered in this SEIS would entail the
2 irreversible and irretrievable commitments of energy, water, chemicals, and, in some cases,
3 fossil fuels. These resources would be committed during the license renewal term and over the
4 entire life cycle of the power plant and would essentially be unrecoverable.

5 Energy expended would be in the form of fuel for equipment, vehicles, and power plant
6 operations and electricity for equipment and facility operations. Electricity and fuels would be
7 purchased from offsite commercial sources. Water would be obtained from existing water supply
8 systems. These resources are readily available, and the amounts required are not expected to
9 deplete available supplies or exceed available system capacities.

10 The irreversible and irretrievable commitments of material resources include materials that
11 cannot be recovered or recycled, materials that are rendered radioactive and cannot be
12 decontaminated, and materials consumed or reduced to unrecoverable forms of waste;
13 however, none of the resources used by these power generating facilities is in short supply,
14 and, for the most part, are readily available.

15 Various materials and chemicals, including acids and caustics, would be required to support
16 operations activities. These materials would be derived from commercial vendors, and their
17 consumption is not expected to affect local, regional, or national supplies.
18 The treatment, storage, and disposal of spent nuclear fuel, low-level radioactive waste,
19 hazardous waste, and nonhazardous waste would require the irretrievable commitment of
20 energy and fuel and would result in the irreversible commitment of space in disposal facilities.

21

22 **9.4 RECOMMENDATION**

23 Based on (1) the analysis and findings in the GEIS; (2) information provided in the
24 environmental report (ER) submitted by DEK; (3) consultation with Federal, State, and local
25 agencies; (4) a review of pertinent documents and reports; and (5) consideration of public
26 comments received during scoping, the preliminary recommendation of the NRC staff is that the
27 adverse environmental impacts of license renewal for KPS are not so great that preserving the
28 option of license renewal for energy planning decisionmakers would be unreasonable.

10.0 LIST OF PREPARERS

This supplemental environmental impact statement (SEIS) was prepared by members of the Office of Nuclear Reactor Regulation, with assistance from other U. S. Nuclear Regulatory Commission (NRC) organizations and contract support from Pacific Northwest National Laboratory.

Table 10-1. List of Preparers. *Pacific Northwest National Laboratory provided contract support for the severe accident mitigation alternatives (SAMA) analysis, presented in Chapter 5 and Appendix F.*

Name	Affiliation	Function or Expertise
Nuclear Regulatory Commission		
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Richard Bulavinetz	Nuclear Reactor Regulation	Aquatic Ecology
Jennifer Davis	Nuclear Reactor Regulation	Historic and Archaeological Resources
Nathan Goodman	Nuclear Reactor Regulation	Terrestrial Ecology
Samuel Hernandez	Nuclear Reactor Regulation	Project Manager
Stephen Klementowicz	Nuclear Reactor Regulation	Radiation Protection
Ekaterina Lenning	Nuclear Reactor Regulation	Air Quality
Dennis Logan	Nuclear Reactor Regulation	Ecology
Sarah Lopas	Nuclear Reactor Regulation	Nonradiological Waste
Robert Palla	Nuclear Reactor Regulation	Severe Accident Mitigation Alternatives
Vanice Perin	Nuclear Reactor Regulation	Project Manager
Jeffrey Rikhoff	Nuclear Reactor Regulation	Socioeconomics; Land Use; Environmental Justice
Andrew Stuyvenburg	Nuclear Reactor Regulation	Alternatives
Allison Travers	Nuclear Reactor Regulation	Hydrology
SAMA Contractor^(a)		
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Tye Blackburn	Pacific Northwest National Laboratory	Severe Accidents Mitigation Alternatives

^(a) Pacific Northwest National Laboratory is operated by Batelle for the U.S. Department of Energy

APPENDIX A
COMMENTS RECEIVED ON THE ENVIRONMENTAL REVIEW

1 **A. COMMENTS RECEIVED ON THE ENVIRONMENTAL REVIEW**

2 **A.1. Comments Received During Scoping**

3 The scoping process related to the review of the Kewaunee Power Station (KPS) license
4 renewal application submitted by Dominion Energy Kewaunee, Inc. (DEK), began on October 9,
5 2008, with the publication of the U.S. Nuclear Regulatory Commission's (NRC's) Notice of Intent
6 to conduct scoping in the *Federal Register* (73 FR 59678). The scoping process included two
7 public meetings held at the Town Hall in Carlton, Wisconsin, on October 22, 2008.
8 Approximately 60 members of the public attended the meetings. After the NRC's prepared
9 statements pertaining to the license renewal process, the meetings were open for public
10 comments. Attendees provided oral statements that were recorded and transcribed by a
11 certified court reporter. All written statements submitted at the public meeting were appended to
12 the transcript. Transcripts of the entire meeting are an attachment to the Scoping Meeting
13 Summary dated November 17, 2008 (NRC, 2008a). In addition to the comments received during
14 the public meetings, comments were received by letter and by electronic mail and were
15 addressed by the NRC staff.

16 Each commenter was given a unique identifier so that every comment could be traced back to
17 its author. Table A-1 identifies individuals providing comments applicable to the environmental
18 review and their Commenter ID, and each person's set of comments. The individuals are listed
19 in the order in which they spoke at the public meeting, and in alphabetical order for the
20 comments received by letter or e-mail. To maintain consistency with the Scoping Summary
21 Report, the unique identifier used in that report for each set of comments is retained in this
22 appendix. Specific comments were categorized and consolidated by topic. Comments with
23 similar and specific objectives were combined to capture the common essential issues raised by
24 participants. Comments fall into one of the following general groups:

- 25 • Specific comments that address environmental issues within the purview of the NRC
26 environmental regulations related to license renewal. These comments address
27 Category 1 (generic), or Category 2 (site-specific) issues or issues not addressed in
28 the GEIS or Category 2 (site-specific) issues. They also address alternatives to license
29 renewal and related Federal actions.
- 30 • General comments (1) in support of or opposed to nuclear power or license renewal or
31 (2) on the renewal process, the NRC's regulations, and the regulatory process. These
32 comments may or may not be specifically related to the KPS license renewal
33 application.
- 34 • Comments that do not identify new information for the NRC to analyze as part of its
35 environmental review.
- 36 • Comments that address issues that do not fall within or are specifically excluded
37 from the purview of NRC environmental regulations related to license renewal. These
38 comments typically address issues such as the need for power, emergency
39 preparedness, security, current operational safety issues, and safety issues related to
40 operation during the renewal period.

Appendix A

1 **Table A-1. Commenters on the Scope of the Environmental Review.** *Each commenter is*
 2 *identified along with their affiliation and how their comment was submitted.*

Commenter ID	Commenter	Affiliation (If Stated)	Comment Source; ML No(s).
KPS-A	Dave Hardtke	Local Citizen	Afternoon Scoping Meeting; Evening Scoping Meeting; ML083190734; ML083190744
KPS-B	Stanley Lacrosse	Local Citizen	Afternoon Scoping Meeting; Written Comments; ML083190734; ML083100095; ML090440072
KPS-C	Ken Paplham	Board Supervisor, Town of Carlton	Afternoon Scoping Meeting; ML083190734
KPS-D	Francis Wojta	Local Citizen	Afternoon Scoping Meeting; ML083190734
KPS-E	Rich Langan	Congressman Steve Kagen's Office	Afternoon Scoping Meeting; ML083190734
KPS-F	Bob Garfinkel	Kewaunee County Board; Literacy Partners of Kewaunee County	Afternoon Scoping Meeting; ML083190734
KPS-G	Jennifer Brown	Kewaunee County Economic Development Corporation	Afternoon Scoping Meeting; ML083190734
KPS-H	Lori Hucek	Kewaunee County Emergency Management	Afternoon Scoping Meeting; ML083190734
KPS-I	Jim Soletzki	State of Wisconsin Assembly Representative	Afternoon Scoping Meeting; Written Comment; ML083100092
KPS-J	Mr. Carrole	Local Citizen	Evening Scoping Meeting; ML083190744
KPS-K	Steve Tadisch	Local Citizen	Evening Scoping Meeting; ML083190744
KPS-L	Bob Ziegelbauer	State Representative, 25th Assembly District; Manitowoc County Executive	Letter; ML083100586; ML083100094
KPS-M	Nancy Crowley	Manitowoc County Emergency Services Coordinator	Letter; ML083100093
KPS-N	Gregory Veith	IUOE Local 310 President; Dominion Energy Kewaunee, Inc.	E-mail; ML083380455

3 Comments received during scoping applicable to this environmental review are presented in this
 4 section along with the NRC response. Comments general or outside the scope of the
 5 environmental review for KPS are not included here. Those comments can be found in the
 6 Scoping Summary Report (NRC, 2009a).

7 Scoping comments are grouped in the following categories:

- 8 • Socioeconomics

1 • Uranium Fuel Cycle and Waste Management

2 **A.1.1. Socioeconomics (Taxes and Distribution of Revenues)**

3 **Comment:** The nuclear plant also pays over \$6 million in utility taxes to the State of Wisconsin
4 every year. Wisconsin is the only State in which that utility does not stay in the municipality
5 where the plant is located. Why is that? All property owners in the town of Carlton are currently
6 paying full taxes as well, and deserve to be compensated. (KPS-B-1)

7 **Comment:** One reason the people of the Township of Carlton are upset is the distribution of the
8 money from the utility tax which the Kewaunee Nuclear Power Plant pays. The plant occupies
9 1000 acres of what was once prime agricultural land. It purchased said land from 13 "small
10 farms" which includes 1 mile of lake frontage where it is possible to walk out to the water's
11 shore. Now the rest of the taxpayers have had to pay extra property taxes to help make up for
12 the lost valuation of those farms. It is simply a matter of getting compensated for what the town
13 has lost. (KPS-B-2)

14 **Comment:** Okay. Ms. Lopas you said that your committee oversees the, like land use and the
15 water and the natural resources and all that. I have a question about land use. I'm from the town
16 of Carlton. I live about three miles north of the nuclear plant. The way I understand it right now
17 the utility taxes that we get from having that plant here just about equals the taxes that we would
18 have gotten from homes that would have been built on that property. That means that in my
19 opinion that means that nothing is gained by having the nuclear waste being stored here on this
20 property which is what is going on right now. Above ground is the waste storage. The pools are
21 full. So my question is what, what's going to happen when the plant closes and then the utility
22 tax no longer applies? The waste is still going to be there. We're not getting anything for that
23 waste. What do we have to gain by extending the license, having more and more waste being
24 piled up there, high level waste. That's part of my concern. (KPS-A-1)

25 **Comment:** You know, it, it's a shame to listen and we have to listen and it's not fair because I
26 can tell you right now the perception of our town of Carlton by the public service commission,
27 the NRC and all our elected officials as being a tax free township is not true. We pay more taxes
28 than our neighboring town. And this is not right for the simple reason we had 480 signatures out
29 of a possibly I think there's maybe a little over 600 people that are voting in this town and we
30 had 480 signatures against letting them put the caskets on top of the ground unless we get
31 compensated. And our town officials gave them the building permit. They scared them into it.
32 Giving them a line. And this is what's all wrong because they ruined our zoning book because
33 they said they didn't need a variance, they didn't need a conditional use, they didn't need that so
34 they turned around and gave them the building permit and now they don't even, they don't know
35 us no more. They're supposed to work without trying to get a little more money out of the State.
36 The State gets six million, very close, for utility tax but none of it stays. We have to share it with
37 the county for 19 percent.

38 And I have to sort of correct Cindy a little bit. If they could put this town back the way it was
39 without the nuclear plant we would pay less taxes. And this is what really makes it bad because
40 in 1968 when they broke ground they bought this land real cheap. And the State says the
41 assessor will be within ten percent of 100 so the assessor has to keep raising the rest of us to
42 make up the difference so that's why our taxes are higher than the Town of Franklin or the Town

Appendix A

1 of Kewaunee. And I don't think this is right and that's why I'm opposing it and all the 480
2 signatures are opposing relicensing that plant until this gets settled.

3 I've got them all, all our officials, even the governor. They want to take the moratorium off to
4 build a nuclear plant because it's the safest, the cleanest. Like I wrote in a letter to them when I
5 sent them all the signatures. Where are you going to put the waste. We've stored it for 34 years
6 under water and we finally got 50,000 and then Dominion devaluated the plant and we lost, how
7 much? \$37,000. Now you just said just a few minutes ago that they update, update, update. It's
8 running at full capacity. How come you can devalue it? I mean that's not your doing, but it,
9 that's lost us \$37,000. (KPS-B-3)

10 **Comment:** I would like to like to make a little comment on that. It's only pocket change for
11 Dominion. But at the same time -- all this volunteer that we have to take is on our fire
12 departments. And the fire departments don't get a penny to do exactly what Dominion wants to
13 get in so that everything is perfect. Us guys never get a penny. We don't even get paid for the
14 gas in the, in the trucks that do all the running. So I don't -- The volunteer, the volunteer fire
15 departments don't get paid. (KPS-B-4)

16 **Comment:** I'd like to differ with that. They do get paid. Any type of response that they have with
17 us whether it's training or for real they bill us. We pay them from our county's budget that we get
18 reimbursed from the plant. If a person has to take off of work we pay their wages that day
19 because they have responded to a training or an exercise or a real event. That is not true.
20 (KPS-H-2)

21 **Comment:** If NRC can come over here and overrule our zoning because they are that big and
22 they can step on us, it's like I told our State senator, we have only 600 voting people in the town
23 and you don't give a damn about us. And that was Herb Cole. And it's the same with Kagen's
24 office and it's the same with every one of them. We met with them all. And Gary Visor is the only
25 one that is trying to fight for us. But the State of Wisconsin is the only State that takes all the
26 utility tax and sends back what they want.(KPS-J-1)

27 There's no incentive for Yucca Mountain to have something done when the rods can be stored
28 at the facility when they get 95 percent of the money. We get the five percent of the money
29 where I think if we got compensated at the very least maybe Yucca Mountain would say hey this
30 is goes here we should get that. That's just the way I feel.(KPS-D-1)

31 **Response:** Chapter 2 of this SEIS includes a discussion of the regional tax structure and the
32 distribution of present revenues to each jurisdiction and district, however, the NRC has no role
33 in how States and local jurisdictions tax their utilities, assess power plant value, or how tax
34 money is distributed.

35 **A.1.2. Uranium Fuel Cycle and Waste Management**

36 **Comment:** I'm Ken Paplham. I'm on the town board here for 34 years as supervisor. And back
37 in January of '93 the town board passed a resolution that there would be no outdoor storage at
38 the power plant. We passed a resolution at that time. And now we're getting these stored
39 outside and I think the municipality should be compensated from the Federal government of
40 \$250,000 a year plus \$40,000 for each containment that's stored there as long as they're stored

1 there. I don't know why these municipalities have to put up with this storage when we had a
2 resolution back in '93 that there was going to be no storage. I know the plant is in problems with
3 Yucca Mountain but so I think something has to be done. Why should we live with that and like
4 Cindy said right out in the open and Yucca Mountain is going to be a mile under the ground or in
5 the, in a shaft there so. (KPS-C-1)

6 **Comment:** I am sending this letter to our officials on behalf of the citizens and taxpayers from
7 the town of Carlton, in Kewaunee County. State and Federal officials need to take a good look
8 at an alternative storage facility in order to keep the Kewaunee Nuclear Power Plant in
9 operation. The storage the plant has in existence will soon be depleted; by the year 2011
10 operation may have to be suspended until a suitable solution is found. We have come to know
11 that nuclear energy is the most affordable, cleanest, most reliable, and safest way to achieve
12 the emission savings that our nation has to strive for. That is why it is important to address this
13 matter with the attention it deserves.

14 The nuclear plants new owners, Dominion, recently came to the town meeting seeking approval
15 to construct the dry storage facility for spent fuel rods on site. This is due to the fact that the
16 pools which currently store the spent rods are reaching their maximum capacity. It had been
17 promised by the Wisconsin Public Service that the rods were to be moved to Yucca Mountain,
18 yet they are unfairly being forced to be stored in the town without being fully compensated. The
19 nuclear plant has paid millions, if not billions, of dollars to the Federal Government over more
20 than a 30 year span for a place to store the spent rods. And yet, regrettable, nothing has ever
21 happened. Every spent rod since operation began in 1974 is still stored at the plant site.

22 The dry storage location needs serious consideration. If nuclear power is less expensive than
23 coal or natural gas, as well as cleaner, all the more important to work our hardest to maintain
24 operation of the Kewaunee nuclear plant. We need our State and U.S. senators as well as
25 Representatives to help do what is necessary and fair for the property owners here in the town
26 of Carlton. The need for this dry storage is present and understood; let us work together for the
27 benefit of everyone to create a workable solution. (KPS-B-5)

28 **Comment:** "We the undersigned believe that if Dominion (Kewaunee Nuclear Power Plant) is
29 allowed to construct the dry storage facility on site which is being proposed the land owners of
30 the town of Carlton should be compensated accordingly. Meaning until the spent rods are
31 moved to an alternate location, only then would it be fair if compensation were to cease." (KPS-
32 B-6)

33 *The complete petition is available at accession number ML083100095.*

34 **Comment:** We have sent this letter to our officials on behalf of the citizens and taxpayers from
35 the Town of Carlton, in Kewaunee County. State and Federal officials need to take a good look
36 at an alternative storage facility in order to keep the Kewaunee Nuclear Power Plant in
37 operation. The storage the plant has in existence will soon be depleted; by the year 2011
38 operation may have to be suspended until a suitable solution is found. We have come to know
39 that nuclear energy is the most affordable, cleanest, most reliable, and safest way to achieve
40 the emission savings that our nation has to strive for. That is why it is important to address this
41 matter with the attention it deserves.

Appendix A

1 Another concern is the “promise” once made that the spent fuel rods from this plant would be
2 moved to Yucca Mountain, that has failed to happen as of yet. We are all concerned for our
3 well-being and also that of our families and neighbors, the entire community. We believe this is
4 God’s country and need to protect what we have for our future generations, our grandchildren
5 and great-grandchildren.

6 The nuclear plants new owners, Dominion, recently came to the town meeting seeking approval
7 to construct a dry storage facility for spent fuel rods on site. This is due to the fact that the pools
8 which currently store the spent fuel rods are reaching their maximum capacity. It has been
9 promised by the Wisconsin Public Service that the rods were to be moved to Yucca Mountain,
10 yet they are unfairly being forced to be stored in the town without being fully compensated. The
11 nuclear plant has paid millions, if not billions of dollars to the Federal government over more
12 than a 30 year span for a place to store the spent rods. And yet, regrettably, nothing has ever
13 happened. Every spent rod since operation began in 1974 is still stored at the plant site.

14 The dry storage location needs serious consideration. If nuclear power is less expensive than
15 coal or natural gas, as well as cleaner, all the more important to work our hardest to maintain
16 operation of the Kewaunee nuclear plant. We need our State and U.S. senators as well as
17 Representatives to help do what is necessary and fair for the property owners here in the town
18 of Carlton. The need for this dry storage is presenting and understood; let us work together for
19 the benefit of everyone to create a workable solution. (KPS-B-7)

20 **Comment:** Resolution of Conditional Approval

21 The town board of the town of Carlton, Kewaunee County, Wisconsin, meeting in
22 a regularly scheduled session on the 12 day January, 1993, upon consideration
23 of the matter and upon vote duly taken, hereby resolves that:

24 The town board of the town of Carlton, Kewaunee County, Wisconsin, approves
25 and supports the proposal before the State of Wisconsin to modify the addendum
26 payment formula of utility tax if, and only if, all affected utilities are prohibited by
27 law from moving or removing any spent fuel currently stored in pools, or to be
28 stored in pools in the future, unless such removal is for the sole purpose of
29 immediate transport out of the town of Carlton.

30 The basis for this Resolution is that the town board strongly believes that the
31 remuneration to the town of Carlton from and on behalf of the nuclear power
32 plant in the Town is unfairly and disproportionately low, in light of the
33 environmental and health risks to the residents, livestock, and land of the town of
34 Carlton and surrounding communities. (KPS-B-8)

35 *The above Resolution is available at accession number ML090440072. The town of Carlton*
36 *board meeting proceedings dated May 13, June 10, and July 10, 2008, were attached to the*
37 *resolution, and are also available at ML090440072.*

38 **Comment:** How can it be just as safe above ground with a fence around it compared to being
39 under the ground about a mile under the ground with a 5,000 I believe, 5,000 foot high mountain
40 on top of it? How can it be just as safe sitting out there a few miles from my house and who
41 knows how long it's going to sit there? (KPS-A-2)

1 **Comment:** My name is Stanley Lacrosse and I've lived in this town for 54 years and I've heard
2 nothing but lies all the way through. I've attended every meeting. And what I'm against, strongly
3 oppose licensing this plant until we get these issues solved for the simple reason we have these
4 caskets up there. We have to take your word for it, the NRC word for it that they're safe. And
5 you say they'll be moved. That's not true. They'll never move because I got the CRS report
6 updates since October of 2008 and it says right in there possibly the year 2020 they might start
7 receiving. But it also states that if everyone goes there there's not enough room. So you know
8 the furthest one away will never go. (KPS-B-9)

9 **Comment:** Yeah, I'm Francis Wojta. I'm just a dairy farmer down the road. I'm probably just an
10 average joe farmer. But, whoops, I just, you know, the NRC takes care of the licensing process,
11 the DOE takes care of the energy process of it. And I know it's, the Federal government is a big
12 bureaucracy. And if somehow they could get together because we say our concerns to you well
13 that's the department, DOE, you have to talk to those people. And we never, the local people
14 never get clear cut answers, you know. You started out with public service they said no rods
15 would be stored here. Dominion came, we have rods stored here. They're a good partner I feel
16 and they do everything safely. We feel safe with the plant but now we're storing nuclear rods.

