



Michael P. Gallagher
Vice President, License Renewal
Exelon Nuclear
200 Exelon Way
Kennett Square, PA 19348
610 765 5958 Office
610 765 5956 Fax
www.exeloncorp.com
michaelp.gallagher@exeloncorp.com

10 CFR 50
10 CFR 51
10 CFR 54

RS-15-221

July 31, 2015

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Revisions to LaSalle County Station, Units 1 and 2, License Renewal Application, Applicant's Environmental Report – Operating License Renewal Stage

- References:**
1. Letter from Michael P. Gallagher, Exelon Generation Company, LLC (Exelon Generation), to U.S. Nuclear Regulatory Commission (NRC) Document Control Desk, "Application for Renewed Operating Licenses," dated December 9, 2014.
 2. Letter from David Drucker, NRC, to Michael P. Gallagher, Exelon Generation, "Request for Additional Information Regarding the LaSalle County Station, Units 1 and 2, License Renewal Application Environmental Review (TAC NOS. MF5567 AND MF5568)," dated May 22, 2015.
 3. Letter from Michael P. Gallagher, Exelon Generation, to NRC Document Control Center, "Response to NRC Request for Additional Information, dated May 22, 2015, Regarding the LaSalle County Station, Units 1 and 2, License Renewal Application, Environmental Review," dated July 2, 2015
 4. Letter from David Drucker, NRC, to Michael P. Gallagher, Exelon Generation, "Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2, License Renewal Application," dated June 25, 2015
 5. Letter from Michael P. Gallagher, Exelon Generation, to NRC Document Control Desk, "Response to NRC Request for Additional Information, dated June 25, 2015, Regarding the LaSalle County Station, Units 1 and 2, License Renewal Application Environmental Review," dated July 24, 2015.

In Reference 1, Exelon Generation Company, LLC (Exelon Generation) submitted the License Renewal Application (LRA) for the LaSalle County Station, Units 1 and 2 (LSCS), including Appendix E, which is the Applicant's Environmental Report – Operating License Renewal Stage (ER-LR).

In Reference 2, the NRC requested additional information to support the Staff's review of the LSCS ER-LR. One of the requests (HC-02) asked Exelon Generation to investigate whether three archaeological sites not discussed in the ER-LR would be located within the corrected LSCS property ownership boundaries.

In Reference 3, the response to NRC's request for additional information (RAI) HC-02 explained that, none of the three archaeological sites about which the NRC inquired in Reference 2 can be definitively located. However, Exelon Generation stated that the location of one of the three sites would be assumed to be within the LSCS property ownership boundaries.

In Reference 4, NRC requested additional information about the analysis in Section 4.13 of the LSCS ER-LR of environmental impacts from future transportation of high-burnup LSCS spent fuel. In part, Reference 4 asked for a reanalysis of impacts from future transportation of high-burnup LSCS spent fuel under incident-free and accident conditions using modified assumptions about certain shipment characteristics as well as route selection options not available at the time the ER-LR was initially prepared.

Reference 5 provided a summary of the results of Exelon Generation's reanalysis of spent fuel transportation impacts and indicated that Section 4.13 of the LSCS ER-LR would be updated in a later ER-LR revision. This letter provides that ER-LR revision.

The enclosure to this letter contains revised versions of pages in the LSCS ER-LR that incorporate changes and updates as follows:

Affected Sections	Purpose of Revisions
2.2; 3.1; 3.2; 3.5; 3.6; 3.7; 6.5	During its preparations for the NRC's LSCS license renewal environmental audit, which occurred in May 2015, Exelon realized that the 1977 LSCS Operating License ER (ER-OL) and subsequent documentation inaccurately depicted LSCS property ownership boundaries for the makeup and blowdown pipeline right-of-way near the Illinois River in the vicinity of the river screen house and blowdown discharge flume, as well as along the southern shore of the cooling pond. The revisions modify text, tables and figures that were erroneous because of the inaccurate depiction of ownership boundaries in the 1977 ER-OL or that were erroneous because of minor typographical errors.
3.2; 10.0	Reported and depicted acreages for land cover types have been updated using the 2011 National Land Cover Database.
3.4	The text has been modified to more accurately describe applicable state noise control standards, as well as current ambient noise sources and conditions in the vicinity of LSCS.
3.7.1.7; 10.0	The text has been revised to acknowledge the changed regulatory status of the American eel, which was listed in May 2015 by the Illinois Department of Natural Resources as threatened.