17 Part of the, part of our tax money goes to pay for the electric bill, goes to Washington for fuel
18 storage which is supposed to go to Yucca Mountain. So Yucca Mountain gets 95 percent of our
19 tax money to build Yucca Mountain that was supposed to be done in 1998. Now they're saying
20 it's supposed to be done in 2018, okay. Or whatever date it's supposed to be done. We aren't
21 sure of that, okay. Here the rods sit here. There's no incentive for Yucca Mountain to have
22 something done when the rods can be stored at the facility when they get 95 percent of the
23 money. We get the five percent of the money where I think if we got compensated at the very
24 least maybe Yucca Mountain would say hey this is goes here we should get that. That's just the
25 way I feel. (KPS-D-2)

26 **Comment:** I just want to inform you a little bit that 26 plants already have gotten billions of
27 dollars from the Department of Energy. One just got 56 million last March. So it's, the
28 Department of Energy is paying it out but it is not coming from the, the nuclear fund. It has come
29 from us taxpayers. (KPS-C-2)

30 **Comment:** I'm from Congressman Kagen's office. Okay. When we talk about suing the Federal
31 government what happens is that anybody who is served by a nuclear power plant there's a
32 surcharge put on your electric bill. I live in Ashwaubenon and a couple of communities away. It's
33 served by and I pay a surcharge. That surcharge goes into a big pot of dollars to the
34 Department of Energy. The Department of Energy holds these dollars for the formulation of a
35 place like Yucca Mountain. Now some of these nuclear plants are running out of room. So
36 they're saying what do you want us to do about this Federal government you're not taking our
37 garbage. We want the garbage taken out. And the Federal government, DOE is saying sorry we
38 can't accept it just yet. So what happens here now is that okay we're going to sue you. Well yes,
39 that's fine, we're not suing the NRC we're going to sue the DOE because the DOE is charged
40 with formulating Yucca Mountain here. So Congress said okay if you're going to sue we're not
41 going to let this money come from the Yucca Mountain fund. We're going to put a pot of dollars
42 over here in another pot from the general treasury of the United States. And if any nuclear plant
43 is successful in suing the Federal government the money will not come out of Yucca Mountain
44 fund it will come out of the general treasury fund. So what happens now is that that money that's

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1 coming out of the general treasury fund is not as, has never been issued or given out to
2 municipalities. It has only been given back to the nuclear plant that has successfully sued the
3 government and the only use of this money is for constructing dry cask storages, okay. So that's
4 the long and the short of it. It's only going to be used for construction of casks and it's not going
5 to go back to the municipality that is, right where the light waste is located. So I hope that kind of
6 gives everybody a little bit of heads up on when we are able to sue successfully sue Uncle Sam.
7 (KPS-E)

8 **Comment:** Yeah, let's just clear the issue up here. This isn't against Carlton against Dominion.
9 Dominion is a good electrical provider and that. We need, we need power. Nuclear power is, we
10 hope it's safe. The big problem with nuclear power is the waste issue. Dominion's good as far as
11 civil projects and helping people out and being a good neighbor, okay. We're not against that.
12 We want to get the issue of the, the waste solved and we just don't like to have it here, you
13 know. (KPS-D-3)

14 **Comment:** I just want to ask a question here. Do anyone of these people that they would take
15 one of those dry casks in their village or the city of Green Bay. Or like I asked Senator Cole if I
16 put one in his parking lot -- over in the ballpark. You know what the answer is? You know what
17 the answer is? No, no not in my backyard. And Mr. Soletzki said the same thing. Human error.
18 Human error is all it takes just remember that. This is what we're all worried about is that human
19 error. Mr. Munsin said it's so safe. I told him I'll tell you what if it's that safe how about putting it
20 in writing so I can have it recorded in the courthouse that it's good for a hundred years, so then I
21 don't have to worry about my grandkids and my great grandkids. You know I've been here first.
22 (KPS-B-10)

23 **Comment:** I think that's what's broken in the system. You stand up there and say it's not your
24 issue. We go to the DOE. DOE is not in control of those rods yet. They belong to Dominion. And
25 so we're stuck with them. So who do we talk to? Dominion says they, they aren't going to settle
26 anything with us. You said you aren't in control. The DOE says they aren't in control but now
27 whose taking responsibility for them? (A-3)

28 **Comment:** Well, I've got the CRS report here. And it's an updated one for October 9th. And
29 Yucca Mountain might be ready by the year 2020. It says might be. But it also says that every,
30 every nuclear plant is getting reimbursed from DOE because they're being sued so they'll get it.
31 So this is the big thing right now is when Dominion put in for theirs there was no reason why
32 they couldn't have put in for compensation for this because that would have been an expense
33 for them. (KPS-J-2)

34 **Comment:** I'm Steve Tadisch. I'm a resident here. And we're talking about this high level waste
35 storage. How is that going to affect an addition to the plant or any new plants in the State or the
36 United States? Are they going to give new licenses even though Yucca Mountain is not going to
37 be running at the time or are they going to just prorate it kind of and -- then hope that it's
38 running? The only thing is I was going to say it also says that those spent fuel rods have to be in
39 the water for five years -- before it can go in the casks. (KPS-K)

40 **Comment:** Okay. Ms. Lopas you said that your committee oversees the, like land use and the
41 water and the natural resources and all that. I have a question about land use. I'm from the town
42 of Carlton. I live about 3 miles north of the nuclear plant. The way I understand it right now the

1 utility taxes that we get from having that plant here just about equals the taxes that we would
2 have gotten from homes that would have been built on that property. That means that in my
3 opinion that means that nothing is gained by having the nuclear waste being stored here on this
4 property which is what is going on right now. Above ground is the waste storage. The pools are
5 full. So my question is what, what's going to happen when the plant closes and then the utility
6 tax no longer applies? The waste is still going to be there. We're not getting anything for that
7 waste. What do we have to gain by extending the license, having more and more waste being
8 piled up there, high level waste. That's part of my concern. (KPS-A-1)

9 **Comment:** I've got them all, all our officials, even the governor. They want to take the
10 moratorium off to build a nuclear plant because it's the safest, the cleanest. Like I wrote in a
11 letter to them when I sent them all the signatures. Where are you going to put the waste. We've
12 stored it for 34 years under water and we finally got 50,000 and then Dominion devaluated the
13 plant and we lost, how much? \$37,000. Now you just said just a few minutes ago that they
14 update, update, update. It's running at full capacity. How come you can devalue it? I mean
15 that's not your doing, but it, that's lost us \$37,000. (KPS-B-3)

16 **Comment:** Okay. My name is Dave Hardtke. I have a question on the financial environmental
17 issue with this plant. If they are allowed to continue to operate we are sitting on a growing pile of
18 nuclear waste. And when this plant shuts down, and it's going to shut down someday, I have
19 kids and grandchildren in the area, who is going to make up the financial loss to the town when
20 this plant shuts down because we will not be getting any money from the utility tax at that point.
21 And we are sitting on a pile of growing waste out here and some day our kids are going to have
22 to pay the price for it. So I am against the, the license renewal right now. (A-4)

23 **Response:** The safety and environmental effects of spent fuel storage on site have been
24 evaluated by the NRC and, as set forth in the Waste Confidence Rule (10 CFR 51.23), the NRC
25 generically determined that such storage could be accomplished without significant
26 environmental impacts. In the Waste Confidence Rule, the Commission determined that spent
27 fuel can be safely stored onsite for at least 30 years beyond the plant's life, including license
28 renewal. Onsite spent fuel storage is considered a Category 1 issue, which was evaluated in the
29 GEIS, NUREG-1437; therefore, accidents would be included within the analysis of the Category
30 1 issue of onsite spent fuel storage. The GEIS is based upon the assumption that storage of the
31 spent fuel onsite is not permanent. The GEIS considered a variety of spent fuel and waste
32 storage scenarios, including onsite storage of these materials for up to 30 years following
33 expiration of the operating license, transfer of these materials to a different plant, and transfer of
34 these materials to an independent spent fuel storage installation (ISFSI). For each potential
35 scenario, the GEIS determined that existing regulatory requirements, operating practices, and
36 radiological monitoring programs were sufficient to ensure that impacts resulting from spent fuel
37 and waste storage practices would be SMALL, and therefore were a Category 1 issue.

38 Furthermore, requirements for dry cask storage are outside the scope of license renewal.
39 During dry cask storage, spent nuclear fuel must be "encased" in NRC-approved casks. An
40 NRC-approved cask is one that has undergone a technical review of its safety aspects and
41 been found to meet all of the NRC's requirements. These requirements are specified in 10 CFR
42 Part 72. The comments provide no new and significant information and, therefore, will not be
43 evaluated further.

Appendix A

1 **A.2. References**

2 U.S. Nuclear Regulatory Commission (NRC). 2008a: "Summary of Public License Renewal
3 Overview and Environmental Scoping Meetings related to the review of the Kewaunee Power
4 Station (KPS) license renewal application submitted by Dominion Energy Kewaunee, Inc,"
5 November 17, 2008. ADAMS Accession No. ML083090452.

6 U.S. Nuclear Regulatory Commission (NRC). 2009a. "Issuance of Environmental Scoping
7 Summary Report Associated with the Staff's Review of the Application by Dominion Energy
8 Kewaunee, Inc., for Renewal of the Operating License for Kewaunee Power Station," April 6,
9 2009. ADAMS Accession No. ML090770880.

**APPENDIX B
NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR
LICENSE RENEWAL OF NUCLEAR POWER PLANTS**

1 **NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE**
 2 **RENEWAL OF NUCLEAR POWER PLANTS**

3 **Table B-1. Summary of Issues and Findings.** *This table is taken from Table B-1 in Appendix*
 4 *B, Subpart A, to Title 40 of the Code of Federal Regulations (CFR) Part 51. Data supporting this*
 5 *table are contained in NUREG-1437, Generic Environmental Impact Statement for License*
 6 *Renewal of Nuclear Plants.*

Issue	Type of Issue	Finding
Surface Water Quality, Hydrology, and Use		
Impacts of refurbishment on surface water quality	Generic	SMALL. Impacts are expected to be negligible during refurbishment because best management practices are expected to be employed to control soil erosion and spills.
Impacts of refurbishment on surface water use	Generic	SMALL. Water use during refurbishment will not increase appreciably or will be reduced during plant outage.
Altered current patterns at intake and discharge structures	Generic	SMALL. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered salinity gradients	Generic	SMALL. Salinity gradients have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered thermal stratification of lakes	Generic	SMALL. Generally, lake stratification has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Temperature effects on sediment transport capacity	Generic	SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Scouring caused by discharged cooling water	Generic	SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.
Eutrophication	Generic	SMALL. Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Discharge of chlorine or other biocides	Generic	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.
Discharge of sanitary wastes and minor chemical spills	Generic	SMALL. Effects are readily controlled through National Pollutant Discharge Elimination System (NPDES) permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.

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Issue	Type of Issue	Finding
Discharge of other metals in wastewater	Generic	SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.
Water use conflicts (plants with once-through cooling systems)	Generic	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	Site-specific	SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations. See § 51.53(c)(3)(ii)(A).
Aquatic Ecology		
Refurbishment	Generic	SMALL. During plant shutdown and refurbishment there will be negligible effects on aquatic biota because of a reduction of entrainment and impingement of organisms or a reduced release of chemicals.
Accumulation of contaminants in sediments or biota	Generic	SMALL. Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.
Entrainment of phytoplankton and zooplankton	Generic	SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Cold shock	Generic	SMALL. Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.
Thermal plume barrier to migrating fish	Generic	SMALL. Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Distribution of aquatic organisms	Generic	SMALL. Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.
Premature emergence of aquatic insects	Generic	SMALL. Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term.

Issue	Type of Issue	Finding
Gas supersaturation (gas bubble disease)	Generic	SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Low dissolved oxygen in the discharge	Generic	SMALL. Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	Generic	SMALL. These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Stimulation of nuisance organisms (e.g., shipworms)	Generic	SMALL. Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)		
Entrainment of fish and shellfish in early life stages	Site-specific	SMALL, MODERATE, OR LARGE. The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See § 51.53(c)(3)(ii)(B).
Impingement of fish and shellfish	Site-specific	SMALL, MODERATE, OR LARGE. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See § 51.53(c)(3)(ii)(B).
Heat shock	Site-specific	SMALL, MODERATE, OR LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See § 51.53(c)(3)(ii)(B).
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)		
Entrainment of fish and shellfish in early life stages	Generic	SMALL. Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

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Issue	Type of Issue	Finding
Impingement of fish and shellfish	Generic	SMALL. The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Heat shock	Generic	SMALL. Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Groundwater Use and Quality		
Impacts of refurbishment on groundwater use and quality	Generic	SMALL. Extensive dewatering during the original construction on some sites will not be repeated during refurbishment on any sites. Any plant wastes produced during refurbishment will be handled in the same manner as in current operating practices and are not expected to be a problem during the license renewal term.
Groundwater use conflicts (potable and service water; plants that use <100 gpm)	Generic	SMALL. Plants using less than 100 gallons per minute (gpm) are not expected to cause any ground-water use conflicts.
Groundwater use conflicts (potable and service water, and dewatering plants that use >100 gpm)	Site-specific	SMALL, MODERATE, OR LARGE. Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users. See § 51.53(c)(3)(ii)(C).
Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river)	Site-specific	SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal. See § 51.53(c)(3)(ii)(A).
Groundwater use conflicts (Ranney wells)	Site-specific	SMALL, MODERATE, OR LARGE. Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See § 51.53(c)(3)(ii)(C).
Groundwater quality degradation (Ranney wells)	Generic	SMALL. Ground-water quality at river sites may be degraded by induced infiltration of poor-quality river water into an aquifer that supplies large quantities of reactor cooling water. However, the lower quality infiltrating water would not preclude the current uses of groundwater and is not expected to be a problem during the license renewal term.

Issue	Type of Issue	Finding
Groundwater quality degradation (saltwater intrusion)	Generic	SMALL. Nuclear power plants do not contribute significantly to saltwater intrusion.
Groundwater quality degradation (cooling ponds in salt marshes)	Generic	SMALL. Sites with closed-cycle cooling ponds may degrade ground-water quality. Because water in salt marshes is brackish, this is not a concern for plants located in salt marshes.
Groundwater quality degradation (cooling ponds at inland sites)	Site-specific	SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See § 51.53(c)(3)(ii)(D).
Terrestrial Ecology		
Refurbishment impacts	Site-specific	SMALL, MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See § 51.53(c)(3)(ii)(E).
Cooling tower impacts on crops and ornamental vegetation	Generic	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling tower impacts on native plants	Generic	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Bird collisions with cooling towers	Generic	SMALL. These collisions have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling pond impacts on terrestrial resources	Generic	SMALL. Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.
Power line right of way management (cutting and herbicide application)	Generic	SMALL. The impacts of right of way (ROW) maintenance on wildlife are expected to be of small significance at all sites.
Bird collisions with power lines	Generic	SMALL. Impacts are expected to be of small significance at all sites.

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Issue	Type of Issue	Finding
Impacts of electromagnetic fields on flora and fauna	Generic	SMALL. No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.
Floodplains and wetland on power line ROW	Generic	SMALL. Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.
Threatened and Endangered Species		
Threatened or endangered species	Site-specific	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected. See § 51.53(c)(3)(ii)(E).
Air Quality		
Air quality during refurbishment (non-attainment and maintenance areas)	Site-specific	SMALL, MODERATE, OR LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage. See § 51.53(c)(3)(ii)(F).
Air quality effects of transmission lines	Generic	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.
Land Use		
Onsite land use	Generic	SMALL. Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.
Power line ROW	Generic	SMALL. Ongoing use of power line ROWs would continue with no change in restrictions. The effects of these restrictions are of small significance.
Human Health		
Radiation exposures to the public during refurbishment	Generic	SMALL. During refurbishment, the gaseous effluents would result in doses that are similar to those from current operation. Applicable regulatory dose limits to the public are not expected to be exceeded.

Issue	Type of Issue	Finding
Occupational radiation exposures during refurbishment	Generic	SMALL. Occupational doses from refurbishment are expected to be within the range of annual average collective doses experienced for pressurized-water reactors and boiling-water reactors. Occupational mortality risk from all causes including radiation is in the mid-range for industrial settings.
Microbiological organisms (occupational health)	Generic	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.
Microbiological organisms (public health)(plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	Site-specific	SMALL, MODERATE, OR LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See § 51.53(c)(3)(ii)(G).
Noise	Generic	SMALL. Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.
Electromagnetic fields—acute effects (electric shock)	Site-specific	SMALL, MODERATE, OR LARGE. Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site. See § 51.53(c)(3)(ii)(H).
Electromagnetic fields—chronic effects	Uncategorized	UNCERTAIN. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a consensus scientific view has not been reached.
Radiation exposures to public (license renewal term)	Generic	SMALL. Radiation doses to the public will continue at current levels associated with normal operations.
Occupational radiation exposures (license renewal term)	Generic	SMALL. Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.
Socioeconomic Impacts		

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Issue	Type of Issue	Finding
Housing impacts	Site-specific	SMALL, MODERATE, OR LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See § 51.53(c)(3)(ii)(I).
Public services: public safety, social services, and tourism, and recreation	Generic	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.
Public services: public utilities	Site-specific	SMALL OR MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See § 51.53(c)(3)(ii)(I).
Public services: education (refurbishment)	Site-specific	SMALL, MODERATE, OR LARGE. Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors. See § 51.53(c)(3)(ii)(I).
Public services: education (license renewal term)	Generic	SMALL. Only impacts of small significance are expected
Offsite land use (refurbishment)	Site-specific	SMALL OR MODERATE. Impacts may be of moderate significance at plants in low population areas. See § 51.53(c)(3)(ii)(I).
Offsite land use (license renewal term)	Site-specific	SMALL, MODERATE, OR LARGE. Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal. See § 51.53(c)(3)(ii)(I).
Public services: transportation	Site-specific	SMALL, MODERATE, OR LARGE. Transportation impacts (level of service) of highway traffic generated during plant refurbishment and during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See § 51.53(c)(3)(ii)(J).
Historic and archaeological resources	Site-specific	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection. See § 51.53(c)(3)(ii)(K).
Aesthetic impacts (refurbishment)	Generic	SMALL. No significant impacts are expected during refurbishment.

Issue	Type of Issue	Finding
Aesthetic impacts (license renewal term)	Generic	SMALL. No significant impacts are expected during the license renewal term.
Aesthetic impacts of transmission lines (license renewal term)	Generic	SMALL. No significant impacts are expected during the license renewal term.
Postulated Accidents		
Design basis accidents	Generic	SMALL. The Nuclear Regulatory Commission (NRC) staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.
Severe accidents	Site-specific	SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See § 51.53(c)(3)(ii)(L).
Uranium Fuel Cycle and Waste Management		
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	Generic	SMALL. Off-site impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the Generic Environmental Impact Statement (GEIS), impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.

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Issue	Type of Issue	Finding
Offsite radiological impacts (collective effects)	Generic	<p>The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person roentgen equivalent man (rem), or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect, which will not ever be mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations.</p> <p>Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1 [Generic].</p>

Issue	Type of Issue	Finding
Offsite radiological impacts (spent fuel and high level waste disposal)	Generic	<p>For the high level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site, which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 3×10^{-3}.</p> <p>Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, EPA's generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing amount of radioactive material released over 10,000 years. (continued)</p>

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Issue	Type of Issue	Finding
Offsite radiological impacts (spent fuel and high level waste disposal) (continued)	Generic	<p>The cumulative release limits are based on EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric ton (MTHM) repository.</p> <p>Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered in Category 1 [Generic].</p>
Nonradiological impacts of the uranium fuel cycle	Generic	<p>SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.</p>
Low-level waste storage and disposal	Generic	<p>SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional onsite land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small.</p> <p>Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.</p>
Mixed waste storage and disposal	Generic	<p>SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.</p>
Onsite spent fuel	Generic	<p>SMALL. The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated onsite with small environmental effects through dry or pool storage at all plants. If a permanent repository or monitored retrievable storage is not available.</p>

Issue	Type of Issue	Finding
Nonradiological waste	Generic	SMALL. No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.
Transportation	Generic	SMALL. The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 megawatt days per metric ton of uranium (MWd/MTU) and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada, are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4 – Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52.
Decommissioning		
Radiation doses	Generic	SMALL. Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.
Waste management	Generic	SMALL. Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.
Air quality	Generic	SMALL. Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.
Water quality	Generic	SMALL. The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.
Ecological resources	Generic	SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.
Socioeconomic impacts	Generic	SMALL. Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.
Environmental Justice		

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Issue	Type of Issue	Finding
Environmental Justice	Uncategorized	NONE. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.

1 **References**

- 2 40 CFR Part 51. Code of Federal Regulations, Title 40, Protection of Environment, Part 51,
3 "Environmental Protection Regulations for Domestic Licensing and Related Regulatory
4 Functions."
- 5 Department of Energy (DOE). 1980. "Final Environmental Impact Statement: Management of
6 Commercially Generated Radioactive Waste," October 1980.
- 7 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards,"
8 and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23.

APPENDIX C
APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS

1 **APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS**

2 The Atomic Energy Act authorizes States to establish programs to assume U.S. Nuclear
3 Regulatory Commission (NRC) regulatory authority for certain activities. For example, through
4 the Agreement State Program, started on August 11, 2003, Wisconsin assumed regulatory
5 responsibility over certain byproduct, source, and small quantities of special nuclear material.
6 The Wisconsin Department of Natural Resources (WDNR) is responsible for implementing the
7 laws of the state and where applicable, the laws of the federal government.

8 In addition to implementing some Federal programs, State legislatures develop their own laws.
9 State statutes supplement as well as implement Federal laws for protection of air, water quality,
10 and groundwater. State legislation may address solid waste management programs, locally rare
11 or endangered species, and historic and cultural resources.

12 The Clean Water Act (CWA) allows for primary enforcement and administration through State
13 agencies, provided the State program is at least as stringent as the Federal program and must
14 conform to the CWA and delegation of authority for the Federal national pollutant discharge
15 elimination system (NPDES) program from the EPA to the state. The primary mechanism to
16 control water pollution is the requirement that direct dischargers to obtain an NPDES permit or
17 in the case of states where the authority has been delegated from the EPA, a SPDES permit,
18 pursuant to the CWA.

19 One important difference between Federal regulations and certain State regulations is the
20 definition of waters regulated by the State. Certain State regulations may include underground
21 waters while the CWA only regulates surface waters.

22 **State Environmental Requirements**

23 Certain environmental requirements, including some discussed earlier, may have been
24 delegated to State authorities for implementation, enforcement, or oversight. Table C-1 provides
25 a list of representative State environmental requirements that may affect license renewal
26 applications for nuclear power plants.

Appendix C

1 **Table C-1. State Environmental Requirements.** *Kewaunee Power Station (KPS) is subject to*
 2 *State requirements regarding their environmental program. Those requirements are briefly*
 3 *described below. See Section 1.9 for KPS’s compliance status with these requirements.*

Law/Regulation	Requirements
Air Quality Protection	
Federal Clean Air Act (42 USC 7401 et seq.), Ch. 285 Wisconsin Statutes	Operation permit is required for air emissions and is issued by WDNR. Note: Dominion Energy Kewaunee (DEK) is considering conversion of this permit to a “Type A Registration Operation Permit,” Air Pollution Control Permit Number ROP-A01, issued by the WDNR.
Water Resources Protection	
Clean Water Act (CWA) (33 USC 1251 et seq.), Ch. 283 Wisconsin Statutes	The NPDES permit is required for plant industrial, sanitary, and stormwater discharges to Lake Michigan and the unnamed tributary. The NPDES permit requires the compliance of each point source with authorized discharge levels, monitoring requirements, and other appropriate requirements. The WDNR is the responsible State agency for NPDES permitting.
CWA, Ch. 281 Wisconsin Statutes	Permit to construct and operate sanitary sewage treatment system.
CWA (33 USC 1251 et seq.), Ch. 283 Wisconsin Statutes	General Wisconsin Pollutant Discharge Elimination System (WPDES) industrial storm water discharge permit for storm water runoff from industrial facilities.
CWA, Chs. 280 and 281 Wisconsin Statutes	Registration for non-transient non-community water supply for KPS.
WDNR, Ch. 283 Wisconsin Statutes	Permit for construction of water intake and discharge structures in Lake Michigan for KPS’s cooling water system.
U.S. Army Corps of Engineers, 33 USC 403	Permit for construction of water intake and discharge structures in Lake Michigan for KPS’s cooling water system.
WDRN, Ch. 281 Wisconsin Statutes	High-capacity well approval for wells with combined capacity >100,000 gallons per day (gpd).
Wisconsin Department of Commerce (WDC), Ch. 101.09 Wisconsin Statutes	Registration for aboveground storage tanks.
Federal Resource Conservation and Recovery Act (42 USC 6901 et seq.), Ch. 101.09 Wisconsin Statutes	Registration for underground storage tanks.
Waste Management	
CWA, Ch. 281 Wisconsin Statutes	Permit to construct and operate sanitary sewage treatment system.
CWA, Ch. 283 Wisconsin Statutes	A land spreading of Wastewater Treatment Facility pretreatment sludge permit is required by the WPDES.

4 **Operating Permits and Other Requirements**

5 Several operating permit applications may be prepared and submitted, and regulator approval
 6 and permits would be received prior to license renewal approval by the NRC. Table C-2 lists
 7 representative Federal, State, and local permits.

- 1 **Table C-2. Federal, State, and Local Permits and Other Requirements.** *KPS is subject to*
 2 *other requirements regarding various aspects of their environmental program. Those*
 3 *requirements are briefly described below.*

License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
Waste Management and Pollution Prevention			
Transportation of radioactive waste to disposal facility in South Carolina.	South Carolina Department of Health and Environment Control	South Carolina Radioactive Waste Transportation and Disposal Act (S.C. Code of Laws 13-7-110 et seq.)	KPS is a radioactive waste generator. The radioactive waste is sent to disposal facility in South Carolina.
License to ship radioactive material to processing facility in Tennessee.	Tennessee Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	KPS radioactive material is shipped to processing facility in Tennessee.
Site access permit for disposal of radioactive material in Utah.	Utah Department of Environmental Quality	R313-26 of Utah Radiation Control Rules	KPS radioactive material is disposed in Utah in land disposal site.
Emergency Planning and Response			
Shipment of hazardous materials.	U.S. Department of Transportation (DOT)	KPS hazardous materials shipments registration 062706 552 0750Q	KPS hazardous materials shipments to comply with DOT packing, labeling, and routing requirements.
Biotic Resource Protection			
Threatened and Endangered Species Consultation: Required between the responsible Federal agencies and affected States to ensure that the project is not likely to: (1) jeopardize the continued existence of any species listed at the Federal or State level as endangered or threatened; or (2) result in destruction of critical habitat of such species.	WDNR Endangered Resources Review	Endangered and Threatened Species Laws (State Statute 29.604 & Administrative Rule NR 27)	Review explains what rare species, natural communities, or natural features tracked in the Natural Heritage Inventory database are found in or near the proposed project area. Includes any additional steps to assure compliance with the Wisconsin Endangered Species Law.
Threatened and Endangered Species Consultation: Required between the responsible Federal agencies and affected States to ensure that the project is not likely to: (1) jeopardize the continued existence of any species listed at the Federal or State level as endangered or threatened; or, (2) result in destruction of critical habitat of such species.	U.S. Fish and Wildlife Service (USFWS)	Endangered Species Act, Section 7 (16 USC 1536)	NRC consulted with USFWS. The Federal agency issuing a license is required to consult with USFWS regarding the impact of license renewal on threatened or endangered species or their critical habitat.
State must concur with the DEK's request for certification of KPS license renewal.	Wisconsin Department of Administration	Federal Coastal Zone Management Act (16 USC 1451 et seq.)	Requires applicant to provide certification to the NRC that the license renewal would be consistent with the federally approved state coastal zone

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License, Permit, or Other Required Approval	Responsible Agency	Authority	Relevance and Status
			management program.
Cultural Resources Protection			
Archaeological and Historical Resources Consultation: Required before a Federal agency approves a project in an area where archaeological or historic resources might be located.	Wisconsin Historical Society	National Historic Preservation Act, Section 106 (16 USC 470f)	NRC consulted with State, Tribal Historic Preservation Officers, and Indian Tribes representatives regarding impacts of license renewal. Federal agency issuing a license is required to consider cultural impacts and consult with State Historic Preservation Officer.

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APPENDIX D
CONSULTATION CORRESPONDENCES

1 CONSULTATION CORRESPONDENCES

2 The Endangered Species Act of 1973, as amended; the Magnuson-Stevens Fisheries
 3 Management Act of 1996, as amended; and the National Historic Preservation Act of 1966
 4 require that Federal agencies consult with applicable State and Federal agencies and groups
 5 prior to taking action that may affect threatened and endangered species, essential fish habitat,
 6 or historic and archaeological resources, respectively. This appendix contains consultation
 7 documentation.

8 **Table D-1. Consultation Correspondences.** *The following is a list of the consultation*
 9 *documents sent between the U.S. Nuclear Regulatory Commission (NRC) and other agencies*
 10 *in accordance with National Environmental Policy Act (NEPA) requirements.*

Author	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (D. Pelton)	U.S. Fish and Wildlife Service (L. Clemency)	September 30, 2008
U.S. Nuclear Regulatory Commission (D. Pelton)	Advisory Council on Historic Preservation (D. Klima)	October 8, 2008
U.S. Nuclear Regulatory Commission (D. Pelton)	Wisconsin Historical Society (S. Baker)	October 10, 2008
U.S. Nuclear Regulatory Commission (D. Pelton)	Wisconsin Coastal Management Program (K. Angel)	October 10, 2008
U.S. Nuclear Regulatory Commission (D. Pelton)	Wisconsin Department of Natural Resources (R. Kazmierczak)	October 10, 2008
U.S. Nuclear Regulatory Commission (D. Pelton)	Menominee Indian Tribe of Wisconsin (L. Boivin)	October 16, 2008(a)
U.S. Fish and Wildlife Service (L. Clemency)	U.S. Nuclear Regulatory Commission (D. Pelton)	October 28, 2008

11 ^(a)Similar letters went to 23 other Native American Tribes listed in Section 1.8 and Appendix E.

12 Consultation Correspondences

13 The following pages contain copies of the letters listed in Table D-1. Figures contained in pages
 14 D-5 and D-6 were included with each letter.

Appendix D

September 30, 2008

Ms. Louise Clemency
Field Supervisor
Green Bay Ecological Services Office
U.S. Fish and Wildlife Service
2661 Scott Tower Drive
Green Bay, WI 54229

SUBJECT: REQUEST FOR LIST OF STATE PROTECTED SPECIES WITHIN THE AREA
UNDER EVALUATION FOR THE KEWAUNEE POWER STATION LICENSE
RENEWAL APPLICATION REVIEW

Dear Ms. Clemency:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by Dominion Energy Kewaunee, Inc., for the renewal of the operating license for Kewaunee Power Station (KPS). KPS is located on the west-central shore of Lake Michigan in Kewaunee County, Wisconsin, approximately 30 miles east-southeast of Green Bay and eight miles south of the City of Kewaunee. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act of 1969. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. The KPS site covers approximately 908 acres, of which approximately 60 acres contain structures, facilities, and parking lots associated with KPS. Approximately 450 acres are used for agriculture, and the remainder of the site is a mixture of woods, fields in various stages of succession, small wetlands and watercourses, and open areas. The site also contains approximately two miles of Lake Michigan western shoreline. A site map is enclosed (Enclosure 1) with this letter.

KPS utilizes a once-through cooling system that withdraws water from and discharges to Lake Michigan. The intake structure is located approximately 1600 feet from the shore, where the water depth is approximately 15 feet. The intake structure consists of a cluster of three 22-foot diameter inlets with 2-foot by 2-foot trash grills to prevent large debris from entering the intake; water velocity at the surface of the intake inlets is less than 1 foot per second when the plant is running at full power. Three 6-foot diameter pipes join to form one 10-foot diameter intake pipe, which is buried approximately three feet below the lake surface. Two auxiliary water intake tees are located 50 and 100 feet shoreward of the intake. Each tee has a 30-inch, screened opening approximately one foot above the lake bottom. The auxiliary water intakes each can supply water in excess of 24,000 gallons per minute (gpm).

L. Clemency

- 2 -

The buried intake pipe brings water to the onshore forebay. From the forebay, water passes through 10-foot wide by 36-foot long traveling screens with 3/8-inch mesh. Water is pumped by two vertical dry-pit circulating water pumps, each designed to supply 210,000 gpm. Normal flow rate throughout the cooling system is approximately 400,000 gpm.

Water velocity through the traveling screens is less than 2.4 feet per second. Fish and debris are automatically backwashed from the traveling screens and returned to the lake via the 10-foot diameter discharge tunnel. The discharge tunnel connects to a discharge structure located on the shoreline, just south of the forebay. During periods of sub-freezing weather, recirculating pumps route water to the intake inlet grills and traveling screens to prevent icing. Cooling water is intermittently treated with sodium hypochlorite to prevent micro- and macro-fouling within the cooling system.

For the specific purpose of connecting KPS to the regional transmission system, there are four transmission lines totaling approximately 75 miles of corridor, comprising approximately 1270 acres of land. These transmission line corridors are being evaluated as part of the SEIS process. The transmission lines run north and south of KPS through Kewaunee and Manitowoc Counties, and west through Kewaunee, Brown, and Outagamie Counties. Land along the corridors is approximately 84 percent farmland, 7 percent woodland, 7 percent scrubland, and 2 percent wetlands. A map of the KPS transmission system is enclosed (Enclosure 2) with this letter.

To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests information on state-listed, proposed, and candidate species and critical habitat that may be in the vicinity of KPS and its associated transmission line corridors. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

The NRC staff plans to hold two public license renewal and environmental scoping meetings on October 22, 2008, at the Carlton Town Hall, N1296, Town Hall Road, Kewaunee, Wisconsin 54216. The first meeting will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., with a repeat of the overview portions of the first meeting, and will continue until 10:00 p.m., as necessary. A separate NRC meeting notice with a more detailed agenda is forthcoming. You will be provided a copy of that notice. In addition, during the week of January 12, 2009, the NRC plans to conduct a site audit. You and your staff are invited to attend both the public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is August 2009.

Appendix D

L. Clemency

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The KPS LRA is available on the internet at www.nrc.gov/reactors/operating/licensing/renewal/applications/kewaunee.html. If you have any questions concerning the NRC staff's review of this LRA, please contact Ms. Sarah Lopas, License Renewal Project Manager, at 301-415-1147 or sarah.lopas@nrc.gov.

Sincerely,

\RA\

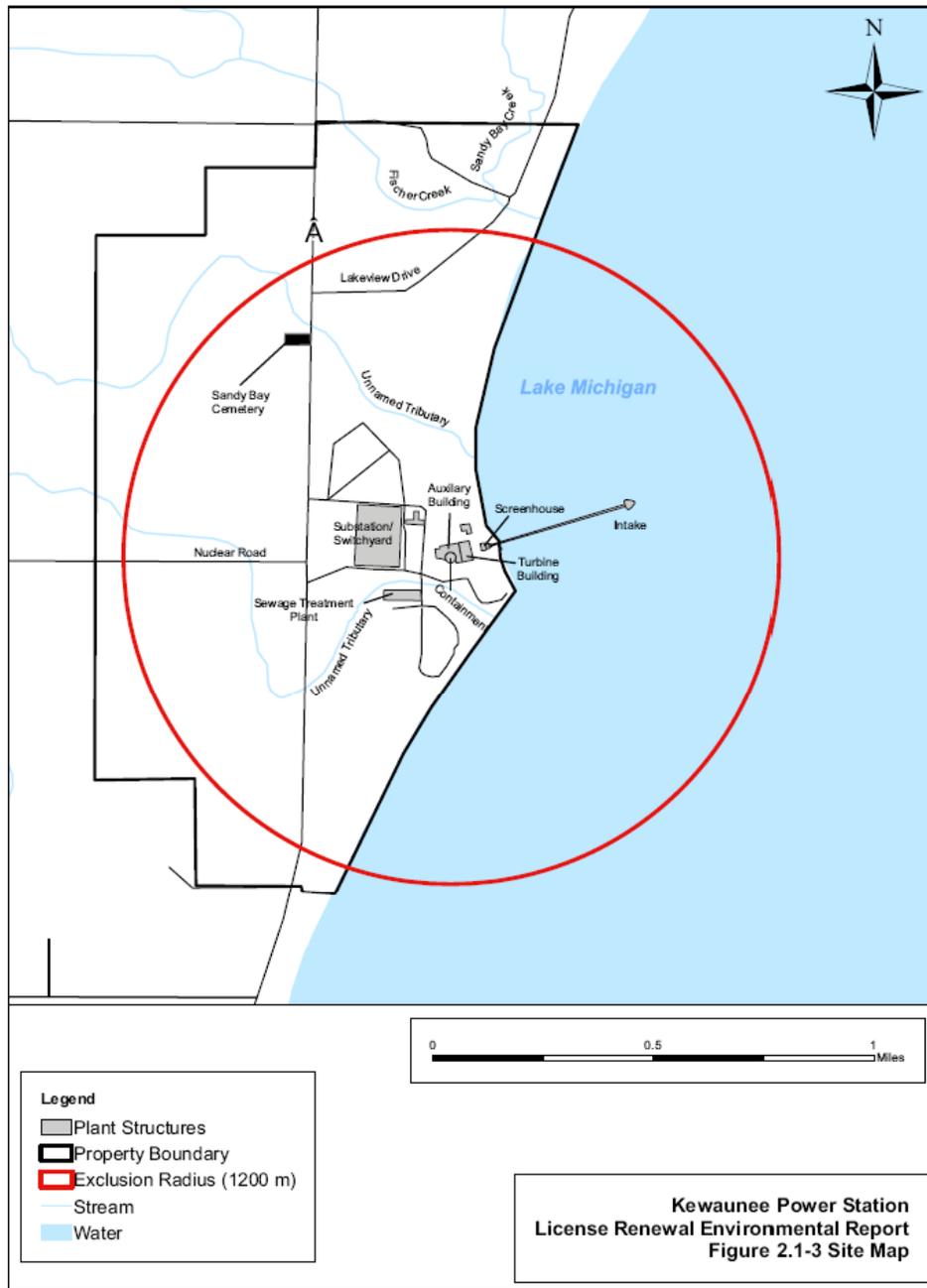
David Pelton, Branch Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures:

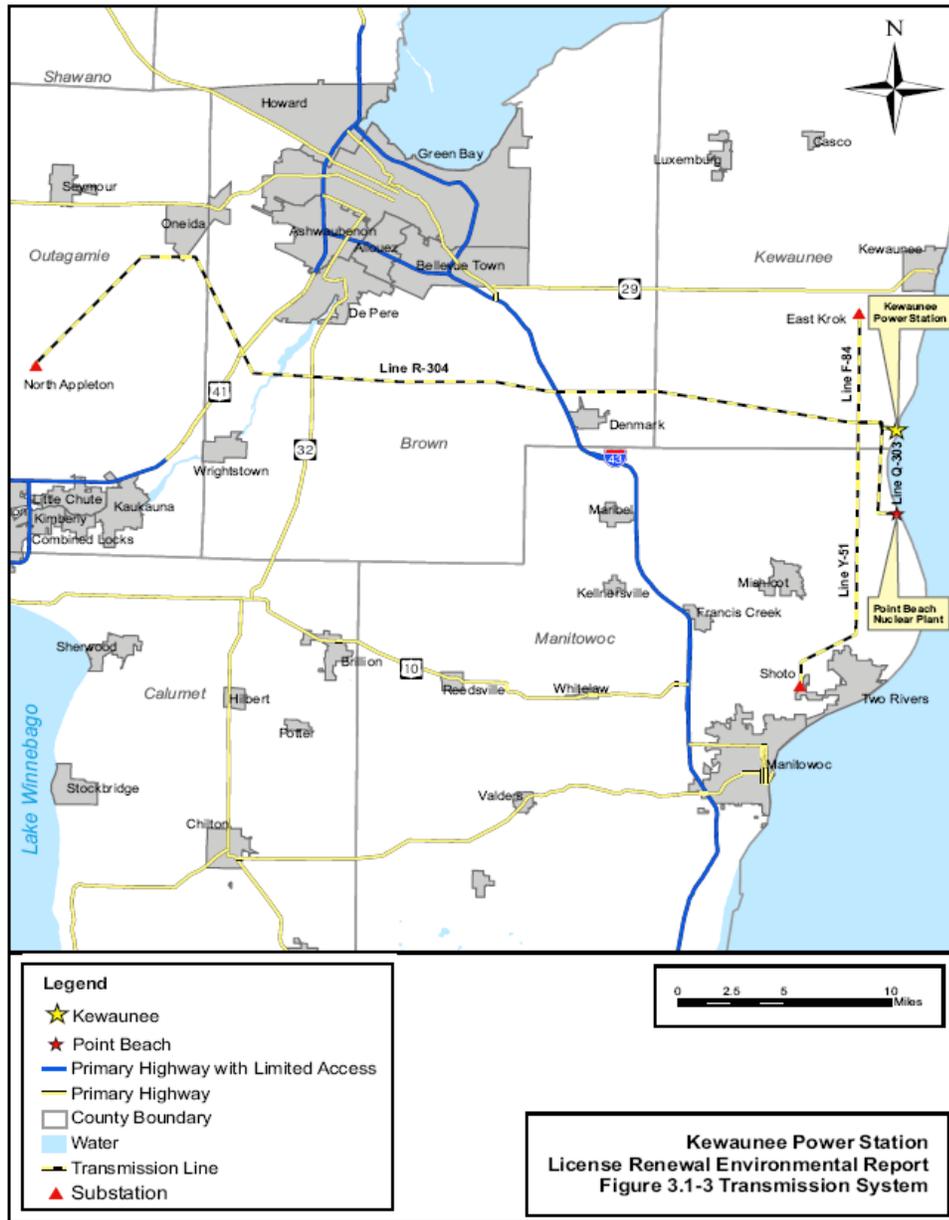
1. KPS Site Map
2. KPS Transmission System

cc w/encls: See next page



ENCLOSURE 1

Appendix D



ENCLOSURE 2

October 8, 2008

Mr. Don L. Klima, Director
Advisory Council on Historic Preservation
Office of Federal Agency Programs
1100 Pennsylvania Ave, NW, Suite 803
Washington, DC 20004

SUBJECT: KEWAUNEE POWER STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application to renew the operating license for Kewaunee Power Station (KPS) which is located on Lake Michigan in Kewaunee County, Wisconsin, and is operated by Dominion Energy Kewaunee, Inc. (DEK). The application for renewal was submitted by DEK in a letter dated August 14, 2008, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulation that implements the National Environmental Policy Act of 1969. In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

The NRC staff plans to hold two public license renewal and environmental scoping process meetings on October 22, 2008, at the Carlton Town Hall, N1296, Town Hall Road, Kewaunee, Wisconsin 54216. The first meeting will convene at 1:30 p.m. and will continue until 4:30p.m., as necessary. The second meeting will convene at 700 p.m., with a repeat of the overview portions of the first meeting, and will continue until 10:00 p.m., as necessary. You and your staff are invited to attend the public meetings. In addition, during the week of January 12, 2009, the NRC staff plans to conduct a site audit at KPS. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is August 2009.

Appendix D

D. Klima

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The KPS license renewal application is available on the internet at www.nrc.gov/reactors/operating/licensing/renewal/applications/kewaunee.html. If you have any questions or require additional information, please contact the License Renewal Project Manager, Ms. Sarah Lopas, at 301-415-1147 or by e-mail at sarah.lopas@nrc.gov.

Sincerely,

/RA/

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-305

cc: See next page

October 10, 2008

Mr. Sherman Banker
Wisconsin Historical Society
816 State Street
Madison, Wisconsin 53706-1482

SUBJECT: KEWAUNEE POWER STATION LICENSE RENEWAL APPLICATION
REVIEW

Dear Mr. Banker:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application to renew the operating license for Kewaunee Power Station (KPS), which is located on the west-central shore of Lake Michigan in Kewaunee County, Wisconsin, approximately 30 miles east-southeast of Green Bay and eight miles south of the City of Kewaunee. KPS is operated by Dominion Energy Kewaunee, Inc. (DEK). The application for renewal was submitted by DEK in a letter dated August 14, 2008, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants", NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or projected refurbishment activities specifically related to license renewal may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

On October 22, 2008, the NRC will conduct two public license renewal and environmental scoping meetings at the Carlton Town Hall, N1296 Town Hall Road, Kewaunee, WI 54216. You and your staff are invited to attend. Your office will receive a copy of the draft SEIS along with a request for comments. The staff expects to publish the draft SEIS in August 2009.

Appendix D

S. Banker

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The KPS license renewal application is available on the internet at www.nrc.gov/reactors/operating/licensing/renewal/applications/kewaunee.html. If you have any questions or require additional information, please contact Ms. Sarah Lopas, License Renewal Project Manager, by phone at 301-415-1147 or by e-mail at sarah.lopas@nrc.gov.

Sincerely,

/RA L. Lund for/

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-305

cc: See next page

October 10, 2008

Ms. Kathleen Angel
Federal Consistency and Coastal Hazards Coordinator
Wisconsin Coastal Management Program
P.O. Box 8944
Madison, WI 53708-8944

SUBJECT: KEWAUNEE POWER STATION LICENSE RENEWAL APPLICATION
REVIEW

Dear Ms. Angel:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by Dominion Energy Kewaunee, Inc. (DEK) for the renewal of the operating license for Kewaunee Power Station (KPS), which is located on the west-central shore of Lake Michigan in Kewaunee County, Wisconsin, approximately 30 miles east-southeast of Green Bay and eight miles south of the City of Kewaunee. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA).

KPS is requesting the renewal of its operating license for a period of 20 years beyond the expiration of the current license term, renewing the license until December 2033. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. The KPS site covers approximately 908 acres, of which approximately 60 acres contain structures, facilities, and parking lots associated with KPS. Approximately 450 acres are used for agriculture, and the remainder of the site is a mixture of woods, fields in various stages of succession, small wetlands and watercourses, and open areas. The site also contains approximately two miles of Lake Michigan western shoreline. As such, DEK submitted a Federal Consistency Certification for Wisconsin's Coastal Management Program on August 19, 2008.

The NRC staff plans to hold two identical public meetings covering the license renewal and environmental scoping process on October 22, 2008, at the Carlton Town Hall, N1296 Town Hall Road, Kewaunee, WI 54216. The first meeting will convene at 1:30 p.m., and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., and will continue until 10:00 p.m., as necessary. You and your staff are invited to attend the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is August 2009.

Appendix D

K. Angel

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If you have any questions concerning the NRC staff's review of this LRA, please contact Ms. Sarah Lopas, License Renewal Project Manager, at 301-415-1147 or by e-mail at sarah.lopas@nrc.gov.

Sincerely,

/RA L. Lund for/

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-305

cc: See next page

October 10, 2008

Mr. Ronald Kazmierczak
Regional Director
Wisconsin Department of Natural Resources
Northeast Region Headquarters
2984 Shawano Avenue
P.O. Box 10448
Green Bay, Wisconsin 54307-0448

SUBJECT: KEWAUNEE POWER STATION LICENSE RENEWAL APPLICATION
REVIEW

Dear Mr. Kazmierczak:

The U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing an application submitted by Dominion Energy Kewaunee, Inc. for the renewal of the operating license for Kewaunee Power Station (KPS), which is located on the west-central shore of Lake Michigan in Kewaunee County, Wisconsin, approximately 30 miles east-southeast of Green Bay and eight miles south of the City of Kewaunee. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act of 1969 (NEPA).

KPS is requesting the renewal of its operating license for a period of 20 years beyond the expiration of the current license term, renewing the license until December 2033. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. The KPS site covers approximately 908 acres, of which approximately 60 acres contain structures, facilities, and parking lots associated with KPS. Approximately 450 acres are used for agriculture, and the remainder of the site is a mixture of woods, fields in various stages of succession, small wetlands and watercourses, and open areas. The site also contains approximately two miles of Lake Michigan western shoreline. A site map is enclosed with this letter.

The NRC staff plans to hold two identical public meetings covering the license renewal and environmental scoping process on October 22, 2008, at the Carlton Town Hall, N1296 Town Hall Road, Kewaunee, WI 54216. The first meeting will convene at 1:30 p.m., and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., and will continue until 10:00 p.m., as necessary. In addition, during the week of January 12, 2009, the NRC plans to conduct a site audit. You and your staff are invited to attend both the site audit and the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is August 2009.

Appendix D

R. Kazmierczak

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The KPS license renewal application is available on the internet at www.nrc.gov/reactors/operating/licensing/renewal/applications/kewaunee.html. If you have any questions concerning the NRC staff's review of this LRA, please contact Ms. Sarah Lopas, License Renewal Project Manager, at 301-415-1147 or by e-mail at sarah.lopas@nrc.gov.

Sincerely,

VA Louise Lund for

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosure:
As stated

cc w/encl: See next page

October 16, 2008

Laurie Boivin, Chairperson
Menominee Indian Tribe of Wisconsin
W2908 Tribal Office Loop
P.O. Box 910
Keshena, WI 54135-0910

SUBJECT: REQUEST FOR SCOPING COMMENTS CONCERNING THE KEWAUNEE
POWER STATION LICENSE RENEWAL APPLICATION REVIEW

The U.S. Nuclear Regulatory Commission (NRC or the staff) has recently received an application from Dominion Energy Kewaunee, Inc. (DEK) for the renewal of the operating license for the Kewaunee Power Station (KPS) located in Kewaunee County, WI, approximately 30 miles east-southeast of Green Bay. The NRC is in the initial stages of developing a Supplemental Environmental Impact Statement to the Generic Environmental Impact Statement (GEIS), which will document the impacts associated with the renewal of KPS. We would like your assistance in our review by providing input to the NRC's environmental review scoping process. The NRC's process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts pursuant to Title 10 of the *Code of Federal Regulations* Part 51, Section 51.28(b). In addition, as outlined in 36 CFR 800.8(c), the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966 through the requirements of the National Environmental Policy Act of 1969 (NEPA).

The NRC has sent copies of this letter to the tribal contacts for the following Federally-recognized tribes: Bad River Band of Lake Superior Tribe of Chippewa Indians, Bay Mills Indian Community, Forest County Potawatomi Community of Wisconsin, Grand Traverse Band of Ottawa and Chippewa Indians, Hannahville Indian Community, Ho-Chunk Nation, Huron Potawatomi, Keweenaw Bay Indian Community, Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin, Lac du Flambeau Band of Lake Superior Chippewa Indians of Wisconsin, Lac Vieux Desert Band of Lake Superior Chippewa Indians, Little River Band of Ottawa Indians, Little Traverse Bay Bands of Odawa Indians, Menominee Indian Tribe of Wisconsin, Oneida Tribe of Indians of Wisconsin, Pokagon Band of Potawatomi Indians, Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin, St. Croix Chippewa Indians of Wisconsin, Sault Ste. Marie Tribe of Chippewa Indians of Michigan, Sokagon Chippewa Community Mole Lake Band of Lake Superior Chippewa Indians, Stockbridge Munsee Community of Wisconsin, Prairie Band Potawatomi Nation, and the Citizen Potawatomi Nation. This letter was also sent to the Midwest Regional Office of the Bureau of Indian Affairs.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating license for KPS will expire in December 2013, and DEK is requesting license renewal for an additional 20 years beyond this original expiration date. The proposed action would include the use and continued maintenance of existing plant facilities

Appendix D

- 2 -

and transmission lines. The KPS Site Map and Transmission System Map are enclosed for your information.

The GEIS considered the environmental impacts of renewing nuclear power plant operating licenses for a 20-year period on all currently operating sites. In the GEIS the NRC staff identified 92 environmental issues and developed generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. For the remaining 23 issues, plant-specific analyses will be documented in a supplement to the GEIS.

A supplemental environmental impact statement will be prepared for KPS to document the staff's review of environmental impacts related to terrestrial ecology, aquatic ecology, hydrology, cultural resources, and socioeconomic issues (among others), and will contain a recommendation regarding the environmental acceptability of the license renewal action.

Please submit any comments that you may have to offer on the scope of the environmental review by December 9, 2008. Written comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Electronic comments may be submitted to the NRC by e-mail at Kewaunee.EIS@nrc.gov. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and mail a copy to you.

To accommodate interested members of the public, the NRC will hold two public scoping meetings for the KPS license renewal supplement to the GEIS on October 22, 2008, located at the Carlton Town Hall, N 1296, Town Hall Road, Kewaunee, Wisconsin 54216. There will be two sessions to accommodate interested parties. The first session will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second session will convene at 7:00 p.m., with a repeat of the overview portions of the meeting, and will continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session.

The KPS license renewal application and the GEIS are available on the internet at www.nrc.gov/reactors/operating/licensing/renewal/applications/kewaunee.html. In addition, the Kewaunee Public Library, located at 822 Juneau Street, Kewaunee, Wisconsin, has agreed to make the license renewal application and the GEIS available for public inspection.

The staff expects to publish the draft supplemental environmental impact statement in August 2009. A copy of the document will be sent to you for your review and comment. The NRC will hold another set of public meetings in the site vicinity to solicit comments on the draft supplemental environmental impact statement. After consideration of public comments received, the NRC will prepare a final supplemental environmental impact statement, which is

- 3 -

scheduled to be issued in January 2010. If you need additional information regarding the license renewal review process, please contact Sarah Lopas, License Renewal Project Manager, at 301-415-1147 or by e-mail at sarah.lopas@nrc.gov.

Sincerely,

/RA/

David L. Pelton, Chief
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures:

1. Site Map
2. Transmission System Map

cc w/encls.: See next page



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Green Bay ES Field Office
2661 Scott Tower Drive
New Franken, Wisconsin 54229-9565
Telephone 920/866-1717
FAX 920/866-1710

October 28, 2008

Mr. David Pelton, Branch Chief
Division of License Renewal
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

re: Request for Species List
License Renewal Application Review
Kewaunee Power Station
Kewaunee County, Wisconsin

Dear Mr. Pelton:

This letter responds to your September 30, 2008 request to the U.S. Fish and Wildlife Service (Service) for a list of federally-listed, proposed and candidate species and critical habitat that may be present in the vicinity of the subject project. The proposed action would renew the operating license for the Kewaunee Power Station (KPS) Nuclear Plant. This action would include the use and maintenance of the existing plant facilities and transmission lines by the applicant Dominion Energy Kewaunee, Inc. (Dominion). The KPS is located on the western shore of Lake Michigan in Kewaunee County, Wisconsin. Our comments follow.

Federally-Listed Species, Candidate Species, and Critical Habitat

A review of the information in our files indicates that one federally-listed species, the Hine's emerald dragonfly (*Somatochlora hineana*), is currently known from Kewaunee County, but is not known from the vicinity of your project area. The preferred habitat of the dragonfly is calcareous streams and associated wetlands overlying dolomite bedrock. One additional species, the piping plover (*Charadrius melodus*), has been documented in adjacent Manitowoc County, and may possibly occur in suitable habitat, consisting of sandy beaches.

While the piping plover is not known to occur on the KPS property, there is designated critical habitat for the species approximately 10 miles south of the plant, within the Point Beach State Forest. Piping plovers nest on wide sandy beaches on the Great Lakes, and prefer sites that have low levels of human disturbance. The habitat present at the project site appears to be possibly suitable for occupation by the piping plover. The Great Lakes piping plover population is currently expanding, and newly formed pairs continue to pioneer new sites and nest in areas where the species has not been previously known to nest. Based upon the secluded nature of the

site, and the type of habitat present there, it is possible that plovers may attempt to use the beaches on the KPS property in the future.

We recommend that the applicant conduct annual surveys for the piping plover within suitable habitat on the KPS site during the species breeding season. We recommend at least two surveys be conducted, with one occurring during the latter half of the month of May, and one or more occurring between June 1 and June 15. However, if only one survey is conducted annually, we request that it be conducted no later than June 10. If one or more piping plovers are observed during the survey, the Green Bay Ecological Services Field Office should be contacted immediately to initiate coordination on additional actions.

Migratory Birds

In recent years there have been a number of incidents of diving bird mortality due to entrainment in the water intake structures of the KPS. Since early 2006, there have been at least 46 individuals of 6 different duck species reported killed at this location. The Migratory Bird Treaty Act of 1918 (16 U.S.C. §§703-712), as amended, prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of Interior. The Service has an interest in proactively preventing the mortality of migratory birds whenever possible.

Following discussions with the Services' Special Agent located in this office, Dominion has developed an informal self-reporting system whereby they have agreed to inform the Service of such mortality events as they occur. In 2008, Dominion contracted a consultant to examine the issue and analyze possible solutions to the problem. According to the consultant's report, there are currently no technically feasible solutions to this problem which are also economically practical. We appreciate the cooperative relationship that Dominion has developed with this office, and encourage them to continue to explore means to further reduce or eliminate incidental avian mortality at the KPS.

We appreciate the opportunity to respond. Questions pertaining to these comments can be directed to Mr. Joel Trick at 920-866-1737.

Sincerely,



Louise Clemency
Field Supervisor

**APPENDIX E
CHRONOLOGY OF ENVIRONMENTAL REVIEW**

1 CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

2 This appendix contains a chronological listing of correspondence between the U.S. Nuclear
3 Regulatory Commission (NRC) and external parties as part of its environmental review for
4 Kewaunee Power Station (KPS). All documents, with the exception of those containing
5 proprietary information, are available electronically from the NRC's Public Electronic Reading
6 Room found on the Internet at the following Web address: <http://www.nrc.gov/reading-rm.html>.
7 From this site, the public can gain access to the NRC's Agency wide Document Access and
8 Management System (ADAMS), which provides text and image files of NRC's public documents
9 in ADAMS. The ADAMS accession number for each document is included below.
10

11 Environmental Review Correspondence

12 August 12, 2008	Dominion Energy Kewaunee, Inc. (DEK); letter from DEK forwarding the application for renewal of operating license for Kewaunee Power Station, requesting an extension of operating license for an additional 20 years. (ADAMS Accession No. ML082341020)
16 August 25, 2008	Letter to DEK, "Receipt and Availability of the License Renewal Application for the Kewaunee Power Station." (ADAMS Accession No. ML082120504)
19 August 29, 2008	Dominion Energy Kewaunee, Inc., "Notice of U.S Nuclear Regulatory Commission (D. Pelton) Receipt and Availability of Application for Renewal of Kewaunee Power Station, Facility Operating License No. DPR-43 for an Additional 20-Year Period" (73 FR 51023), <i>Federal Register</i> , August 29, 2008.
24 September 2, 2008	NRC press release "announcing the availability of the license renewal application for Kewaunee Power Station for public inspection." (ADAMS Accession No. ML082460767)
27 September 25, 2008	Letter to DEK, "Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding an Application from Dominion Energy Kewaunee, Inc., for Renewal of the Operating License for the Kewaunee Power Station." (ADAMS Accession No. ML082610303)
32 September 30, 2008	Letter to Louise Clemency, U.S. Fish and Wildlife Service, "Request for List of State Protected Species within the Area under Evaluation for the Kewaunee Power Station License Renewal Application Review" (ADAMS No. ML082610748)
36 October 1, 2008	Dominion Energy Kewaunee, Inc.; Kewaunee Power Station, "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing; Regarding Renewal of Facility Operating

Appendix E

- 1 License No. DPR-43 for an Additional 20-Year Period;” (73 FR
2 57154), *Federal Register*, October 1, 2008.
- 3 October 2, 2008 Letter to DEK, “Notice of Intent to Prepare an Environmental Impact
4 Statement and Conduct Scoping Process for License Renewal for
5 Kewaunee Power Station.” (ADAMS Accession No. ML082520774)
- 6 October 8, 2008 Notice of public meeting “To discuss the license renewal process and
7 environmental scoping for Kewaunee Power Station, license renewal
8 application review.” (ADAMS Accession No. ML082750112)
- 9 October 8, 2008 Letter to Don L. Klima, Advisory Council on Historic Preservation,
10 “Kewaunee Power Station License Renewal Application Review.”
11 (ADAMS Accession No. ML082610168)
- 12 October 9, 2008 Dominion Energy Kewaunee, Inc.; Kewaunee Power Station, “Notice
13 of Intent to Prepare an Environmental Impact Statement and Conduct
14 Scoping Process” (73 FR 59678), *Federal Register*, October 9, 2008.
- 15 October 10, 2008 Letter to Kathleen Angel, Wisconsin Coastal Management Program,
16 “Kewaunee Power Station License Renewal Application Review.”
17 (ADAMS Accession No. ML082680027)
- 18 October 10, 2008 Letter to Sherman Baker, Wisconsin Historical Society, “Kewaunee
19 Power Station License Renewal Application Review.” (ADAMS
20 Accession No. ML082670685)
- 21 October 10, 2008 Letter to Ronald Kazmierczak, Wisconsin Department of Natural
22 Resources, “Kewaunee Power Station License Renewal Application
23 Review.” (ADAMS Accession No. ML082661119)
- 24 October 16, 2008 Press release “announcing the Kewaunee Power Station license
25 renewal scoping meeting.” (ADAMS Accession No. ML082900265)
- 26 October 16, 2008 Letter to Terrence Virden, Bureau of Indian Affairs, “Request for
27 Scoping Comments Concerning the Kewaunee Power Station License
28 Renewal Application Review.” (ADAMS Accession No. ML082800098)
- 29 October 16, 2008 Letter to Laurie Boivin, Menominee Indian Tribe of Wisconsin,
30 “Request for Scoping Comments Concerning the Kewaunee Power
31 Station License Renewal Application Review.” (ADAMS Accession
32 No. ML082800098)
- 33 October 16, 2008 Letter to Steve Ortiz, Prairie Band Potawatomi Nation, “Request for
34 Scoping Comments Concerning the Kewaunee Power Station License
35 Renewal Application Review.” (ADAMS Accession No. ML082800098)

Appendix E

1	October 16, 2008	James Williams, Jr., Lac Vieux Desert Band of Lake Superior
2		Chippewa Indians, "Request for Scoping Comments Concerning the
3		Kewaunee Power Station License Renewal Application Review."
4		(ADAMS Accession No. ML082800098)
5	October 16, 2008	Louis Taylor, Lac Courte Oreilles Band of Lake Superior Chippewa
6		Indians of Wisconsin, "Request for Scoping Comments Concerning
7		the Kewaunee Power Station License Renewal Application Review."
8		(ADAMS Accession No. ML082800098)
9	October 16, 2008	Victoria A. Doud, Lac du Flambeau Band of Lake Superior Chippewa
10		Indians of Wisconsin, "Request for Scoping Comments Concerning
11		the Kewaunee Power Station License Renewal Application Review."
12		(ADAMS Accession No. ML082800098)
13	October 16, 2008	Phillip Shopodock, Forest County Potawatomi Community of
14		Wisconsin, "Request for Scoping Comments Concerning the
15		Kewaunee Power Station License Renewal Application Review."
16		(ADAMS Accession No. ML082800098)
17	October 16, 2008	Robert Kewaygoshkum, Grand Traverse Band of Ottawa and
18		Chippewa Indians, "Request for Scoping Comments Concerning the
19		Kewaunee Power Station License Renewal Application Review."
20		(ADAMS Accession No. ML082800098)
21	October 16, 2008	Kenneth Meshigaud, Hannahville Indian Community, "Request for
22		Scoping Comments Concerning the Kewaunee Power Station License
23		Renewal Application Review." (ADAMS Accession No. ML082800098)
24	October 16, 2008	Wilfred Cleveland, Ho-Chuck Nation, "Request for Scoping Comments
25		Concerning the Kewaunee Power Station License Renewal
26		Application Review." (ADAMS Accession No. ML082800098)
27	October 16, 2008	Laura Spurr, Huron Potawatomi, Inc., "Request for Scoping
28		Comments Concerning the Kewaunee Power Station License
29		Renewal Application Review." (ADAMS Accession No. ML082800098)
30	October 16, 2008	Susan J. LaFernier, Keweenaw Bay Indian Community, "Request for
31		Scoping Comments Concerning the Kewaunee Power Station License
32		Renewal Application Review." (ADAMS Accession No. ML082800098)
33	October 16, 2008	Arlyn Ackley, Sokagon Chippewa Community, Mole Lake Band of
34		Lake Superior Chippewa Indians, "Request for Scoping Comments
35		Concerning the Kewaunee Power Station License Renewal
36		Application Review." (ADAMS Accession No. ML082800098)

1 October 16, 2008 John Barret, Citizen Potawatomi Nation, "Request for Scoping
2 Comments Concerning the Kewaunee Power Station License
3 Renewal Application Review." (ADAMS Accession No. ML082800098)

4 October 27, 2008 Letter to DEK, "Request for Additional Information Regarding the
5 Review of the License Renewal Application for Kewaunee Power
6 Station." (ADAMS Accession No. ML082560558)

7 October 28, 2008 Letter from Louise Clemency, U.S. Fish and Wildlife Service, "Re:
8 Request for Species List License Renewal Application Review
9 Kewaunee Power Station Kewaunee County, Wisconsin." (ADAMS
10 Accession No. ML083390643)

11 November 17, 2008 Summary of Public License Renewal Overview and Environmental
12 Scoping Meetings Related to the Review of the Kewaunee Power
13 Station License Renewal Application. (ADAMS Accession No.
14 ML083090452)

15 November 25, 2008 Letter from DEK, "Dominion Energy Kewaunee, Inc. Kewaunee Power
16 Station Response to Request for Additional Information License
17 Renewal Application." (ADAMS Accession No. ML083520612)

18 December 3, 2008 Letter to DEK, "Project Manager Change for the License Renewal
19 Review for Kewaunee Power Station." (ADAMS Accession No.
20 ML083370231)

21 December 9, 2008 Letter to DEK, "Revision of Schedule for the Conduct of the Review of
22 the Kewaunee Power Station License Renewal Application." (ADAMS
23 Accession No. ML083370245)

24 January 8, 2009 "Request for Additional Information Regarding Severe Accident
25 Mitigation Alternatives for Kewaunee Power Station." (ADAMS
26 Accession No. ML083250719)

27 February 3, 2009 Summary of Conference Call with Dominion Energy Kewaunee, Inc.,
28 to Discuss the Severe Accident Mitigation Alternatives Requests for
29 Additional Information for Kewaunee Power Station. (ADAMS
30 Accession No. ML090290287)

31 March 9, 2009 Letter from DEK, "Dominion Energy Kewaunee, Inc. Kewaunee Power
32 Station Response to Request for Additional Information Regarding
33 Severe Accident Mitigation Alternatives for Kewaunee Power Station
34 License Renewal Application." (ADAMS Accession No.
35 ML0906900458)

36 April 6, 2009 Letter to DEK, "Issuance of Environmental Scoping Summary Report
37 Associated with the Staff's Review of the Application by Dominion

Appendix E

1		Energy Kewaunee, Inc., for Renewal of the Operating License for
2		Kewaunee Power Station.” (ADAMS Accession No. ML090770880)
3	April 11, 2009	Letter to DEK, “Environmental Site Audit Regarding Kewaunee Power
4		Station License Renewal Application.” (ADAMS Accession No.
5		ML090750720)
6	April 20, 2009	“Reissuing of the Environmental Scoping Summary Report Associated
7		with the Staff’s Review of the Application by Dominion Energy
8		Kewaunee, Inc., for Renewal of the Operating License for Kewaunee
9		Power Station (ADAMS Accession No. ML091100093).
10	June 1, 2009	Letter from DEK, “Dominion Energy Kewaunee, Inc. Kewaunee Power
11		Station Response to Follow-Up Questions Regarding the Severe
12		Accident Mitigation Alternatives for Kewaunee Power Station.”
13		(ADAMS Accession No. ML091600037)
14	July 6, 2009	Letter from DEK, “Response to Request to Docket Information
15		Related to the Environmental Site Audit for Kewaunee Power Station.”
16		(ADAMS Accession No. ML0919705124)
17	July 8, 2009	Summary of Conference Calls With Dominion Energy Kewaunee, Inc.,
18		to Discuss Response to Follow-Up Question Regarding Severe
19		Accident Mitigation Alternatives Request for Additional Information For
20		Kewaunee Power Station. (ADAMS Accession No. ML091820565)
21	July 8, 2009	Letter to DEK, “Environmental Project Manager Change for the
22		License Renewal of Kewaunee Power Station.” (ADAMS Accession
23		No. ML091880344)
24	July 10, 2009	Letter to DEK, “Request for Additional Information Regarding the
25		Environmental Review of the License Renewal Application for
26		Kewaunee Power Station.” (ADAMS Accession No. ML091890017)

**APPENDIX F
U.S. NUCLEAR REGULATORY COMMISSION STAFF
EVALUATION OF SEVERE ACCIDENT MITIGATION
ALTERNATIVES FOR KEWAUNEE POWER STATION IN
SUPPORT OF LICENSE RENEWAL APPLICATION REVIEW**

1 **U.S. NUCLEAR REGULATORY COMMISSION STAFF EVALUATION OF**
2 **SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR KEWAUNEE**
3 **POWER STATION IN SUPPORT OF LICENSE RENEWAL**
4 **APPLICATION REVIEW**

5 **F.1 Introduction**

6 Dominion Energy Kewaunee, Inc. (DEK) submitted an assessment of severe accident mitigation
7 alternatives (SAMAs) for Kewaunee Power Station (KPS) as part of the environmental report
8 (ER) (DEK, 2008a). This assessment was based on the most recent KPS probabilistic risk
9 assessment (PRA) available at that time, a plant-specific offsite consequence analysis
10 performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer
11 code, and insights from the KPS individual plant examination (IPE) (WPSC, 1992) and individual
12 plant examination of external events (IPEEE) (WPSC, 1994a). In identifying and evaluating
13 potential SAMAs, DEK considered SAMAs that addressed the major contributors to core
14 damage frequency (CDF) and large early release frequency (LERF) at KPS, as well as SAMA
15 candidates for other operating plants, which have submitted license renewal applications. DEK
16 identified 189 potential SAMA candidates. This list was reduced to 64 SAMAs by eliminating
17 SAMAs that are not applicable at KPS due to design differences, have been effectively
18 implemented at KPS, have estimated costs that would exceed the dollar value associated with
19 completely eliminating all severe accident risk at KPS, or have a very low benefit because they
20 are associated with a non-risk-significant system. DEK assessed the costs and benefits
21 associated with each of the potential SAMAs and concluded in the ER that several of the
22 candidate SAMAs evaluated are potentially cost-beneficial.

23 Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC)
24 issued a request for additional information (RAI) to DEK by letter dated January 8, 2009 (NRC,
25 2009a). Key questions concerned: additional details regarding the plant-specific PRA model and
26 changes to the model since the IPE; identification of candidate SAMAs from the available plant-
27 specific fire and seismic risk analyses; additional information regarding the Level 2 PRA
28 analysis and Level 3 PRA inputs; the screening of specific candidate SAMAs; and further
29 information on the cost-benefit analyses of several specific candidate SAMAs and low-cost
30 alternatives. DEK submitted additional information by letter dated March 9, 2009 (DEK, 2009a).
31 In response to the RAIs, DEK provided: information regarding PRA models and recent changes;
32 additional justification for the treatment of external events; additional information on the Level 2
33 and 3 PRA analysis and inputs; and additional information regarding selection, screening and
34 cost-benefit analysis of several specific SAMAs. DEK responded to six follow-up questions from
35 the NRC staff (NRC, 2009b) by letters dated June 1, 2009 (DEK, 2009b), and July 28, 2009
36 (DEK, 2009c). DEK's responses addressed the NRC staff's concerns and resulted in the
37 identification of additional potentially cost-beneficial SAMAs.

Appendix F

1 An assessment of SAMAs for KPS is presented below.

2 **F.2. Estimate of Risk for Kewaunee Power Station**

3 DEK's estimates of offsite risk at KPS are summarized in Section F.2.1. The summary is
4 followed by the NRC staff's review of DEK's risk estimates in Section F.2.2.

5 **F.2.1. Kewaunee's Risk Estimates**

6 Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA
7 analysis: (1) the KPS Level 1 and 2 PRA model, which is an updated version of the IPE (WPSC,
8 1992), and (2) a supplemental analysis of offsite consequences and economic impacts
9 (essentially a Level 3 PRA model) developed specifically for the SAMA analysis. The SAMA
10 analysis is based on the most recent KPS Level 1 and 2 PRA model available at the time of the
11 ER, referred to as version K101AASAMA. The scope of the KPS PRA does not include external
12 events.

13 The baseline CDF for the purpose of the SAMA evaluation is approximately 7.7×10^{-5} per year
14 as determined from the sum of the minimal cutsets. When determined from the sum of the event
15 tree sequences, the CDF is 8.1×10^{-5} per year. The latter value was used in the SAMA
16 analysis. The CDF is based on the risk assessment for internally-initiated events, which includes
17 internal flooding. DEK did not include the contribution from external events within the KPS risk
18 estimates; however, it did account for the potential risk reduction benefits associated with
19 external events by doubling the estimated benefits for internal events. This is discussed further
20 in Sections F.2.2 and F.6.2.

21 The breakdown of CDF by initiating event is provided in Table F.2-1. This information was
22 summarized from that provided in Table F-1 of the ER and in response to an RAI (DEK, 2009a).
23 As shown in this table, events initiated by internal flooding are the dominant contributors to
24 CDF, contributing a total of 4.5×10^{-5} per year or 58 percent of the total internal events CDF.
25 Although not separately reported, station blackout (SBO) sequences contribute roughly $3.3 \times$
26 10^{-6} per year (4.3 percent of the total internal events CDF), while anticipated transient without
27 scram (ATWS) sequences contribute less than 1 percent to the total internal events CDF.

28 The Level 2 KPS PRA model is based on the IPE model, with updates in 2004 and May 2007.
29 The Level 1/Level 2 interface utilizes plant damage states (PDS) determined from "bridge trees".
30 These bridge trees extend the Level 1 analysis to include systems relevant to the Level 2
31 analysis. Each PDS is then evaluated through the Level 2 containment event tree (CET) (ER
32 Figure F-1). The CET probabilistically evaluates the progression of the damaged core with
33 respect to release to the environment. The CET end states then are examined for
34 considerations of timing and magnitude of release and assigned to release categories using a
35 release category diagram (ER Figure F-2).

36 The result of the Level 2 model is a set of 14 release categories, also referred to as source term
37 categories (STCs), with their respective frequency and release characteristics. The release
38 categories and their characteristics are provided in Table F-6 and F-10 of the ER. The
39 categories were defined based on the timing, duration, and magnitude of the release and
40 whether the containment remains intact, fails, or is bypassed. The frequency of each release

1 category was obtained by summing the frequency of the individual CET end states assigned to
 2 each release category. The release characteristics for the 14 release categories were based on
 3 analyses using the Modular Accident Analysis Program (MAAP) computer code.

4 **Table F.2-1. Kewaunee Power Station Core Damage Frequency**
 5

Initiating Event	CDF1 (Per Year)	% Contribution to CDF
Internal Floods	4.5 x 10 ⁻⁵	58
Transient with Main Feedwater Available	6.5 x 10 ⁻⁶	8
Loss of Component Cooling Water	6.0 x 10 ⁻⁶	8
Steam Generator Tube Rupture (SGTR)	4.7 x 10 ⁻⁶	6
Loss of Offsite Power	3.9 x 10 ⁻⁶	5
Stuck Open Pressurizer PORV	2.0 x 10 ⁻⁶	3
Loss of Service Water	1.9 x 10 ⁻⁶	3
Loss of Main Feedwater	1.6 x 10 ⁻⁶	2
Small LOCA	1.2 x 10 ⁻⁶	2
Vessel Failure	9.5 x 10 ⁻⁷	1
Loss of Instrument Air	8.0 x 10 ⁻⁷	1
All Others	2.5 x 10 ⁻⁶	3
Total CDF (internal events)	7.7 x 10⁻⁵	100

6
 7 The offsite consequences and economic impact analyses use the MACCS2 code to determine
 8 the offsite risk impacts on the surrounding environment and public. Inputs for these analyses
 9 include plant-specific and site-specific input values for core radionuclide inventory, source term
 10 and release characteristics, site meteorological data, projected population distribution (within an
 11 80-kilometer (50-mile) radius) for the year 2033, emergency response evacuation modeling, and
 12 economic data. The magnitude of the onsite impacts (in terms of clean-up and decontamination
 13 costs and occupational dose) is based on information provided in NEI 05-01 (NEI, 2005), which
 14 in turn is based on NUREG/BR-0184 (NRC, 1997a).

15 In the ER, DEK estimated the dose to the population within 50 miles (80 km) of the KPS site to
 16 be approximately 0.302 person-sievert (Sv) (30.2 person-rem) per year. The breakdown of the
 17 total population dose by containment release mode is summarized in the following table:

Appendix F

1 **Table F.2-2. Containment bypass events (such as transients with an induced SGTR, or**
 2 **SGTR-initiated accidents with a stuck open safety relief valve on the ruptured steam**
 3 **generator) and late containment failures without containment spray dominate the**
 4 **population dose risk at Kewaunee Power Station.**

Containment Release Mode	Population Dose (Person-Rem Per Year)	% Contribution
Late Containment Failure without containment sprays	8.6	29
ISLOCA with scrubbing	0.2	<1
ISLOCA without scrubbing	0.9	3
SGTR with failure of secondary side isolation	19.5	64
SGTR with successful secondary side isolation	0.9	3
Other	0.1	1
Total	30.2	100

5 One person-rem = 0.01 person-Sv

6 **F.2.2. Review of Dominion Energy Kewaunee, Inc.'s Risk Estimates**

7 DEK's determination of offsite risk at KPS is based on the following three major elements of
 8 analysis:

- 9 • the Level 1 and Level 2 risk models that form the bases for the 1992 IPE submittal
 10 (WPSC, 1992) and the external events analyses of the 1994 IPEEE submittal (WPSC,
 11 1994a),
- 12 • the major modifications to the IPE model that have been incorporated in the
 13 K101AASAMA PRA model, and
- 14 • the MACCS2 analyses performed to translate fission product source terms and release
 15 frequencies from the Level 2 PRA model into offsite consequence measures.

16 Each of these analyses was reviewed to determine the acceptability of DEK's risk estimates for
 17 the SAMA analysis, as summarized below.

18 The NRC staff's review of the KPS IPE is described in an NRC report dated January 15, 1997
 19 (NRC, 1997b). Based on a review of the IPE submittal and responses to RAIs, the NRC staff
 20 concluded that the IPE submittal met the intent of Generic Letter (GL) 88-20; that is, the
 21 licensee's IPE process is capable of identifying the most likely severe accidents and severe
 22 accident vulnerabilities. While the NRC Staff Evaluation Report (SER) and the attached
 23 Technical Evaluation Report (TER) did not specifically highlight any weaknesses in the IPE, in a
 24 subsequent submittal relative to risk-informed in-service inspection (NMC, 2005), the licensee
 25 indicated that six weaknesses were identified in the IPE review. In response to an RAI, DEK

1 addressed each weakness and confirmed that they are not applicable to the model used for the
2 SAMA analysis (DEK, 2009a).

3 The IPE identified nine severe accident vulnerabilities associated with core damage and six
4 improvements to address the first five of these vulnerabilities (WPSC, 1994a). Improvements to
5 address the remaining four vulnerabilities were being given further consideration at the time of
6 the IPE submittal. In a subsequent IPE submittal, all but one of the original six improvements
7 were stated to have been implemented. The one improvement not implemented was to change
8 the normal position of two safety injection motor operated valves from open to closed, thereby
9 reducing the ISLOCA frequency. While this was included in the IPE, it was subsequently found
10 that the CDF contribution of failing to open was higher than the CDF reduction from having the
11 valves closed. Accordingly, implementation of this change was not considered appropriate. The
12 status of the remaining four vulnerabilities was also given (WPSC, 1994b). SAMAs in the
13 current evaluation address these remaining four vulnerabilities. No vulnerabilities or
14 improvements associated with containment performance were identified (WPSC, 1992).

15 The CDF value from the 1996 KPS revised IPE (1.1×10^{-4} per year) is at the high end of the
16 range of the CDF values reported in the IPEs for Westinghouse two-loop plants. Figure 11.6 of
17 NUREG-1560 (NRC, 1997c) shows that the IPE-based total internal events CDF for two-loop
18 Westinghouse plants ranges from 5×10^{-5} per year to 1.2×10^{-4} per year (NRC, 1997c). It is
19 recognized that other plants have updated the values for CDF subsequent to the IPE submittals
20 to reflect modeling and hardware changes. The internal events CDF result for KPS used for the
21 SAMA analysis is somewhat higher than that for other plants of similar vintage and
22 characteristics due to the relatively high internal flooding contribution to CDF, as described
23 below.

24 There have been nine revisions to the PRA model between the 1992 IPE submittal and the
25 model used for the SAMA analysis. A description of changes made from one model to another
26 is provided in Section F.2 of the ER and is summarized in Table F.2-3. The CDF and LERF
27 values have varied widely over these revisions.

28 In response to an RAI concerning the major reasons for these changes, DEK indicated that the
29 principal reason for the changes was due to internal flood modeling (DEK, 2009a). According to
30 DEK, the flood model in the 8/2003 PRA was not substantially different from that in the IPE, and
31 resulted in a flood CDF of 3.6×10^{-7} per year. The 12/2004 PRA incorporated what was
32 considered to be a conservative model that bounded actual flooding conditions until a best
33 estimate model could be developed. This model had a flooding CDF contribution of 6.8×10^{-4}
34 per year with the majority of the frequency due to (1) rupture of the condenser expansion joint,
35 with flood water propagating to the safeguards alley via floor drains and under doors, and (2)
36 break of safety injection piping from the refueling water storage tank, with flood water
37 propagating to the safeguards alley through a failed door. In 2005, design changes were made
38 to mitigate these flooding contributors. Credit for these design changes, as well as planned
39 internal flood modifications, was included in the K101AASAMA model and reduced the internal
40 flood CDF to 4.5×10^{-5} per year.

1 **Table F.2-3. Kewaunee Power Station Probabilistic Risk Assessment Historical Summary**

Version	Description/changes from previous model	CDF (per year)	LERF (per year)
IPE	11.0 ORIGINAL IPE	6.6 x 10 ⁻⁵	NC
Revised IPE 6/1996	Revised in response to RAIs, including new Human Reliability Analysis	1.1 x 10 ⁻⁴	NC
1/1997	- Credited operator to refill RWST - Modeled alternate cooling for air compressors	3.9 x 10 ⁻⁵	2.2 x 10 ⁻⁶
4/1998	Removed asymmetric modeling	3.6 x 10 ⁻⁵	1.9 x 10 ⁻⁶
12/2001	- Incorporated plant failure and initiating event data - Included consideration of replacement SGs - Converted from GRAFTER code to WinNUPRA code - Reviewed in 6/2002 WOG Group peer review	4.1 x 10 ⁻⁵	4.8 x 10 ⁻⁶
8/2003	- Reevaluated important human error probabilities - Updated Level 2 success criteria for power uprate - Updated medium LOCA and ISLOCA models - Incorporated WOG RCP seal LOCA model - Revised steam line break analysis to include pressurized thermal shock - Added quantitative shutdown model - Resolved numerous peer review comments	3.0 x 10 ⁻⁵	5.3 x 10 ⁻⁶
12/2004	- Revised internal flooding model - Added need to stop safety injection following steam line break - Added dependence of letdown on component cooling water - Added power recovery and 480 VAC bus cross-ties - Updated success criteria for power uprate	7.2 x 10 ⁻⁴	5.0 x 10 ⁻⁶
K101A 6/2006	- Incorporated new internal flooding model which included plant changes to address flooding concerns - Incorporated revised diesel-generator reliability data - Incorporated reactor coolant system cooldown and depressurization following RCP seal LOCA to avoid core damage	2.7 x 10 ⁻⁴	5.7 x 10 ⁻⁶
K101AA 12/2006	- Incorporated flood barriers to protect RHR pumps - Incorporated operator actions to address flooding of battery room, auxiliary feedwater (AFW) room, and switchgear room ventilation - Incorporated procedure changes addressing service water isolation and removed other isolation conservatisms	1.3 x 10 ⁻⁴	7.0 x 10 ⁻⁶
K101AASAMA 5/2007	One time only model for SAMA. Updates were carried through to future revisions as specified - Revised service water model for internal flooding sequences - Incorporated credit for planned internal flooding design changes (described below) - Restructured Level 1 event trees to support revised Level 2 model	7.7 x 10 ⁻⁵ (8.1 x 10 ⁻⁵)	9.5 x 10 ⁻⁶ (9.9 x 10 ⁻⁶)

Version	Description/changes from previous model	CDF (per year)	LERF (per year)
K101AB 5/2007	Update to K101AA - Revised service water model for internal flooding sequences Note: No internal flooding modifications included	1.1 x 10 ⁻⁴	5.7 x 10 ⁻⁶
K107A 8/2007	Subjected to independent review 1/2008 - Updated basic event database - Updated internal flooding model to remove conservatisms - Restructured Level 1 event trees to support revised Level 2 model Note: No internal flooding modifications included	7.6 x 10 ⁻⁵	9.8 x 10 ⁻⁶
K107Aa 7/2008	Updated model to "as installed" configuration of internal flooding modifications included in K101AASAMA model.	4.8 x 10 ⁻⁵	6.4 x 10 ⁻⁶
K107AaLRT 7/15/2008	Re-evaluated significant operator actions	4.2 x 10 ⁻⁵ (4.3 x 10 ⁻⁵)	4.9 x 10 ⁻⁶ (4.9 x 10 ⁻⁶)

1 NC - Not Calculated

2 Values in parentheses are sum of sequence frequencies

3 The planned internal flood modifications were discussed with the NRC on November 30, 2006
4 (DEK, 2006). At the time of the SAMA analysis, three of the four planned modifications had
5 been implemented, and the fourth modification, involving relocating two electrical safety-related
6 supply circuit breakers (breakers 15206 and 16206), had not yet been completed. In response
7 to an RAI, DEK indicated that relocation of breaker 16206 is currently planned for the next
8 available opportunity, but relocation of breaker 15206, which is stated to have a much lower
9 benefit, is no longer planned (DEK, 2009a). However, another design change, involving
10 rerouting a wire for a Turbine Building basement fan coil unit, was completed in 2008 but not
11 included in the K101AASAMA model. DEK indicated that credit for rerouting this wire would
12 more than offset the impact of raising the breakers (DEK, 2009a).

13 Subsequent to the SAMA analysis, DEK submitted an unrelated risk-informed license
14 amendment request regarding containment integrated leak rate testing (DEK, 2008b) that
15 provided information on a more recent version of the PRA (i.e., the K107Aa PRA model of July
16 2008). The July 2008 PRA update has a significantly lower CDF (4.8 x 10⁻⁵ per year) than that
17 for the SAMA model. In response to an RAI, DEK provided information on PRA model changes
18 subsequent to the K101AASAMA PRA (DEK, 2009a). A description of these changes is
19 included in Table F.2-3. The majority of the CDF reduction from the SAMA model to the K107Aa
20 model is attributed to the database update and the incorporation of credit for rerouting a wire
21 connecting the supply breaker for the turbine building basement fan coil unit B and auxiliary
22 relays (DEK, 2009a). Other changes in the model, principally incorporating several specific
23 ventilation design features and requirements, had a smaller impact on CDF. It is also noted that
24 the current model does not include credit for raising of either breaker 15206 or 16206. The
25 impact of this new PRA version on the results of the SAMA evaluation is discussed in Section
26 3.2 below.

27 The NRC staff considered the peer reviews performed for the KPS PRA and the potential
28 impact of the review findings on the SAMA evaluation. In the ER, DEK described the June 2002
29 peer review by the (former) Westinghouse Owner's Group (WOG) of the 12/2001 PRA model.

Appendix F

1 The peer review identified five Level A and 49 Level B Facts & Observations (F&Os) (DEK,
2 2008a). DEK stated in the ER that all Level A F&Os (important and necessary to address before
3 the next regular PRA update) and all but two Level B F&Os (important and necessary to
4 address but disposition may be deferred until the next PRA update) have been dispositioned,
5 and that those items requiring model and/or documentation changes have been addressed in
6 the PRA used for the SAMA analysis (K101AASAMA). One unresolved F&O pertains to not
7 documenting the basis for not including room cooling as a required support system. In the
8 SAMA model, room cooling is required unless a calculation shows it is not needed. The second
9 unresolved F&O pertains to loss of room cooling as a separate initiating event. In response to
10 an RAI, DEK discusses loss of room-cooling events and points out that the equipment needed
11 during power operation is in different plant locations from that needed to respond to a reactor
12 trip or accident. Consequently, the same room-cooling failures would not be expected to impact
13 both functions. DEK concluded that loss of room cooling need not be treated as an initiator. In
14 the SAMA model, room cooling is considered as a support function and this has led to the
15 identification of a number of room cooling related SAMAs. The NRC staff considers this
16 modeling approach sufficient for the purposes of the SAMA analysis.

17 In the aforementioned integrated leak rate testing submittal (DEK, 2008b), DEK described a
18 review of the July 2008 revised KPS PRA (K107Aa) against Regulatory Guide (RG) 1.200,
19 Revision 1, and the supporting requirements (SRs) of the ASME PRA Standard (ASME, 2003).
20 In response to an RAI, DEK provided additional information on this review and the impact of its
21 findings on the SAMA analysis (DEK, 2009a). DEK summarized the unmet SRs, described how
22 the unmet SRs were reviewed to determine if they would have an impact on the risk insights of
23 the SAMA analysis, and concluded that resolution of the unmet SRs is not expected to alter the
24 findings of the SAMA analysis.

25 In the ER and in response to an RAI, DEK described the PRA update process in use at KPS.
26 The model is updated at least every 3 years to maintain it consistent with the as-built, as-
27 operated plant, to incorporate improved thermal-hydraulic results, and to incorporate PRA
28 improvements. The entire process of logging and tracking potential model changes, making the
29 model changes, documenting the changes, independent review of the changes and
30 management approval of the updated model and its documentation are governed by DEK
31 procedures.

32 Given that the KPS internal events PRA model has been peer reviewed and the peer review
33 findings were all addressed, and that DEK has satisfactorily addressed NRC staff questions
34 regarding the PRA, the NRC staff concludes that the internal events Level 1 PRA model is of
35 sufficient quality to support the SAMA evaluation.

36 As indicated above, the KPS PRA does not include external events. In the absence of such an
37 analysis, DEK used the KPS IPEEE to identify the highest risk accident sequences and the
38 potential means of reducing the risk posed by those sequences (DEK 2009a, 2009b). This is
39 discussed below and in Section F.3.2.

40 The KPS IPEEE was submitted in June 1994 (WPSC, 1994a), in response to Supplement 4 of
41 Generic Letter 88-20 (NRC, 1991). This submittal included a seismic PRA, a fire PRA, and a
42 screening analysis for other external events. While no fundamental weaknesses or
43 vulnerabilities to severe accident risk in regard to the external events were identified, several

1 opportunities for seismic risk reduction were identified from the seismic IPEEE/USI A-46
2 reviews, walkdowns, and relay chatter evaluations, and implemented as discussed below. In a
3 letter dated October 5, 1999, the NRC staff concluded that the submittal met the intent of
4 Supplement 4 to Generic Letter 88-20, and that the licensee's IPEEE process is capable of
5 identifying the most likely severe accidents and severe accident vulnerabilities (NRC, 1999).

6 The seismic PRA included in the KPS IPEEE consisted of a Level 1 seismic PRA with a
7 qualitative and quantitative evaluation of containment structures and containment safeguard
8 systems. The seismic PRA approach employed was a composite of seismic PRA and seismic
9 margins assessment (SMA) methods. Plant seismic walkdowns and screening were conducted
10 using the SMA procedures and guidance (EPRI, 1991). For the components screened out using
11 high confidence in low probability of failure (HCLPF) requirements for the 0.30g peak ground
12 acceleration Review Level Earthquake (RLE), "surrogate elements" were included in the PRA
13 model. Inclusion of these surrogate elements is necessary to incorporate in the seismic risk
14 estimates the failure of relatively robust elements at higher ground accelerations. While the
15 NRC review of the seismic PRA concluded that the use of "surrogate elements" resulted in an
16 identification and ranking of dominant sequences that was not meaningful, the overall
17 conclusion was that the resulting CDF of 1.1×10^{-5} per year was likely to be realistic or
18 conservative, and that there are, with reasonable confidence, no significant vulnerabilities. The
19 seismic outliers and the "bad actor" relays identified in the IPEEE were all resolved by
20 modifications so that they would not contribute to seismic risk, and therefore were not included
21 in the model (DEK, 2008a; NRC, 1998). The containment performance analysis included a
22 review and walkdown of the containment structures and components (penetrations, hatches,
23 isolation valves, freestanding steel shell, and attached piping and conduit). All met the screening
24 criteria and were therefore evaluated using the surrogate element approach, leading to a single
25 containment structural failure sequence. Fragilities for containment safeguard systems (spray,
26 air-cooling, and isolation) were determined based on walkdown results. Models for failures of
27 these systems were then input into a simplified Level 2 analysis based on the IPE model.
28 Subsequent to the IPEEE, changes made to the seismic PRA, including credit for seismically-
29 rugged air accumulators and more realistic human error probabilities, led to a slight reduction in
30 seismic CDF to 1.04×10^{-5} per year.

31 To provide additional insight into the appropriate seismic CDF to use for the SAMA evaluation,
32 the NRC staff developed an independent estimate of the seismic CDF for KPS using the
33 simplified-hybrid approximation method described in a paper by Robert P. Kennedy, entitled
34 "Overview of Methods for Seismic PRA and Margin Analysis Including Recent Innovations"
35 (Kennedy, 1999) and using both updated 2008 seismic hazard curve data from the U.S.
36 Geologic Survey (USGS, 2008) and LLNL seismic hazard curve data (NRC, 1994). The NRC
37 staff's independent calculations indicate the seismic CDF for KPS to be in the range of 6×10^{-6}
38 per year to 1×10^{-5} per year depending on seismic hazard curve and plant fragility
39 assumptions. Based on these estimates of the seismic CDF, the NRC staff concludes that the
40 seismic CDF given in the ER is appropriate for use in the SAMA assessment.

41 The KPS IPEEE fire analysis employed a combination of fire PRA methodology with the Electric
42 Power Research Institute's fire-induced vulnerability evaluation (FIVE) methodology. Fire zones
43 were initially screened out if a fire did not cause an initiating event or did not involve mitigating
44 equipment modeled in the PRA. Quantitative screening was then performed using fire
45 frequencies based on the FIVE methodology and the assumption that fire destroyed everything

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1 in the zone. The sequence was then quantified using the PRA internal events model. If the CDF
2 was greater than 1×10^{-6} per year the zone was subjected to more detailed analysis. The
3 potential impact on containment performance and isolation was evaluated following the core
4 damage evaluation.

5 The fire model was revised in response to an RAI on potential weaknesses that were noted in
6 the staff's evaluation of the IPEEE fire analysis. This revision included adding the control room
7 and cable spreading room to the fire zones evaluated, revising the human error probabilities
8 (HEPs), and updating the initiating event frequencies and severity factors (DEK, 2008a; WPSC
9 1995, 1998). The total fire CDF from the revised IPEEE analysis was estimated to be 1.8×10^{-4}
10 per year.

11 In general, the fire PRA model has not been updated since the completion of the IPEEE review.
12 However, when HEPs and plant failure data were updated for the internal events model, these
13 updates were carried into the fire model. In addition, the fire propagation modeling for the
14 auxiliary feedwater (AFW) pump B room, a dominant fire area, was updated, resulting in a fire
15 CDF of about 1.4×10^{-4} per year. The important fire areas and their contributions to the fire
16 CDF are listed in Table F.2-4.

17 In the ER, DEK identifies a number of conservatisms in the fire analysis. These are:

- 18 • Initiating-event frequencies are based on old data that does not reflect
19 current housekeeping practices.
- 20 • Fire-coping strategies credited only one train and did not rely on offsite
21 power.
- 22 • If a cable tray is damaged, all cables in the tray are assumed to be
23 damaged.
- 24 • Fire propagation analysis is highly conservative.
- 25 • Except for AFW Pump Room B, the most severe fire was assumed to occur
26 with a frequency equal to the total fire initiating event frequency for the
27 room.

28 In response to an RAI, DEK indicated the fire zones to which each of the conservatisms was
29 applicable. Most of the conservatisms are applicable to all fire zones and all are applicable to
30 the dominant fire zones (CDF greater than 1×10^{-6} per year).

31 DEK further states in the ER that changes to plant procedures made subsequent to the
32 completion of the IPEEE would reduce the fire CDF by at least a factor of five from the IPEEE.
33 In response to an RAI, DEK provided a reassessment of the top 100 cutsets from the fire risk
34 analysis in which these fire procedures were credited, i.e., OP-KW-AOP-FP-001, "Abnormal
35 Operating Procedure—Fire", and OP-KW-AOP-FP-002, "Fire in Alternate Zone." The
36 reassessment supports a reduction in CDF of slightly more than a factor of 5. DEK concluded
37 that the fire CDF would be 3.6×10^{-5} per year, based on applying the factor of 5 reduction to the
38 IPEEE fire CDF of 1.8×10^{-4} per year. However, the staff notes that the assessment that led to
39 this factor of 5 reduction used the updated fire PRA model with a CDF of about 1.4×10^{-4} per
40 year as the baseline. Thus, the adjusted fire CDF should be 2.8×10^{-5} per year. DEK agrees

- 1 that this is the correct value to use and that the value used in SAMA analysis is conservative.
- 2 The fire CDF for the dominant fire zones after making this adjustment are given in Table F.2-4
- 3 (DEK, 2009b).

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1 **Table F.2-4. Important Fire Areas and Their Contribution to Fire Core Damage Frequency**

Event ID	Description	CDF (Per Year)	
		Post-IPEEE	SAMA Analysis
IE-FIR14	Fire in Diesel Generator Room A	4.2 x 10 ⁻⁵	4.9 x 10 ⁻⁶
IE-FIR5	Fire in Relay Room	3.3 x 10 ⁻⁵	5.6 x 10 ⁻⁶
IE-FIR8	Fire Near Buses 51 and 52	2.4 x 10 ⁻⁵	2.9 x 10 ⁻⁶
IE-FIR4	Fire in Diesel Generator Room B	1.8 x 10 ⁻⁵	1.8 x 10 ⁻⁶
IE-FIR6	Auxiliary Feedwater Pump A Oil fire	1.2 x 10 ⁻⁵	1.3 x 10 ⁻⁶
IE-FIR10	Fire in Bus 5 Switches in ECCA	5.5 x 10 ⁻⁶	5.5 x 10 ⁻⁶
IE-FIR11	Fire in Bus 6 Switches in ECCA	5.2 x 10 ⁻⁶	5.2 x 10 ⁻⁶
Total (All Fire Zones)		1.4 x 10 ⁻⁴	2.8 x 10 ⁻⁵

2

3 Considering the above conservatisms and procedure assessment and the response to the staff
 4 RAIs, the staff concludes that the fire CDF of 3.6 x 10⁻⁵ per year is reasonable for the SAMA
 5 analysis.

6 The IPEEE analysis of high winds, floods, and other (HFO) external events followed the
 7 screening and evaluation approaches described in Supplement 4 of Generic Letter 88-20 (NRC,
 8 1991) and did not identify any significant sequences or vulnerabilities (WPSC, 1994a). Based on
 9 this result, the licensee concluded that these other external hazards would be negligible
 10 contributors to overall core damage and did not consider any plant specific SAMAs for these
 11 events.

12 The NRC SER on the IPEEE (NRC, 1999) identified an open item pertaining to the protection of
 13 the vents on the underground diesel oil storage tanks against tornado-generated missiles. In
 14 response to an RAI, DEK indicated that these vents had been lowered so as to be less
 15 vulnerable to tornado missiles, thereby meeting the IPEEE requirements. A future modification
 16 is, however, planned to further minimize the tornado risk.

17 Based on the aforementioned results, the external events CDF is approximately 60 percent of
 18 the internal events CDF from the K101AASAMA PRA (based on a fire CDF of 3.6 x 10⁻⁵ per
 19 year, a seismic CDF of 1 x 10⁻⁵ per year, a negligible HFO contribution, and an internal events
 20 CDF of 8.1 x 10⁻⁵ per year). Accordingly, the total CDF from internal and external events would
 21 be approximately 1.6 times the internal events CDF from the K101AASAMA PRA. In the SAMA
 22 analysis submitted in the ER, DEK doubled the benefit that was derived from the internal events
 23 model to account for the combined contribution from internal and external events. The NRC staff
 24 agrees with the licensee's overall conclusion concerning the impact of external events, and
 25 concludes that the licensee's use of a multiplier of 2 to account for external events is reasonable
 26 for the purposes of the SAMA evaluation.

27 The NRC staff reviewed the general process used by DEK to translate the results of the Level 1
 28 PRA into containment releases, as well as the results of the Level 2 analysis, as described in
 29 the ER and in response to an NRC staff RAI (DEK, 2009a). The current Level 2 KPS PRA is

1 based on the IPE model with updates in 2004 and 2007, the latter using the results from the
2 K101AASAMA Level 1 PRA. The 2004 update incorporated a design change that ensured that
3 water on the containment floor would spill into the reactor sump after reaching a level of 29
4 inches, thereby providing a flooded reactor cavity that could reduce the impact of core-concrete
5 interactions in a severe accident. In addition, the 2004 update incorporated the results of
6 reanalysis of accident sequences using a later version of the MAAP code and reflected a 6
7 percent power uprate at KPS. The 2007 update included consideration of induced SGTR
8 sequences, separation of SGTR sequences into those that had a large early release and those
9 that did not, and resolution of comments from the WOG peer certification.

10 Each plant damage state is analyzed through the Level 2 CET to evaluate the
11 phenomenological progression of the sequence. The CET end states are then assigned to one
12 of 14 release categories based on characteristics that determine the timing and magnitude of
13 fission product release using a release category diagram (Figure F-2 of the ER). The frequency
14 of each release category was obtained by summing the frequency of the individual accident
15 progression CET endpoints into the release category.

16 Source term release characteristics were developed for each release category based on results
17 of plant-specific calculations using the MAAP computer program, Version 4.0.5. The release
18 categories and their frequencies and release characteristics are presented in Table F-6 of the
19 ER. The MAAP case selected to represent each release category was the sequence with the
20 highest frequency that bounded the release fractions for the release category. In response to an
21 RAI, DEK stated that when the Level 2 sequences were reanalyzed in 2007, the previously
22 analyzed sequences for each release category were reviewed to ensure that they still reflected
23 the expected accident progression for the associated release category, and if not, new cases
24 were run (DEK, 2009a). DEK indicated that in most cases the previously selected sequence still
25 represented the new source term category. The exception was release category 4 for which a
26 flood scenario was selected for the revised analysis since floods are the dominant contributor.

27 The NRC staff's review of the Level 2 IPE concluded that it appeared to have considered the
28 most important severe accident phenomena and it identified no significant problems or errors
29 (NRC, 1997b). Based on the NRC staff's review of the Level 2 methodology and in particular the
30 changes made since the IPE, and the fact that the Level 2 model was reviewed as part of the
31 WOG peer review and a subsequent self-assessment, the NRC staff concludes that the Level 2
32 PRA provides an acceptable basis for evaluating the benefits associated with various SAMAs.

33 As indicated in the ER, the reactor core radionuclide inventory used in the consequence
34 analysis was determined from the results of an end-of-cycle ORIGEN2 code calculation. The
35 results for a power level of 1772 MWt (the uprated power level) were increased by 0.6 percent
36 for potential measurement error. In response to an RAI, the licensee indicated that KPS does
37 not have any current plans that would cause fuel burnup/management to change during the
38 renewal period.

39 The NRC staff reviewed the process used by DEK to extend the containment performance
40 (Level 2) portion of the PRA to an assessment of offsite consequences (essentially a Level 3
41 PRA). This included consideration of the source terms used to characterize fission product
42 releases for the applicable source term categories and the major input assumptions used in the
43 offsite consequence analyses. The MACCS2 code was utilized to estimate offsite

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1 consequences. Plant-specific input to the code includes the source terms for each source term
2 category and the reactor core radionuclide inventory (both discussed above), site-specific
3 meteorological data, projected population distribution within an 80-kilometer (50-mi) radius for
4 the year 2033, emergency evacuation modeling, and economic data. This information is
5 provided in Attachment F of the ER.

6 All releases were modeled as occurring at the top of the containment approximately 180 feet
7 above grade, with a thermal content the same as ambient (i.e., a non-buoyant plume). The
8 impact of the shield building that surrounds the containment on initial plume size and release
9 elevation was neglected. DEK assessed the impact of alternatively assuming a ground level
10 release and a higher (buoyant) plume. The results of these sensitivity studies showed that a
11 ground level release produces about a 6 percent reduction in population dose and offsite
12 economic cost, while a conservatively large thermal content (buoyant plume) produces about a
13 4 to 5 percent increase in population dose and economic cost. DEK also reported that an
14 increase or decrease in initial plume size due to building wake size has no impact on population
15 dose and a small (1 percent) change in offsite cost. In response to an RAI concerning the
16 validity of release parameters for the dominant SGTR sequence, which has a release elevation
17 somewhat lower than that assumed, but with a buoyant plume, DEK stated that the base case
18 assumption of perpetual rain fall in the 40 to 50 mile segment surrounding the site introduces a
19 30 to 40 percent conservatism that more than offsets any increase from selection of alternative
20 release parameters (DEK, 2009a). Based on the information provided, the NRC staff concludes
21 that the release parameters utilized are acceptable for the purposes of the SAMA evaluation.

22 DEK used site-specific meteorological data for the 2002 calendar year as input to the MACCS2
23 code. The development of the meteorological data is discussed in Section F.3.5 of the ER and
24 in response to an RAI (DEK, 2009a). The wind and atmospheric stability data were collected
25 from the onsite meteorological tower. Precipitation data was from Sturgeon Bay, Wisconsin,
26 approximately 40 miles north of KPS, which is the closest weather station collecting hourly
27 precipitation data. Seasonal morning and afternoon mixing heights were determined for each
28 year from National Weather Service (NWS) measurements at Green Bay, Wisconsin. Data from
29 2003 and 2004 were also considered, but the 2002 data was chosen because results of a
30 MACCS2 sensitivity case comparing the use of the data indicated that the 2002 data produced
31 more conservative results. In response to an RAI, DEK described the sources of data used to fill
32 in gaps due to missing and invalid data (DEK, 2009a). The principal source was onsite
33 measurements at other elevations, followed by data from the Point Beach site (approximately 4
34 miles to the South), followed by nearest NWS locations. The NRC staff notes that previous
35 SAMA analysis results have shown little sensitivity to year-to-year differences in meteorological
36 data and concludes that the approach taken for collecting and applying the meteorological data
37 in the SAMA analysis is reasonable.

38 The population distribution the licensee used as input to the MACCS2 analysis was estimated
39 for the year 2033. This estimate was based on the U.S. Census Bureau population data for
40 2000, as provided by the SECPOP 2000 program (NRC, 2003), transient population estimates
41 used in the updated evacuation time estimate study for KPS (TOMCOD, 2005), and county-by-
42 county growth rate estimates for the years 2000 to 2030 (State of Wisconsin, 2003). As
43 described by DEK in response to an RAI, both geometric and exponential annual county growth
44 rates were calculated for the 2030-2033 population growth (DEK, 2009a). The exponential rates
45 were found to result in a larger 2033 population and were applied to the populations in each of

1 the 160 population zones (10 distance rings and 16 directions). Individual county rates were
2 applied to the fraction of area in each zone in each county. Transient population was
3 extrapolated in the same manner. The NRC staff considers the methods and assumptions for
4 estimating population reasonable and acceptable for purposes of the SAMA evaluation.

5 The emergency evacuation model was modeled as a single evacuation zone extending out 10
6 miles (16 km) from the plant. It was assumed that 95 percent of the population would evacuate.
7 This assumption is conservative relative to the NUREG-1150 study (NRC, 1990), which
8 assumed evacuation of 99.5 percent of the population within the emergency planning zone. The
9 evacuation time used in the SAMA analysis was based on a projection for the year 2033. The
10 evacuees were assumed to begin evacuating 80 minutes after a General Emergency has been
11 declared and to evacuate at an average radial speed of approximately 2.6 miles per hour (1.16
12 meters per second). The evacuation speed is based on that for adverse weather conditions from
13 the 2000 evacuation study extrapolated to 2033 by the ratio of the year 2000 population to the
14 year 2033 population within the emergency planning zone (TOMCOD, 2005). The ER reports
15 the results of several sensitivity analyses in which the evacuation modeling assumptions were
16 varied. These analyses show that variations in the modeling assumptions had little or no impact
17 on the results. Reducing the evacuation speed to half the base value, increasing it to the year
18 2000 value or decreasing the evacuation effectiveness to 50 percent had less than a 0.5
19 percent impact on population dose or offsite costs. Changing the time of declaration of a general
20 emergency to the time when the core gets uncovered had no measurable impact on population
21 dose and reduced offsite costs by 1 percent. The NRC staff concludes that the evacuation
22 assumptions and analysis are reasonable and acceptable for the purposes of the SAMA
23 evaluation.

24 Much of the site-specific economic data was provided from SECPOP2000 (NRC, 2003) by
25 specifying the data for each of the counties surrounding the plant to a distance of 50 miles (80
26 km). This included the fraction of land devoted to farming, annual farm sales, the fraction of farm
27 sales resulting from dairy production, and the value of non-farm land. SECPOP2000 utilizes
28 economic data from the 1997 Census of Agriculture (USDA, 1998). Area-wide farm wealth was
29 determined from 2002 National Census of Agriculture (USDA, 2002) county statistics for
30 farmland, buildings and machinery, with only the fraction of each county within 50 miles of KPS
31 considered. Non-farm wealth was similarly calculated from 2003 Wisconsin tax assessments but
32 was found to be less than that from SECPOP2000, so the latter value was used.

33 In addition, generic economic data that applies to the region as a whole was obtained from the
34 MACCS2 sample problem input. This included parameters describing the cost of evacuating
35 and relocating people, land decontamination, and property condemnation. An escalation factor
36 of 1.85 was applied to these parameters to account for cost escalation from 1986 (the year the
37 input was first specified) to 2007.

38 As described in the ER, the three recently discovered problems in SECPOP2000 have all been
39 accounted for in preparing the input for KPS. These problems involved: (1) an inconsistency in
40 the format in which several economic parameters were output from the SECPOP2000 code and
41 input to the MACCS2 code, (2) an error that resulted in use of agricultural/economic data for the
42 wrong counties in the SECPOP2000 calculations, and (3) an error that resulted in the economic
43 data for some counties being handled incorrectly.

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1 The NRC staff concludes that the methodology used by DEK to estimate the offsite
2 consequences for KPS provides an acceptable basis from which to proceed with an assessment
3 of risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its
4 assessment of offsite risk on the CDF and offsite doses reported by DEK.

5 **F.3. Potential Plant Improvements**

6 This section discussed the process for identifying potential plant improvements, an evaluation of
7 that process, and the improvements evaluated in detail by DEK.

8 **F.3.1. Process for Identifying Potential Plant Improvements**

9 DEK's process for identifying potential plant improvements (SAMAs) consisted of the following
10 elements:

- 11 • Review of the most significant basic events from the plant-specific PRA,
- 12 • Review of potential plant improvements identified in the KPS IPE and IPEEE,
- 13 • Review of Phase 2 SAMAs from recent license renewal applications for six other U.S.
14 nuclear sites, and
- 15 • Review of generic SAMAs as documented in NEI 05-01 (NEI, 2005).

16 Additionally, in response to RAIs, DEK's process for identifying potential plant improvements
17 was expanded to include:

- 18 • Review of dominant fire and seismic risk contributors from the IPEEE analysis for
19 improvements that could potentially reduce the associated fire risk, and
- 20 • Review of the results of importance analysis of the K107Aa PRA (completed after the
21 original SAMA assessment) for any additional potential improvements.

22 Based on this process, an initial set of 189 SAMA candidates, referred to as Phase 1 SAMAs,
23 was identified (ER Table F-17). In Phase 1 of the evaluation, DEK performed a qualitative
24 screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the
25 following criteria:

- 26 • The SAMA is not applicable at KPS due to design differences (21 screened out),
- 27 • The SAMA has been effectively implemented at KPS (45 screened out),
- 28 • The SAMA has estimated costs that would exceed the dollar value associated with
29 completely eliminating all severe accident risk at KPS (28 screened out), or
- 30 • The SAMA would be of very low benefit because it is associated with a non-risk-
31 significant system, and a change would have negligible impact on the risk profile (31
32 screened out).

33 Based on this screening, a total of 125 SAMAs were eliminated leaving 64 SAMAs for further
34 evaluation. The remaining SAMAs, referred to as Phase 2 SAMAs, are listed in Table F-19 of
35 the ER. Several of the SAMAs retained for further evaluation were considered to be similar in

1 terms of their benefits. As noted in Table F-17 of the ER, these SAMAs were combined and
2 analyzed together in the Phase 2 evaluations.

3 In Phase 2, a detailed evaluation was performed for the remaining SAMA candidates (46
4 evaluations after combining similar SAMAs), as discussed in Sections F.4 and F.6 below. To
5 account for the potential impact of external events, the estimated benefits based on internal
6 events were multiplied by a factor of 2, as previously discussed.

7 The review of the dominant fire and seismic contributors to risk did not identify any additional
8 SAMAs. The review of the K107Aa PRA importance analysis identified one additional SAMA,
9 involving implementation of temporary greenhouse ventilation. These reviews are discussed
10 further in Section F.3.2

11 **F.3.2. Review of Dominion Energy Kewaunee, Inc.'s Process**

12 DEK's efforts to identify potential SAMAs focused primarily on areas associated with internal
13 initiating events, but also included explicit consideration of potential SAMAs for fire and seismic
14 events. The initial list of SAMAs generally addressed the accident sequences considered to be
15 important to CDF from functional, initiating event, and risk reduction worth perspectives at KPS,
16 and included selected SAMAs from prior SAMA analyses for other plants.

17 DEK provided a tabular listing of the PRA basic events sorted according to their Fussell-Vesely
18 (F-V) importance with respect to CDF (DEK, 2008a). SAMAs impacting these basic events
19 would have the greatest potential for reducing risk. DEK used an F-V cutoff of 0.005, which
20 corresponds to about a 0.5 percent change in CDF given 100 percent reliability of the SAMA.
21 This equates to a benefit of approximately \$25,000. All 149 basic events in the listing were
22 reviewed to identify potential SAMAs. Based on this review, 16 SAMAs were identified and
23 included in the Phase 1 list of Table F-17. The remaining basic events were found to be events
24 that had no physical meaning (such as complement events or constants), were covered by
25 generic SAMAs already listed, or were due to conservative assumptions and could be
26 eliminated by more detailed modeling. DEK also provided and reviewed the LERF-related F-V
27 events down to an F-V value of 0.005. DEK correlated these basic events with the SAMAs
28 already identified and did not find any additional SAMAs.

29 In addition to basic event importance review, DEK reviewed the top 200 core damage cutsets to
30 identify any basic events not included in the importance analysis that might suggest additional
31 SAMAs. The resulting list contained 47 basic events (excluding events that had no physical
32 meaning) and is provided in Table F-18 of the ER. Two additional SAMAs were identified in this
33 review.

34 DEK considered the potential plant improvements described in the IPE and IPEEE in the
35 identification of plant-specific candidate SAMAs for internal and external events, as summarized
36 below.

37 The KPS IPE (WPSC, 1992) identified nine severe accident vulnerabilities and/or improvements
38 associated with core damage. Six of these have either been implemented or assessed as not
39 appropriate due to downside risk considerations (WPSC, 1994b). The Phase 1 SAMA list
40 includes the remaining improvements identified in the IPE. No vulnerabilities or improvements

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1 associated with poor containment performance were identified in the IPE nor are there any
2 identified in the IPEEE. While the IPEEE did not identify any vulnerabilities, as discussed above,
3 a number of equipment outliers were identified during the walkdowns, all of which have been
4 resolved.

5 The NRC staff questioned DEK about the disposition of a number of the basic events listed in
6 the importance analyses, including consequential loss of offsite power and requested
7 consideration of alternative SAMAs (NRC, 2009a). In response, DEK discussed why the
8 consequential loss of offsite power event is important at KPS and the impact that potentially
9 cost-beneficial SAMAs would have on this importance. Conservatism in the modeling of the
10 impact of this event were also discussed. Based on this information, the NRC staff concludes
11 that no additional SAMAs would be effective in reducing the risk related to this event. DEK also
12 discussed the benefit of additional refueling water storage tank (RWST) low-level alarms or an
13 automatic RWST refilling system. DEK pointed out that the benefit of multiple low-level alarms is
14 already included in the model and additional alarms would have a negligible impact on risk. A
15 cost-benefit analysis for an automatic refill system, performed in a manner similar to the
16 evaluation of other SAMAs, was provided, which showed that such a system would not be cost-
17 beneficial.

18 The NRC staff requested clarification and further information regarding the screening of a
19 number of the Phase 1 SAMAs (NRC, 2009a). In response, DEK: provided additional
20 information regarding those SAMA that were screened out because they had already been
21 implemented, cited additional data indicating that trip circuitry failure is not important to diesel
22 generator failures, and clarified why additional transfer and isolation switches would not have
23 any benefit. DEK clarified that while the central cooling water (CCW) system can be cross tied,
24 there is presently no provision to cross tie the fire water system to the CCW system. A cost-
25 benefit analysis for adding a cross tie was provided that showed that such a modification would
26 not be cost-beneficial.

27 The NRC staff noted that KPS does not presently have a diesel-driven fire pump. In response to
28 an RAI, DEK discussed the current fire pump design and the potential benefits and cost
29 implications of adding a diesel-driven fire pump. While there is some opportunity for risk
30 reduction by adding a diesel-driven pump, the benefits were qualitatively assessed by DEK to
31 be small; whereas, the cost of a new pump, probably requiring a new building, was assessed as
32 being more than any potential benefits. The NRC staff considers this conclusion reasonable
33 given the available information on fire risk.

34 DEK also clarified that while SAMA 151, "Increase training and operating experience feedback
35 to improve operator response," is stated to need further evaluation in ER Table F-17, it was not
36 specifically evaluated since individual operator actions identified in the importance analysis
37 review (ER Table F-3) and the cutset review (ER Table F-18) were evaluated separately.

38 As indicated above, a number of Phase 1 SAMAs were combined for the Phase 2 evaluation. In
39 response to an RAI concerning combining SAMAs 170 and 171 (involving safeguards alley
40 cooling) with SAMAs 81, 82 and others (involving diesel building and switchgear room cooling),
41 DEK provided a description of the various rooms and areas referred to as the "safeguards alley"
42 (DEK, 2009a). The safeguards alley consists of a series of interconnected rooms housing both
43 motor drive auxiliary feedwater pumps, the turbine driven auxiliary feedwater pump, both

1 divisions of 480 VAC switchgear, and both divisions of diesel generator/4160 VAC buses. DEK
2 stated that because of the proximity and interconnections between these rooms, the benefits of
3 providing high-temperature alarms and temporary ventilation can most effectively be evaluated
4 by considering all rooms of the safeguards alley together.

5 As requested in an RAI, DEK reviewed the results of importance analyses of the K107Aa
6 completed after the original SAMA analysis to determine if any additional SAMAs would have
7 been identified based on a review of the updated PRA. One of the modifications made in the
8 PRA model involved adding screenhouse ventilation as a support system for the service water
9 system. The K107Aa-based importance analysis showed that failures in screenhouse ventilation
10 were important. In response, DEK indicated that a SAMA involving implementing temporary
11 screenhouse ventilation and installing additional temperature detectors will be considered
12 further (DEK, 2009a).

13 The NRC staff questioned DEK about lower cost alternatives to some of the SAMAs evaluated
14 (NRC 2009a, 2009b), including:

- 15 • Automating the cross-tie of the existing condensate storage tank (CST) to other water
16 sources rather than installing a new CST,
- 17 • Modifying procedures to direct primary system cooldown to further reduce the
18 probability of RCP seal failures,
- 19 • Modifying procedures and equipment for using a portable diesel-driven or AC-powered
20 pump to provide feedwater to the steam generators with suction from the intake canal,
- 21 • Developing a procedure to cross-connect the chemical and volume control system
22 (CVCS) holdup tanks to the volume control tank (VCT) through the CVCS holdup
23 transfer pump, and
- 24 • Procuring and developing a procedure for using a gagging device to close a stuck-
25 open steam generator safety valve on a faulted steam generator before core damage
26 occurs.

27 In response to the RAIs, DEK addressed the lower cost alternatives and gave specific reasons
28 why they would not impact the results of the SAMA evaluation, including the fact that some of
29 these items are covered by an existing procedure or are addressed by other SAMAs (DEK
30 2009a, 2009b, 2009c). This is discussed further in Section F.6.2.

31 Based on this information, the NRC staff concludes that the set of SAMAs evaluated in the ER,
32 together with those identified in response to NRC staff RAIs, addresses the major contributors
33 to internal event CDF.

34 Although the KPS IPEEE did not identify any vulnerabilities for external events, at the request of
35 the NRC staff, DEK reviewed the results of the IPEEE fire and seismic risk analysis to
36 determine if any KPS-specific external event SAMAs could be identified. This review is
37 summarized below.

38 The top cutsets resulting from the IPEEE fire PRA were reviewed to identify potential SAMAs
39 that might reduce the KPS fire risk. The fire risk cutsets include failures due to fire itself

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1 combined with non-fire related failures. DEK reviewed the non-fire related failures and
2 determined that those in the dominant fire contributors were already addressed by multiple
3 SAMAs identified in the internal events review (DEK, 2009a). To address the fire-induced
4 failures, DEK estimated the total benefit that might result from entirely eliminating the fire risk
5 from each fire risk contributor. This was done for the 7 percent discount rate base case as well
6 as the 3 percent discount rate and the 95 percentile uncertainty sensitivity study cases. Six fire
7 risk contributors were found to have a benefit that exceeded the \$100,000 value used to
8 estimate the minimum cost of a modification. DEK reviewed the fire induced failures for each of
9 these six fire risk contributors and concluded that no cost-beneficial improvements in fire
10 detection or mitigation were reasonably available (DEK, 2009b). At the request of the NRC staff,
11 DEK also considered the impact on identification of SAMAs of several weaknesses in the fire
12 PRA identified in the NRC review of the IPEEE submittal (NRC, 1999). Based on consideration
13 of each weakness, DEK concluded that no new SAMAs would be identified as a result of
14 correcting these weaknesses (DEK, 2009a). The NRC staff concludes that the opportunity for
15 fire-related SAMAs has been adequately explored and that it is unlikely that there are additional
16 potentially cost-beneficial, fire-related SAMA candidates.

17 Based on the IPEEE seismic analysis, six sequences dominate the seismic risk at KPS. Three
18 of these sequences involve major structural failures. DEK estimated that the cost of
19 strengthening structures would exceed any potential benefit associated with reducing seismic
20 risk. One dominant sequence involved failure of the operator to switch AFW pump suction from
21 the CST to the service water system. A sensitivity study performed for the IPEEE showed that
22 reducing the operator error resulted in only a 2 percent reduction in seismic CDF. DEK also
23 noted that internal event SAMA items address improvements to long-term AFW availability,
24 hence no new SAMAs are indicated for this sequence. The two other dominant sequences have
25 a CDF of 1×10^{-6} per year or less and involve the emergency AC and DC power systems. All
26 components in the AC power system have median seismic capacities of 1.86g PGA or more
27 while the components of the DC power system have median seismic capacities of 1.10g PGA or
28 more. Considering these relatively high seismic capacities, the low frequency of the seismic
29 sequences that would challenge these systems, and the expected cost of strengthening the
30 components, DEK identified no new SAMA items for these sequences (DEK, 2009a). At the
31 request of the NRC staff, DEK also considered the impact on identification of SAMAs of the
32 weaknesses in the seismic PRA identified in the NRC review of the IPEEE submittal (NRC,
33 1999). Based on a discussion of each weakness, DEK concluded that no new SAMAs would be
34 identified as a result of correcting these weaknesses (DEK, 2009a).

35 The NRC staff notes that the set of SAMAs submitted is not all inclusive, since additional,
36 possibly even less expensive, design alternatives can always be postulated. However, the NRC
37 staff concludes that the benefits of any additional modifications are unlikely to exceed the
38 benefits of the modifications evaluated and that the alternative improvements would not likely
39 cost less than the least expensive alternatives evaluated, when the subsidiary costs associated
40 with maintenance, procedures, and training are considered.

41 The NRC staff concludes that DEK used a systematic and comprehensive process for
42 identifying potential plant improvements for KPS, and that the set of SAMAs evaluated in the
43 ER, together with those evaluated in response to NRC staff inquiries, is reasonably
44 comprehensive and therefore acceptable. This search included reviewing insights from the
45 plant-specific risk studies and reviewing plant improvements considered in previous SAMA

1 analyses. While explicit treatment of external events in the SAMA identification process was
2 limited, it is recognized that the absence of external event vulnerabilities reasonably justifies
3 examining primarily the internal events risk results for this purpose.

4 **F.4. Risk Reduction Potential of Plant Improvements**

5 DEK evaluated the risk-reduction potential of the 64 remaining SAMAs that were applicable to
6 KPS (46 SAMA evaluations after combining similar SAMAs). The SAMA evaluations were
7 performed using generally conservative assumptions. On balance, such calculations
8 overestimate the benefit and are conservative.

9 For most of the SAMAs, DEK used model re-quantification to determine the potential benefits.
10 The CDF, population dose and offsite economic cost reductions were estimated using the 2007
11 version of the KPS PRA model (K101AASAMA). The changes made to the model to quantify the
12 impact of the SAMAs are detailed in Section F.6 of Attachment F to the ER. Table F.5-1 lists the
13 assumptions considered to estimate the risk reduction for each of the evaluated SAMAs, the
14 estimated risk reduction in terms of percent reduction in CDF and population dose, and the
15 estimated total benefit (present value) of the averted risk. The estimated benefits reported in
16 Table F.5-1 reflect the combined benefit in both internal and external events. The determination
17 of the benefits for the various SAMAs is further discussed in Section F.6.

18 The NRC staff questioned the assumptions used in evaluating the benefits or risk reduction
19 estimates of certain SAMAs provided in the ER (NRC, 2009a). For example, in the ER DEK
20 reported a negative benefit for SAMA 19, provide backup cooling to emergency diesel
21 generators. In response to an RAI, DEK indicated the evaluation of SAMA 19 resulted in an
22 increase in risk because of certain assumptions relative to operator response to the sequence
23 after the modification was made. DEK provided an alternative assessment, incorporating
24 procedure changes as well as hardware changes, which indicated a positive benefit. For SAMA
25 150, improved maintenance procedures, the NRC staff questioned the applicability of the benefit
26 determined by setting the maintenance unavailability to zero. In response, DEK stated that
27 because no specific procedure improvement was identified by this generic SAMA, the
28 maintenance unavailability for all of the Maintenance Rule (a)(1) equipment was used as a
29 surrogate. DEK stated that this bounds the impact of improving the reliability of individual
30 equipment items. Further, compliance with the Maintenance Rule will require reliability
31 improvement actions be taken for any items failing to meet Maintenance Rule goals. DEK
32 therefore concluded that no action for this SAMA is cost beneficial (DEK, 2009a).

33 The NRC staff has reviewed DEK's bases for calculating the risk reduction for the various plant
34 improvements and concludes that the rationale and assumptions for estimating risk reduction
35 are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what
36 would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for
37 the various SAMAs on DEK's risk reduction estimates.

38 **F.5. Cost Impacts of Candidate Plant Improvements**

39 DEK estimated the costs of implementing the candidate SAMAs through the application of
40 engineering judgment, the use of other licensees' estimates for similar improvements and the
41 use of KPS actual experience for similar improvements. The cost estimates conservatively did

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1 not include the cost of replacement power during extended outages required to implement the
2 modifications, nor did they include contingency costs associated with unforeseen
3 implementation obstacles (DEK, 2008a).

4 For a simple procedure change, DEK assumed a minimum cost of \$50K for preparation, review,
5 approval, training, and implementation. Complex procedure changes or changes involving
6 emergency operating procedures were assumed to cost more. For a simple design change,
7 DEK assumed a minimum cost of \$100K for completing and assembling the design change
8 package, performing limited calculations, and minor drawing revisions. Complex design
9 changes were assumed to cost considerably more (DEK, 2008a). The cost estimates for each
10 SAMA are detailed in Section F.6 of the ER.

11 For a number of SAMAs (SAMAs 19, 26, 55, 56, 58, 59, 71, 81, 111, 112, 124, 125, 150, 178,
12 179, 180, and 182) the estimated benefit for the 3 percent discount rate case and/or the 95th
13 percentile uncertainty case was found to exceed the initial implementation cost estimate. The
14 implementation costs for these SAMAs were further assessed to more realistically account for
15 additional cost considerations. This is described in ER Sections F.7.1 and F.7.5, and in
16 responses to NRC staff RAIs (DEK 2009a, 2009b).

17 The NRC staff reviewed the bases for the licensee's cost estimates (presented in Section F.6 of
18 Attachment F to the ER). For certain improvements, the NRC staff also compared the cost
19 estimates to estimates developed elsewhere for similar improvements, including estimates
20 developed as part of other licensees' analyses of SAMAs for operating reactors and advanced
21 light-water reactors. The NRC staff reviewed the costs and found them to be reasonable and
22 generally consistent with estimates provided in support of other plants' analyses.

23 The NRC staff concludes that the cost estimates provided by DEK are sufficient and appropriate
24 for use in the SAMA evaluation.

25

Table F.5-1. Severe Accident Mitigation Alternative Cost/Benefit Screening Analysis for Kewaunee Power Station^(a)

Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 1 Improved Availability and Reliability of DC Power	1, 3, 5, 6, 74	AC power to safety related battery chargers completely available.	<0.1	<0.1	1.0K	1.9K	50K
SAMA 19 Provide Backup Cooling to emergency diesel generators (EDGs)	19, 20	No service water required for EDGs.	See Note (c)	See Note (c)	(-)23K	(-)41K	50K
		0.1 probability of EDG cooling failure	1.9	1.9	81K	150K	100K(e)
SAMA 21 Develop Procedures to Repair 4kVAC Breakers	21	Failure probability of breakers supplying safety related buses 5 and 6 set to zero.	0.2	0.9	8.6K	16K	50K
SAMA 26 Provide Additional Diesel-Powered Safety Injection Pump	26	Reactor coolant pump (RCP) seals and safety injection pumps would not fail.	41	27	1.7M	3.0M	2M (e)
SAMA 31 Provide for Manual Alignment to emergency core cooling system (ECCS) Recirculation	31	Electric power is not required for the valves needed to switch to ECCS recirculation.	<0.1	0	360	650	50K

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Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 32 Provide Automatic Alignment to ECCS Recirculation	32	HEPs associated with ECCS recirculation set to zero.	1.6	0.3	51K	92K	100K
SAMA 46 Add a Service Water Pump	46	Failure probability of service water pumps set to zero.	18	15	820K	1.5M	2.7M
SAMA 50 Enhance Loss of Cooling Water Procedures	50, 162, 163	Failure probability of the basic event that represents failure of operator action to initiate reactor coolant system (RCS) cool down in response to a loss of seal cooling set to 1.0E-04.	0.37	0.3	15K	28K	50K
SAMA 55 Install Independent RCP Seal Injection System With Dedicated Diesel	55	Failure probability of charging to RCP seals set to zero.	33	19	1.3M	2.3M	2M (e)
SAMA 56 Install Independent RCP Seal Injection System Without Dedicated Diesel	56	Failure probability of charging to RCP seals for all accident scenarios except station blackout set to zero.	29	14	1.0M	1.8M	1.5M (e)
SAMA 58 Install Improved RCP Seals	58	Failure probability of charging to RCP seals set to zero.	33	19	1.3M	2.3M	1.4M (e)

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Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Populati on Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 59 Install an Additional CCW Pump	59	Failure probability of CCW pumps set to zero.	25	14	980K	1.8M	1.4M (e)
SAMA 66 Install a New Feedwater Source [Proceduralize use of existing sources] ^(d)	66	Failure probability for the hardware associated with water sources to the feedwater systems set to zero.	6.7	8.5	380K	690K	50K
SAMA 71 Install A New Condensate Storage Tank	71	Failure probability of events associated with providing a cross-tie of the CSTs to other sources set to zero.	19	18	1.0M	1.8M	1.7M (e)
SAMA 76 Change Failure Position of Condenser Makeup Valve	76, 184	Remove any power dependencies from valve MU-3A.	<0.1	<0.1	4.4K	7.9K	100K
SAMA 80 Add Redundant Ventilation Systems [Stage temporary equipment and provide procedures and power source connections] ^(d)	80	Remove any ventilation system dependencies for equipment located in the auxiliary building from the fault tree models.	12	6.0	510K	910K	250K
SAMA 81 Diesel Room Cooling Improvements ^(f)	81, 160, 166, 167, 170, 171	Diesel room ventilation was always successful.	4.6	5.1	240K	430K	400K (e)

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Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 82 Switchgear Room Ventilation Response [Stage backup fans in switchgear rooms, add switchgear room high temperature alarm, stage temporary fans and ducts along with power cords for safeguards alley room cooling, provide high temperature alarms for safeguards alley] ^(d)	82, 83, 170, 171	Add an operator action to implement actions for temporary ventilation following any loss of switchgear room ventilation.	8.8	9.4	440K	800K	400K
SAMA 86 Proceduralize Backup Power to Air Compressors	86	Power to air compressors F and G does not fail.	0.2	0.2	11K	19K	50K
SAMA 87 Replace Air Compressors With Self-Cooled Units	87	Remove the service water and plant equipment water dependency of air compressors from the system fault trees.	0.7	0.4	26K	46K	100K
SAMA 111 Improve Prevention and Detection of interfacing systems loss-of-coolant accident (ISLOCA)	111, 113	ISLOCA frequency set to zero.	1.1	3.8	130K	240K	190K (e)

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Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 112 Enhance Containment Isolation Valve Indication	112	ISLOCA frequency set to zero and containment isolation set to success.	1.1	3.4	130K	240K	150K (e)
SAMA 114 Install Self-Actuating Containment Isolation Valves	114	Containment isolation set to success in the Level 2 PRA models.	0	<0.1	1.3K	2.3K	100K
SAMA 118 Improve Training on ISLOCA	118	Failure probability of all human action events associated with ISLOCAs set to 1.0E-04.	<0.1	0.1	4.7K	8.6K	50K
SAMA 122 Improve RCS Depressurization Capability	122	Hardware associated with primary depressurization does not fail.	0.1	<0.1	4.7K	8.4K	100K
SAMA 124 Improve Detection of SGTR	124	Probability of operator failure to detect and diagnose a SGTR is 1.0E-04.	0.1	4.2	130K	240K	150K (e)
SAMA 125 Prevent Release of SGTR From Steam Generators	125, 129	Level 2 PRA model changed so that SGTR events do not lead to containment bypass.	<0.1	64	1.8M	3.2M	2.7M (e)
SAMA 126 Install Closed-Loop Steam Generator Cooling System	126	Hardware associated with cool down and depressurization would not fail following a SGTR.	3.6	2.8	170K	300K	2.7M

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Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 131 Install Additional Primary System Relief Capacity to Mitigate ATWS	131	Initiating event equation for ATWS events set to zero.	3.3	3.5	170K	310K	700K
SAMA 150 Improve Maintenance Procedures	150	Maintenance unavailability for Maintenance Rule (a)(1) equipment set to zero.	1.4	0.6	56K	100K	100K (e)
SAMA 168 Add Capability to Isolate Service Water Without Power	168	Eliminate from the fault tree models the requirement for power to close service water valves SW-10A and SW-10B.	1.2	<0.1	33K	59K	100K
SAMA 169 Provide Flood Protection for MCC-52E, -62E, and -62H	169	Eliminate flood-induced failure of the three MCCs from the fault tree models.	12	4.3	420K	750K	284K
SAMA 172 Provide Additional Alarm for Extremely Low CST Level	172	Failure probability for the associated basic event set to 1.0E-04.	14	13	750K	1.4M	250K
SAMA 173 Protect Auxiliary Building Mezzanine Cooling Units From Spray	173	Remove flood-induced failures of the auxiliary building mezzanine cooling units from the fault tree models.	3.6	2.9	170K	310K	150K
SAMA 174 Protect Boric Acid Transfer Pumps From Spray	174	Remove flood-induced failures of the boric acid transfer pumps from the fault tree models.	3.3	2.5	160K	280K	150K

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Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 175 Protect A-Train CCW Pump From Spray	175	Remove flood-induced failures of the A-train CCW pump from the fault tree models.	4.0	2.9	185K	330K	150K
SAMA 176 Install Larger Sump Pumps In Safeguards Alley	176	Eliminate submergence-induced failures of equipment from the fault tree models.	8.7	6.7	360K	660K	269K
SAMA 177 Install Watertight Barrier Between 480 VAC Switchgear Rooms	177	Remove flood propagation-induced failures of equipment in safeguards alley from the fault tree models for events that initiate on the opposite side of the wall.	9.7	8.7	440K	790K	162K
SAMA 178 Install Flood Detection In Battery Rooms	178	Probability of the basic event that represents operator failure to isolate battery room floods set to zero.	2.0	2.5	110K	200K	150K (e)
SAMA 179 Add Diverse AFW Flow Indication	179	Probability of the AFW flow miscalibration errors set to zero.	3.2	2.6	160K	280K	200K (e)
SAMA 180 Remove AFW Low Lube Oil Pressure Start Interlock	180	Remove the auxiliary lube oil pump failure logic from the fault tree models.	2.5	2.7	130K	240K	150K (e)
SAMA 181 Install Break Away Mechanisms on EDG Room Doors	181	Remove flood-induced failures from the main, reserve, and tertiary auxiliary transformers.	2.7	4.6	180K	330K	100K

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Case ID - Title	Potential SAMAs evaluated by case	Modeling Assumptions	% Risk Reduction ^(b)		Total Benefit (\$)		Cost (\$)
			CDF	Population Dose	Baseline (Internal + External)	Baseline With Uncertainty	
SAMA 182 Install Flood Relief Path In Screenhouse	182	Remove flood propagation-induced equipment failures from accident sequences that begin with a screenhouse flood.	1.4	1.5	72K	130K	100K (e)
SAMA 183 Install Flood Detection in Control Room heating, ventilation, and air conditioning (HVAC) Room	183	Remove flood propagation-induced equipment failures from accident sequences that begin with a control room HVAC room flood.	<0.1	0.4	17K	30K	100K
SAMA 188 Install Larger Capacity Sump Pumps In Turbine Building	188	HEP associated with isolating turbine building floods and assuming that small flooding events in safeguards alley cannot propagate set to 1.0E-04.	2.8	2.2	120K	210K	269K
SAMA 189 Install Diverse SI Flow Indication	189	Eliminate miscalibration errors from the SI fault tree.	0.4	0.5	23K	45K	100K

^(a)SAMAs in bold are potentially cost-beneficial.

^(b)Percent risk reduction determined from base case and uncertainty values provided in ER Sections F.6 and F.7.5.

^(c)CDF and Population Dose increased for this SAMA due to modeling assumptions. Results of an alternate evaluation provided below based on DEK RAI response (DEK, 2009a).

^(d)Description in brackets is more appropriate for understanding the SAMA evaluation.

^(e)Costs and/or benefits of these SAMAs were further assessed. Based on further assessment, implementation costs were determined to be higher than the estimated benefits, even for the 95th percentile uncertainty case (ER Section F.7.5, DEK, 2008a, and responses to RAI 6a, 7.b and 7.c in DEK, 2009a and 2009b).

^(f)SAMA 81 found to be cost-beneficial if implemented simultaneously with other SAMAs (ER Section 7.7, DEK, 2008a).

1 F.6. Cost-Benefit Comparison

2 DEK's cost-benefit analysis and the NRC staff's review are described in the following sections.

1 **F.6.1. Dominion Energy Kewaunee, Inc.'s Evaluation**

2 The methodology used by DEK was based on NEI 05-01, *Severe Accident Mitigation*
 3 *Alternatives (SAMA) Analysis Guidance Document* (NEI, 2005), which in turn is based on NRC's
 4 guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184, *Regulatory Analysis*
 5 *Technical Evaluation Handbook* (NRC, 1997a). NEI 05-01 was endorsed by the NRC for use in
 6 license renewal applications (NRC, 2007). The guidance involves determining the net value for
 7 each SAMA according to the following formula:

8 Net Value = (APE + AOC + AOE + AOSC) - COE, where

9 APE = present value of averted public exposure (\$)

10 AOC = present value of averted offsite property damage costs (\$)

11 AOE = present value of averted occupational exposure costs (\$)

12 AOSC = present value of averted onsite costs (\$)

13 COE = cost of enhancement (\$)

14 If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the
 15 benefit associated with the SAMA, and it is not considered cost-beneficial. DEK's derivation of
 16 each of the associated costs is summarized below.

17 NUREG/BR-0058 has recently been revised to reflect the agency's policy on discount rates.
 18 Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed, one at 3
 19 percent and one at 7 percent (NRC, 2004). DEK provided a base set of results using the 7
 20 percent discount rate and a sensitivity study using the 3 percent discount rate (DEK, 2008a).

21 Averted Public Exposure (APE) Costs

22 The APE costs were calculated using the following formula:

23 APE = Annual reduction in public exposure (units of person-rem per year)

24 x monetary equivalent of unit dose (\$2000 per person-rem)

25 x present value conversion factor (10.76 based on a 20-year period with a 7-
 26 percent discount rate).

27 As stated in NUREG/BR-0184 (NRC, 1997a), the monetary value of the public health risk after
 28 discounting does not represent the expected reduction in public health risk caused by a single
 29 accident. Rather, it is the present value of a stream of potential losses extending over the
 30 remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected
 31 annual loss caused by a single accident, the possibility that such an accident could occur at any
 32 time over the renewal period and the effect of discounting these potential future losses to
 33 present value. For the purposes of initial screening, which assumes elimination of all severe
 34 accidents caused by internal events, DEK calculated an APE of approximately \$650,000 for the
 35 20-year license renewal period.

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1 Averted Offsite Property Damage Costs (AOC)

2 The AOCs were calculated using the following formula:

- 3 AOC = Annual CDF reduction
4 x offsite economic costs associated with a severe accident (on a per event basis)
5 x present value conversion factor

6 This term represents the sum of the frequency-weighted offsite economic costs for each release
7 category, as obtained for the Level 3 risk analysis. For the purposes of initial screening, which
8 assumes elimination of all severe accidents caused by internal events, DEK calculated an
9 annual offsite economic cost of about \$49,700 based on the Level 3 risk analysis. This results in
10 a discounted value of approximately \$535,000 for the 20-year license renewal period.

11 Averted Occupational Exposure (AOE) Costs

12 The AOE costs were calculated using the following formula:

- 13 AOE = Annual CDF reduction
14 x occupational exposure per core damage event
15 x monetary equivalent of unit dose
16 x present value conversion factor

17 DEK derived the values for AOE from information provided in Section 5.7.3 of the regulatory
18 analysis handbook (NRC, 1997a). Best estimate values provided for immediate occupational
19 dose (3,300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year
20 cleanup period) were used. The present value of these doses was calculated using the
21 equations provided in the handbook, in conjunction with a monetary equivalent of unit dose of
22 \$2,000 per person-rem, a real discount rate of 7 percent, and a time period of 20 years to
23 represent the license renewal period. For the purposes of initial screening, which assumes
24 elimination of all severe accidents caused by internal events, DEK calculated an AOE of
25 approximately \$30,800 for the 20-year license renewal period.

26 Averted Onsite Costs

27 Averted onsite costs (AOSC) include averted cleanup and decontamination costs and averted
28 power replacement costs. Repair and refurbishment costs are considered for recoverable
29 accidents only and not for severe accidents. DEK derived the values for AOSC based on
30 information provided in Section 5.7.6 of NUREG/BR-0184, the regulatory analysis handbook
31 (NRC, 1997a).

32 DEK divided this cost element into two parts—the onsite cleanup and decontamination cost,
33 also commonly referred to as averted cleanup and decontamination costs (ACC), and the
34 replacement power cost (RPC).

1 ACCs were calculated using the following formula:

2 ACC = Annual CDF reduction
 3 x present value of cleanup costs per core damage event
 4 x present value conversion factor

5 The total cost of cleanup and decontamination subsequent to the severe accident is estimated
 6 in NUREG/BR-0184 to be $\$1.5 \times 10^9$ (undiscounted). This value was converted to present costs
 7 over a 10-year cleanup period and integrated over the term of the proposed license extension.
 8 For the purposes of initial screening, which assumes elimination of all severe accidents caused
 9 by internal events, DEK calculated an ACC of approximately \$939,000 for the 20-year license
 10 renewal period.

11 Long-term RPCs were calculated using the following formula:

12 RPC = Annual CDF reduction
 13 x present value of replacement power for a single event
 14 x factor to account for remaining service years for which replacement power is
 15 required
 16 x reactor power scaling factor

17 DEK based its calculations on the rated KPS net electric output of 556 megawatt-electric (MWe)
 18 and scaled down from the 910 MWe reference plant in NUREG/BR-0184 (NRC, 1997a).
 19 Therefore, DEK applied a power scaling factor of 556/910 to determine the replacement power
 20 costs. For the purposes of initial screening, which assumes elimination of all severe accidents
 21 caused by internal events, DEK calculated an RPC of approximately \$390,000, and an AOSC of
 22 approximately \$1.3M for the 20-year license renewal period.

23 Using the above equations, DEK estimated the total present dollar value equivalent associated
 24 with completely eliminating severe accidents caused by internal events at KPS to be about
 25 \$2.54M. Use of a multiplier of two to account for external events increases the value to \$5.09M
 26 and represents the dollar value associated with completely eliminating all internal and external
 27 event severe accident risk at KPS, also referred to as the Modified Maximum Averted Cost Risk
 28 (MMACR).

29 DEK's Results

30 If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA
 31 was considered not to be cost-beneficial. In the baseline analysis contained in the ER, (using a
 32 7 percent discount rate), DEK identified 14 potentially cost-beneficial SAMAs. The potentially
 33 cost-beneficial SAMAs are:

- 34 • SAMA 66 – Install a New Feedwater Source (The evaluated SAMA actually involved
 35 proceduralizing use of existing water sources)

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- 1 • SAMA 80 – Add Redundant Ventilation Systems (The evaluated SAMA actually
2 involved staging temporary equipment and providing procedures and power source
3 connections)
- 4 • SAMA 82, 83, 170, 171 – Switchgear Room Ventilation Response (The evaluated
5 SAMA actually involved staging backup fans in switchgear rooms, adding switchgear
6 room high-temperature alarm, staging temporary fans and ducts along with power
7 cords for safeguards alley room cooling, and providing high-temperature alarms for the
8 safeguards alley)
- 9 • SAMA 169 – Provide Flood Protection for MCC-52E, -62E, and -62H
- 10 • SAMA 172 – Provide Additional Alarm for Extremely Low CST Level
- 11 • SAMA 173 – Protect Auxiliary Building Mezzanine Cooling Units from Spray
- 12 • SAMA 174 – Protect Boric Acid Transfer Pumps from Spray
- 13 • SAMA 175 – Protect A-Train CCW Pump from Spray
- 14 • SAMA 176 – Install Larger Sump Pumps In Safeguards Alley
- 15 • SAMA 177 – Install Watertight Barrier between 480 VAC Switchgear Rooms
- 16 • SAMA 181 – Install Break Away Mechanisms on EDG Room Doors

17 DEK performed additional analyses to evaluate the impact of parameter choices and
18 uncertainties on the results of the SAMA assessment (DEK, 2008a).

19 Based on an analysis using 3 percent, as recommended in NUREG/BR-0058 (NRC, 2004),
20 DEK determined that four of the Phase 1 SAMAs screened out due to excessive implementation
21 cost (SAMAs 2, 104, 116 and 119) and would have been retained for further analysis. Thirteen
22 of the Phase 2 SAMAs, which had a negative net value at a 7 percent discount rate (SAMAs 19,
23 26, 55, 56, 58, 59, 111, 112, 124, 178, 179, 180, and 182) would have a potentially positive net
24 value at a 3 percent discount rate. In Section F.7.1 of the ER (and in RAI 6.a responses for
25 SAMA 19), DEK discussed each of these SAMAs and concluded that in each case the cost of
26 implementation would be higher than that utilized in the original cost-benefit analyses and would
27 exceed the benefit using the 3 percent discount rate (DEK 2008a, 2009a, 2009b).

28 If the benefits are increased by a factor of 1.8 to account for uncertainties, four Phase 1 SAMAs
29 (the same four SAMAs mentioned above) would have been retained for further analysis, and 17
30 Phase 2 SAMAs (the 13 SAMAs mentioned above plus SAMAs 71, 81, 125, and 150) would
31 become potentially cost-beneficial. In Section F.7.5 of the ER (and in RAI responses for SAMAs
32 19 and 58), DEK discusses each of these items noting: costs that were not included in the base
33 case assessment, the optimistic nature of some of the estimates and, in some cases, the
34 conservative nature of the benefit calculation. Based on this, DEK concludes that no additional
35 SAMAs would be cost beneficial even at the 95 percentile risk values.

36 DEK also considered the impact of simultaneous implementation of several of the SAMAs from
37 both a benefit and a cost standpoint. DEK concluded that while the simultaneous
38 implementation of several SAMAs would not increase the total benefit beyond that for each
39 SAMA individually, the implementation cost could be reduced. Based on the evaluation of

1 similar SAMAs involving improvements in room cooling and ventilation, DEK concluded that the
2 following three additional SAMAs involving diesel room cooling improvements would be cost
3 beneficial:

- 4 • SAMA 81 – Add a diesel building high temperature alarm or redundant louver and
5 thermostat
- 6 • SAMA 166 – Open Doors for Alternate DG Room Cooling
- 7 • SAMA 167 – Proceduralize Actions to Open EDG Room Doors on Loss of HVAC and
8 Implement Portable Fans

9 As discussed above, DEK's review of the results of importance analysis of the K107Aa PRA,
10 prepared subsequent to the SAMA evaluation documented in the ER, indicated one new
11 contributor to risk that could be impacted by a candidate SAMA. DEK concluded that a new
12 SAMA addressing this contributor—loss of greenhouse ventilation—could be cost effectively
13 combined with similar SAMAs 81, 82, 83, 160, 166, 167, 170, and 171.

- 14 • Implementation of temporary greenhouse ventilation, including installing additional
15 temperature detectors

16 DEK committed to further review these SAMAs for implementation as part of DEK's ongoing
17 performance improvement program (DEK 2008a, 2009a).

18 The potentially cost-beneficial SAMAs and DEK's plans for further evaluation of these SAMAs
19 are discussed in more detail in Section F.6.2.

20 **F.6.2. Review of Dominion Energy Kewaunee, Inc.'s Cost-Benefit Evaluation**

21 The cost-benefit analysis performed by DEK was based primarily on NEI 05-01, *Severe*
22 *Accident Mitigation Alternatives (SAMA) Analysis Guidance Document* (NEI, 2006), which in
23 turn is based on NRC's guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184,
24 *Regulatory Analysis Technical Evaluation Handbook* (NRC, 1997a). NEI 05-01 was endorsed by
25 the NRC for use in license renewal applications (NRC, 2007). The NRC staff's review indicated
26 that the cost-benefit analysis was implemented in accordance with these guidance documents.

27 NUREG/BR-0058 has recently been revised to reflect the agency's policy on discount rates.
28 Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed, one at 3
29 percent and one at 7 percent (NRC, 2004). DEK provided a base set of results using the 7
30 percent discount rate and a sensitivity study using the 3 percent discount rate (DEK, 2008a).

31 SAMAs identified primarily on the basis of the internal events analysis could provide benefits in
32 certain external events, in addition to their benefits in internal events. To account for the
33 additional benefits in external events, DEK multiplied the internal event benefits by a factor of 2.
34 The NRC staff notes that the KPS external events CDF is approximately 60 percent of the
35 internal events CDF from the K101AASAMA PRA (based on a fire CDF of 3.6×10^{-5} per year, a
36 seismic CDF of 1×10^{-5} per year, a negligible HFO contribution, and an internal events CDF of
37 8.1×10^{-5} per year). Accordingly, the total CDF from internal and external events would be
38 approximately 1.6 times the internal events CDF from the K101AASAMA PRA. Thus, the use a

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1 multiplier of 2 is conservative. The NRC staff concludes that the factor of 2 multiplier for external
2 events is reasonable for purposes of the SAMA evaluation.

3 DEK considered the impact that possible increases in benefits from analysis uncertainties would
4 have on the results of the SAMA assessment. In the ER, DEK presents the results of an
5 uncertainty analysis of the internal events CDF for KPS, which indicates that the 95th percentile
6 value is a factor of 1.8 greater than the mean CDF for KPS. DEK assessed the impact on the
7 SAMA screening, if the estimated benefits were further increased by this uncertainty factor (in
8 addition to the multiplier of 2 for external events).

9 DEK performed additional sensitivity analyses, including use of a 3 percent discount rate, use of
10 a longer plant life and use of different evacuation assumptions, and considered the impact of
11 unresolved peer review findings and recent plant modifications on the results of the SAMA
12 analysis. These analyses did not identify additional potentially cost-beneficial SAMAs beyond
13 those already identified through the uncertainty analysis.

14 The NRC staff noted in an RAI that a number of important basic events involved failure of the
15 operator to refill the RWST and requested that DEK consider an automatic refilling system as a
16 potential SAMA (NRC, 2009a). In response, DEK provided a cost benefit analysis, based on a 7
17 percent discount rate, which showed that this modification would not be cost beneficial (DEK,
18 2009a). In a request for clarification of the RAI response (NRC, 2009b), the NRC staff pointed
19 out that based on DEK's analysis, the automatic refilling system would be cost-beneficial at a 3
20 percent discount rate or when considering uncertainties in CDF. In response to the request for
21 clarification, DEK agreed that using the original cost estimate of \$850,000 for an automatic
22 refilling system, the enhancement would be cost beneficial for these sensitivity cases. However,
23 they indicated that this cost estimate was a conservatively low screening estimate. DEK
24 provided an updated cost estimate of approximately \$1.5 million, based on a more refined
25 analysis similar to that for a CST refill system (discussed later). Since this is more than the
26 benefit using a 3 percent discount rate (\$972,000) or when accounting for uncertainty (\$1.1
27 million), DEK concluded that this enhancement would not be cost-beneficial (DEK, 2009b).

28 A similar situation was observed for SAMA 19. As noted previously, DEK's evaluation of SAMA
29 19, provide backup cooling to emergency diesel generators, resulted in an increase in CDF. In
30 response to an RAI, DEK provided a cost benefit analysis that indicated that the SAMA was not
31 cost beneficial. The analysis in this initial response was performed for a 7 percent discount rate.
32 In a request for clarification of the RAI response (NRC, 2009b), the NRC staff pointed out that
33 based on DEK's analysis, the SAMA would be cost-beneficial at a 3 percent discount rate or
34 when considering uncertainties in CDF. In response to the request for clarification, DEK agreed
35 that using the original cost estimate of \$100,000, this SAMA would be cost beneficial for these
36 sensitivity cases. However, they indicated that this cost estimate was a conservatively low
37 screening estimate. DEK provided an updated cost estimate of at least \$150,000, which
38 accounted for additional hardware costs associated with the modification. Since this is more
39 than the benefit using a 3 percent discount rate (\$125,000) or when accounting for uncertainty
40 (\$146,000), DEK concluded that this enhancement would not be cost beneficial (DEK, 2009b).

41 The NRC staff noted that for certain SAMAs considered in the ER, there may be alternatives
42 that could achieve much of the risk reduction at a lower cost. The NRC staff asked the licensee
43 to evaluate several lower cost alternatives to the SAMAs considered in the ER, including

1 SAMAs that had been found to be potentially cost-beneficial at other PWR plants. These
2 alternatives were: (1) automating the cross-tie of the existing CST to other water sources rather
3 than installing a new CST, (2) modifying procedures to direct primary system cool-down to
4 further reduce the probability of RCP seal failures, (3) modifying procedures and equipment for
5 using a portable diesel-driven or AC-powered pump to provide feedwater to the steam
6 generators with suction from the intake canal, (4) developing a procedure to cross-connect the
7 CVCS holdup tanks to the VCT through the CVCS holdup transfer pump, and (5) procuring and
8 developing a procedure for using a gagging device to close a stuck-open steam generator
9 safety valve on a faulted steam generator before core damage occurs. The latter had been
10 found potentially cost-beneficial in two previous SAMA evaluations (Entergy, 2008; FENOC,
11 2007) and might be cost beneficial at KPS as a SGTR where failure to isolate contributes 64
12 percent of the population dose at KPS (See Table F.2-2). DEK provided a further evaluation of
13 these alternatives, as summarized below:

- 14 • Automate the CST Cross-Tie. The cost benefit of automating the CST cross-tie was
15 evaluated by setting the operator failure to perform the cross-tie to zero. This produced
16 an 18 percent reduction in CDF and a 17 percent reduction in person-rem, yielding a
17 benefit of \$912,000 (based on a 7 percent discount rate, and including the factor of 2
18 multiplier for external events). The cost of this enhancement was estimated to be
19 approximately \$1.5 million. Based on this assessment, the enhancement would not be
20 cost beneficial. In a request for clarification of RAI responses, DEK addressed the
21 impact of assuming a 3 percent discount rate or accounting for uncertainty. A revised
22 analysis using a 3 percent discount rate and the K101AASAMA PRA model yielded a
23 total benefit of about \$1.4 million, which is less than the cost of the enhancement. To
24 address the impact of uncertainty, DEK recalculated the base case and SAMA
25 assessment case using the more recent K107AaILRT PRA model. Use of this PRA
26 model and a more realistic (less conservative) assumption concerning the SAMA
27 benefits (both operator failure and electrical bus failure required to fail the CST cross-
28 tie rather than setting operator error to zero) resulted in only an 8 percent reduction in
29 CDF and a \$333,000 benefit. Based on this alternative evaluation, DEK concluded that
30 this enhancement would not be cost-beneficial even for the 95th percentile uncertainty
31 case (DEK Electric Kewaunee, 2009b).
- 32 • Modify Procedures to Reduce RCP Seal Failures. Modifying procedures to direct
33 primary system cooldown was evaluated in SAMAs 50, 162 and 163 and found by DEK
34 to not be cost beneficial.
- 35 • Modify Procedures to Use a Portable Pump to Provide Feedwater to Steam
36 Generators. DEK described the procedures followed and actions taken by the
37 operators following a reactor trip. These include determining status of AFW flow,
38 attempting to restore AFW flow, if not available, or restoring main feedwater. If this is
39 not possible, procedures include depressurizing the steam generators to establish
40 condensate flow or initiating feed and bleed cooling. The time available and steps
41 necessary to establish flow to a steam generator from a portable pump were also
42 described. Based on the required actions and time available, DEK concluded that,
43 unless significant plant impairments exist, it would be best for the operators to focus on
44 restoration of cooling using permanently installed equipment. Modifying procedures to

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- 1 use a portable pump for steam generator makeup would provide a negligible risk
2 reduction and would not be cost-beneficial.
- 3 • Modify Procedures to Provide Makeup to the Volume Control Tank. DEK discussed the
4 potential use of the CVCS holdup tanks to provide makeup to the VCT and thereby
5 provide a continued source of water for injection to the RCP seals and the RCS. DEK
6 noted that makeup to the VCT is normally from the letdown flow. If this is interrupted,
7 then flow is provided automatically from the RWST. If this fails, RCP seal integrity will
8 be maintained as long as component cooling water to the seals continues. If this is lost,
9 seals will fail if injection is not restored within 13 minutes. DEK indicated that provision
10 of flow from the CVCS holdup tanks to the VCT in 13 minutes is not considered
11 practical. While flow from the CVCS after a seal loss of coolant accident (LOCA) would
12 provide RCS makeup, it would not remove decay heat nor prevent core damage.
13 Based on the above, DEK concluded that this proposed enhancement would not offer
14 significant risk reduction benefits and would not be cost-beneficial.
 - 15 • Provide a Gagging Device to Close a Stuck-Open Steam Generator Safety Valve. DEK
16 discussed and evaluated the conditions under which a gagging device could be used
17 to close a stuck-open steam generator safety valve, and the resulting benefit
18 associated with it. As outlined in the DEK response, two circumstances contribute to
19 the release of radioactivity following an SGTR event with a stuck-open safety valve.
20 The first is an induced-SGTR, which occurs after core damage when hot gases and
21 high RCS pressure cause a steam generator tube to fail, with subsequent safety valve
22 opening and failure to re-close. The second circumstance is a spontaneous SGTR, in
23 which a tube rupture is the initiating event and high pressure from the reactor coolant
24 system causes the steam generator pressure to rise. If the operators fail to cool down
25 and depressurize soon enough in this latter event, the secondary water level would
26 increase along with pressure causing a safety valve to open and pass liquid. There
27 would then be a significant chance that, when the pressure is reduced, the safety valve
28 would fail to re-close.

29 For the induced-SGTR events (which account for approximately 80 percent of the total SGTR-
30 related release frequency), the radiation levels in the vicinity of the valve is expected to be too
31 high to permit operators to install and utilize the gagging device. Thus, the gagging device
32 would not provide benefits in induced-SGTR events. With regard to SGTR-initiated events, the
33 gagging device would only provide benefits for a limited subset of events, specifically, events in
34 which the operators follow the emergency operating procedures (EOPs), but fail to cool down
35 and depressurize in time to prevent overfilling the steam generator. (If operators were not
36 following the EOPs, then secondary pressure would keep rising and the gagging device could
37 not be used.) Given that operators follow the EOPs but fail to prevent overfilling the steam
38 generator, the EOPs direct the operators to continue to cool down and depressurize the RCS to
39 cold shutdown conditions and to establish heat removal using the residual heat removal (RHR)
40 system. If this is successful, core damage is prevented. If a gagging device is used to re-close
41 the stuck open safety valve, achieving cold shutdown and use of the RHR is not needed as heat
42 can be removed via the intact (or faulted) steam generator without loss of reactor coolant
43 inventory. Thus, the risk associated with failure to achieve cold shutdown and use RHR would
44 be eliminated by the gagging device.

1 To determine the benefit associated with the use of a gagging device, DEK revised the SAMA
2 base case model to eliminate the operator execution error and the hardware failures associated
3 with establishing RHR cooling following a SGTR with stuck-open safety valve. The result was a
4 0.4 percent reduction in CDF (from 8.089×10^{-5} per year to 8.060×10^{-5} per year) and a 1.1
5 percent reduction in offsite person-rem per year (from 30.19 person-rem per year to 29.86
6 person-rem per year). The total averted cost is about \$19,000 at a 7 percent discount rate, and
7 \$35,000 accounting for uncertainty. Based on an estimated cost of procuring a gagging device
8 and preparing procedures for its use of \$50,000, DEK concluded that this potential
9 enhancement would not be cost-beneficial (DEK, 2009c). The NRC staff notes that this benefit
10 estimate does not include doubling to account for external events, but that this is considered
11 appropriate because SGTR events would not generally occur as a direct result of an external
12 event and this SAMA would not have any associated benefit for these events.

13 The NRC staff concurs with DEK's conclusions regarding these alternative SAMAs because the
14 NRC staff finds the additional information provided by DEK for the aforementioned alternative
15 SAMAs to be technically sound.

16 In the discussion of the conclusions of the cost-benefit analysis, DEK identified the individual
17 SAMAs that address improving the availability of HVAC. The SAMAs identified were those
18 found to be cost-beneficial in the baseline analysis (SAMAs 80, 82, 83, 170, and 171), plus
19 those found to be cost-beneficial due to synergies, if the SAMAs were implemented concurrently
20 (SAMAs 81, 160, 166 and 167). In response to an RAI, DEK noted that the latter four SAMAs
21 would be included within the set of SAMAs that they intend to review further for possible
22 implementation as part of DEK's ongoing performance improvement program (DEK, 2009a). In
23 a request for clarification, the NRC staff noted that SAMA 160, Insulate EDG Exhaust Ducts,
24 was not included in the evaluation of simultaneous implementation in Section 7.7 of the ER. In
25 response, DEK agreed that SAMA 160 should not have been included as a SAMA to be
26 considered further, since it does not have any implementation synergisms with the HVAC
27 SAMAs and there would be no noticeable risk reduction if implemented alone. DEK, however,
28 indicated SAMA 160 will be considered further when risk reduction strategies are evaluated in
29 the future (DEK, 2009b).

30 The NRC staff concludes that, with the exception of the potentially cost-beneficial SAMAs
31 discussed above, the costs of the SAMAs evaluated would be higher than the associated
32 benefits.

33 **F.7. Conclusions**

34 DEK compiled a list of 189 SAMAs based on a review of the most significant basic events from
35 the current (at the time of the ER preparation) plant-specific PRA, insights from the plant-
36 specific IPE and IPEEE, Phase 2 SAMAs from license renewal applications for other plants, and
37 review of other industry documentation. An initial screening removed SAMA candidates that (1)
38 are not applicable at KPS due to design differences, (2) have been effectively implemented at
39 KPS, (3) have estimated costs that would exceed the dollar value associated with completely
40 eliminating all severe accident risk at KPS, or (4) have a very low benefit because they are
41 associated with a non-risk-significant system. Based on this screening, 125 SAMAs were
42 eliminated, leaving 64 candidate SAMAs for evaluation.

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1 For the remaining 64 SAMA candidates, a more detailed evaluation was performed as shown in
2 Table F.5-1. The cost-benefit analyses in the ER showed that 14 SAMA candidates were
3 potentially cost-beneficial in the baseline analysis (SAMAs 66, 80, 82, 83, 169, 170, 171, 172,
4 173, 174, 175, 176, 177, and 181). DEK performed additional analyses to evaluate the impact of
5 parameter choices and uncertainties on the results of the SAMA assessment. As a result, no
6 additional SAMAs were identified as potentially cost-beneficial. In response to an NRC request,
7 DEK reviewed the most recent KPS PRA, prepared subsequent to the SAMA evaluation
8 documented in the ER, and identified one additional potentially cost-beneficial enhancement
9 involving implementing temporary greenhouse ventilation and installing additional temperature
10 detectors. DEK also considered the cost savings associated with simultaneous SAMA
11 implementation and concluded that three additional SAMAs (SAMAs 81, 166 and 167) would be
12 potentially cost-beneficial if implemented together with SAMAs 82, 83, 160, 170, and 171 (all but
13 SAMA 160 were found to be potentially cost-beneficial in the baseline analysis). Although not
14 cost-beneficial, SAMA 160 will also be considered during the evaluation of risk reduction
15 strategies. DEK has indicated that all these potentially cost-beneficial SAMAs will be considered
16 for implementation at KPS as part of the ongoing performance improvement program.

17 The NRC staff reviewed the DEK analysis and concludes that the methods used and the
18 implementation of those methods were sound. The treatment of SAMA benefits and costs
19 support the general conclusion that the SAMA evaluations performed by DEK are reasonable
20 and sufficient for the license renewal submittal. Although the treatment of SAMAs for external
21 events was somewhat limited, the likelihood of there being cost-beneficial enhancements in this
22 area was minimized by improvements that have been realized as a result of the IPEEE process,
23 and inclusion of a multiplier to account for external events.

24 The NRC staff concurs with DEK's identification of areas in which risk can be further reduced in
25 a cost-beneficial manner through the implementation of the identified, potentially cost-beneficial
26 SAMAs. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further
27 evaluation of these SAMAs by DEK is warranted. However, these SAMAs do not relate to
28 adequately managing the effects of aging during the period of extended operation. Therefore,
29 they need not be implemented as part of license renewal pursuant to Title 10 of the *Code of*
30 *Federal Regulations*, Part 54.

31 **F.8. References**

32 American Society of Mechanical Engineers (ASME). 2003. "ASME RA-Sa-2003, Addenda to
33 ASME RA-S-2002 Standard for Probabilistic Risk Assessment for Nuclear Power Plant
34 Applications."

35 Dominion Energy Kewaunee, Inc. (DEK). 2006. *Regulatory Meeting Internal Flooding Risk*
36 *Reduction Activities*, ML063460495, November 30, 2006.

37 Dominion Energy Kewaunee, Inc. (DEK). 2008a. Kewaunee Power Station, Licensee's
38 Environmental Report Operating License Renewal Stage, August 2008.

39 Dominion Energy Kewaunee, Inc. (DEK). 2008b. Letter from Leslie N. Hartz, Dominion, to U.S.
40 Nuclear Regulatory Commission Document Control Desk. Subject: "Kewaunee Power Station,
41 License Amendment Request 242: Extension of the One-time Fifteen Year Containment
42 Integrated Leak Rate Test Interval," September 11, 2008.

- 1 Dominion Energy Kewaunee, Inc. (DEK). 2009a. Letter from Leslie N. Hartz, Dominion, to U.S.
2 Nuclear Regulatory Commission Document Control Desk. Subject: "Kewaunee Power Station,
3 Response to Request Additional Information Regarding Severe Accident Mitigation Alternative
4 for Kewaunee Power Station License Renewal Application", March 9, 2009.
- 5 Dominion Energy Kewaunee, Inc. (DEK). 2009b. Letter from Leslie N. Hartz, Dominion, to U.S.
6 Nuclear Regulatory Commission Document Control Desk. Subject: "Kewaunee Power Station,
7 Response to Follow-up Questions Regarding Severe Accident Mitigation Alternative for
8 Kewaunee Power Station," June 1, 2009.
- 9 Dominion Energy Kewaunee, Inc. (DEK). 2009c. Letter from J. Alan Price, Dominion, to U.S.
10 Nuclear Regulatory Commission Document Control Desk. Subject: "Kewaunee Power Station,
11 Response to Follow-up Questions Regarding Severe Accident Mitigation Alternatives," July 28,
12 2009.
- 13 Electric Power Research Institute (EPRI). 1991. *A Methodology for Assessment of Nuclear*
14 *Power Plant Seismic Margins*, Revision 1. EPRI Report NP-6041-SL.
- 15 Entergy Nuclear Northeast (Entergy). 2008. Letter from Fred R. Dacimo, Entergy Nuclear
16 Northeast, to U. S. Nuclear Regulatory Document Control Desk. Subject: "Supplemental Reply
17 to Request for Additional Information Regarding License Renewal Application – Severe
18 Accident Mitigating Alternatives," May 22, 2008.
- 19 First Energy Nuclear Operating Company (FENOC). 2007. *License Renewal Application*.
20 August 27, 2007.
- 21 Kennedy, R. P. 1999. "Overview of Methods for Seismic PRA and Margin Analysis Including
22 Recent Innovations", Proceedings of the OECD-NEA Workshop of Seismic Risk, Tokyo, Japan,
23 10-12 August 1999.
- 24 Nuclear Management Company, LLC (NMC). 2005. Letter from Michael G. Gaffney, Nuclear
25 Management Company, LLC to U. S. Nuclear Regulatory Commission Document Control Desk.
26 Subject: "Response to Request for Additional Information Regarding Risk-Informed Inservice
27 Inspection Program Plan (TAC No. MC2537)." June 17, 2000.
- 28 Nuclear Energy Institute (NEI). 2005. "Severe Accident Mitigation Alternative (SAMA) Analysis
29 Guidance Document", NEI 05-01 (Rev. A), November 2005.
- 30 State of Wisconsin, 2003. Final Projections for Wisconsin Counties by Components of Change".
31 Available URL: http://www.doa.state.wi.us/docs_view2.asp?docid=2065
- 32 TOMCOD, 2005. "Evacuation time Estimate Study for the Kewaunee Power Station Emergency
33 Planning Zone (EPZ)", TOMCOD, Inc. August 8, 2005.
- 34 U.S. Department of Agriculture (USDA). 1998. "1997 Census of Agriculture, National Agriculture
35 Statistics Service," 1998. Available URL:
36 <http://www.nass.usda.gov/census/census97/volume1/vol1pubs.htm>
- 37 U.S. Department of Agriculture (USDA). 2002. 2002 Census of Agriculture, Volume 1
38 Geographic Area Series Census, State-county Data," Available URL:
39 http://www.nass.usda.gov/census/create_census_US_CNTY.jsp
- 40 U. S. Geologic Survey (USGS). 2008. "2008 NSHM Gridded Data, Peak Ground Acceleration,"
41 Available URL: http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data

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- 1 U.S. Nuclear Regulatory Commission (NRC). 1990. *Severe Accident Risks: An Assessment for*
2 *Five U.S. Nuclear Power Plants*. NUREG-1150, Washington, D.C., December 1990.
- 3 U.S. Nuclear Regulatory Commission (NRC). 1991. Generic Letter No. 88-20, Supplement 4,
4 "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," NUREG-
5 1407, Washington, D.C., June 28, 1991.
- 6 U.S. Nuclear Regulatory Commission (NRC). 1994. *Revised Livermore Seismic Hazard*
7 *Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains*. NUREG-
8 1448, Washington, D.C., March 1994.
- 9 U.S. Nuclear Regulatory Commission (NRC). 1997a. *Regulatory Analysis Technical Evaluation*
10 *Handbook*. NUREG/BR-0184, Washington, D.C., January 1997.
- 11 U.S. Nuclear Regulatory Commission (NRC). 1997b. Letter from Richard J. Laufer, U.S. NRC,
12 to M. L. Marchi, Wisconsin Public Service Corporation. Subject: "Review of Individual Plant
13 Examination for Internal Events," (TAC No. M74424), January 15, 1997.
- 14 U.S. Nuclear Regulatory Commission (NRC). 1997c. *Individual Plant Examination Program:*
15 *Perspectives on Reactor Safety and Plant Performance*. NUREG-1560, Washington, D.C.
16 December 1997.
- 17 U.S. Nuclear Regulatory Commission (NRC). 1998. Letter from William O. Long, U.S. NRC to
18 M. L. Marchi, Wisconsin Public Service Corporation, Subject: "Kewaunee Nuclear Power Plant –
19 Safety Evaluation for USI A-46 Program Implementation, Revision 1 (TAC No. M69455)," May
20 26, 1998.
- 21 U.S. Nuclear Regulatory Commission (NRC). 1999. Letter from Tae Kim, U.S. NRC to M. L.
22 Marchi, Wisconsin Public Service Corporation, Subject: Kewaunee Nuclear Power Plant -
23 Review of Individual Plant Examination for External Events (IPEEE) Submittal (TAC No.
24 M83633)," October 5, 1999.
- 25 U.S. Nuclear Regulatory Commission (NRC). 2003. "SECPOP 2000: Sector Population, Land
26 Fraction, and Economic Estimation Program." NUREG/CR-6525 Revision 1, Washington, D.C.,
27 August 2003.
- 28 U.S. Nuclear Regulatory Commission (NRC). 2004. *Regulatory Analysis Guidelines of the U.S.*
29 *Nuclear Regulatory Commission*. NUREG/BR-0058, Revision 4, Washington, D.C., September
30 2004.
- 31 U.S. Nuclear Regulatory Commission (NRC). 2007. Letter from Pao-Tsin Kuo, U.S.NRC, to
32 James H. Riley, Nuclear Energy Institute, subject: "Final License Renewal Interim Staff
33 guidance LR-ISG-2006-03: Staff Guidance for Preparing Severe Accident Mitigation Alternatives
34 Analysis," August 2, 2007.
- 35 U.S. Nuclear Regulatory Commission (NRC). 2009a. Letter from Sarah Lopas, U.S. NRC, to
36 David A. Christian, Dominion Energy Kewaunee, Inc., Subject: "Request for Additional
37 Information Regarding Severe Accident Mitigation Alternatives for the Kewaunee Power Station
38 (TAC No. MD9409)," January 8, 2009.
- 39 U.S. Nuclear Regulatory Commission (NRC). 2009b. Memorandum by Sarah Lopas, U.S. NRC,
40 Subject: "Summary of Conference Call with Dominion Energy Kewaunee, Inc. to Discuss
41 Responses to Severe Accident Mitigation Alternatives Request for Additional Information for the
42 Kewaunee Power Station (TAC No. MD9409)," April 22, 2009.

- 1 Wisconsin Public Service Corporation (WPSC). 1992. Letter from C. R. Steinhardt, WPSC to
2 U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Docket No. 50-305,
3 Operating License No. DPR-43, Kewaunee Nuclear Power Plant, Response to Generic Letter
4 88-20, Individual Plant Examination," December 1, 1992.
- 5 Wisconsin Public Service Corporation (WPSC). 1994a. Letter from C. R. Steinhardt, WPSC to
6 U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Docket No. 50-305,
7 Operating License No. DPR-43, Kewaunee Nuclear Power Plant, Response to Generic Letter
8 88-20, Supplement 4. Individual Plant Examination of External Events," June 28, 1994.
- 9 Wisconsin Public Service Corporation (WPSC). 1994b. Letter from C. R. Steinhardt, WPSC to
10 U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Docket No. 50-305,
11 Operating License No. DPR-43, Kewaunee Nuclear Power Plant, Response to Generic Letter
12 88-20 Individual Plant Examination," September 21, 1994.
- 13 Wisconsin Public Service Corporation (WPSC). 1995. Letter from C. R. Steinhardt, WPSC to
14 U.S. Nuclear Regulatory Commission Document Control Desk. Subject: "Docket No. 50-305,
15 Operating License No. DPR-43, Kewaunee Nuclear Power Plant, Response to Request for
16 Additional Information Regarding Individual Plant Examination for External Events," October 13,
17 1995.
- 18 Wisconsin Public Service Corporation (WPSC). 1998. Letter from Mark L Marchi, WPSC to U.S.
19 Nuclear Regulatory Commission Document Control Desk. Subject: "Docket No. 50-305,
20 Operating License No. DPR-43, Kewaunee Nuclear Power Plant, Response to Supplemental
21 Request for Additional Information Regarding Individual Plant Examination for External Events,"
22 September 28, 1998.
- 23

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NUREG-1437, Supplement 40

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11. ABSTRACT (200 words or less)

This draft supplemental environmental impact statement (SEIS) has been prepared in response to an application submitted by Dominion Energy Kewaunee, Inc. (DEK) to renew the operating license for Kewaunee Power Station (KPS) for an additional 20 years. This draft SEIS includes the preliminary analysis that evaluates the environmental impacts of the proposed action and alternatives to the proposed action. It also includes the NRC's recommendation regarding the proposed action.

The NRC's preliminary recommendation is that the adverse environmental impacts of license renewal for KPS are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. The recommendation is based on (1) the analysis and findings in the GEIS; (2) information submitted in DEK's Environmental Report; (3) consultation with other Federal, State, and local agencies; (4) a review of other pertinent studies and reports; and (5) a consideration of public comments received during the scoping process.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

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