Affected Sections	Purpose of Revisions
3.8.3	The text and tables have been revised to remove information about two archaeological sites not located within the corrected LSCS property ownership boundaries and to add information about one archaeological site that was revisited in response to an NRC staff request for additional information and found not to be definitively outside the LSCS property ownership boundary.
3.10.1	A transposition error has been corrected in this section's reporting of the highest maximum daily temperatures in the cooling pond discharge to the Illinois River during 2011 and 2012.
4.13; 5.2; 10.0	The text has been revised to incorporate the results of reanalyzing the impacts of transporting LSCS high-burnup spent nuclear fuel under incident-free and accident conditions using the TRAGIS highway route controlled quantity (HRCQ) option and TRAGIS state-specific distances and population densities in urban, suburban, and rural areas, which were not available options at the time the ER-LR was initially prepared. The changes include modifying the transportation analysis to assume shipments of LSCS high-burnup fuel would contain 0.5 metric ton of uranium per cask.

This letter and its enclosure contain no regulatory commitments.

If you have any questions, please contact Ms. Nancy Ranek, Environmental Lead, Exelon Generation License Renewal, at 610-765-5369.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 7-31-2015

Respectfully,



Michael P. Gallagher
Vice President - License Renewal Projects
Exelon Generation Company, LLC

Enclosure: LaSalle County Station Units 1 and 2, Revisions to License Renewal Application,
Applicant's Environmental Report – Operating License Renewal Stage

cc: Regional Administrator - NRC Region III
NRC Project Manager (Environmental Review), NRR-DLR
NRC Project Manager (Safety Review), NRR-DLR
NRC Project Manager, NRR-DORL LaSalle County Station
NRC Senior Resident Inspector, LaSalle County Station
Illinois Emergency Management Agency - Division of Nuclear Safety

**RS-15-221
ENCLOSURE**

**LaSalle County Station, Units 1 and 2
Revisions to License Renewal Application,
Applicant's Environmental Report – Operating License Renewal Stage**

THIS PAGE INTENTIONALLY BLANK

Purpose and Description of Revisions

The following table identifies the locations and purposes of revisions to the LaSalle County Station (LSCS) Applicant's Environmental Report – Operating License Renewal Stage (ER-LR). Replacement pages showing revised text, tables and figures are also provided in this Enclosure. The replacement pages supersede the pages in the originally filed version of the LSCS ER-LR. The locations of revisions are indicated on each replacement page by vertical lines in the right-hand margin, and the date of this ER-LR revision (i.e., July 2015) has been placed in the lower right-hand corner of each replacement page. Readers should note, however, that in Section 10, insertion of new reference entries at alphabetically correct locations throughout the section shifted the entries on every page, regardless of whether or not a new entry was added to any given page. Accordingly, all pages in Section 10 are being replaced, but vertical lines appear in the right-hand margin only on the pages and at the locations where new reference entries occur.

ER-LR Page #	ER-LR Section #	Description of Revision	Purpose of Revision
Cover page	Not applicable	Added ER-LR revision number and changed document date to July 2015	To provide updated document information.
2-5	2.2	Revised Figure 2.2-1, LSCS Site Layout	To correct the location of LSCS property ownership boundaries.
2-6	2.2	Revised Figure 2.2-2, LSCS Plant Layout	To correct the location of LSCS property ownership boundaries.
3-2	3.1	In 2 nd paragraph, 1 st line on the page, changed LSCS total land area from 1,568 ha (3,875 ac) to 1,528 ha (3,776 ac)	To revise the total land area value within the corrected LSCS property ownership boundaries.
3-4	3.2	Revised Figure 3.1-2, 6 Mile (10 km) Radius Map	To correct the location of LSCS property ownership boundaries.
3-5	3.2	In 1 st paragraph, 10 th line on page, updated the reference citation for the National Land Cover Database (NLCD), to the 2011 version of the NLCD (i.e., NLCD 2012)	To clarify that land areas occupied by land use types within the corrected LSCS property ownership boundaries, as presented in Table 3.2-1, have been updated using the 2011 version of the NLCD.
3-5	3.2	In 4 th paragraph, 2 nd line on the page, changed the percentage of LSCS land area occupied by the cooling pond from 53% to 52%, and changed LSCS total land area from 1,568 ha (3,875 ac) to 1,528 ha (3,776 ac)	To revise the total land area value and land areas occupied by specific land use types within the corrected LSCS property ownership boundaries.
3-5	3.2	In 4 th paragraph, 8 th line on the page, corrected the acreage of LSCS land area occupied by the facilities and associated infrastructure from 60 ha (150 ac) to 65 ha (160 ac), and changed the acreage of	To revise the land areas occupied by specific land use types within the corrected LSCS property ownership boundaries.

ER-LR Page #	ER-LR Section #	Description of Revision	Purpose of Revision
		LSCS land area occupied by undeveloped acreage from 101 ha (250 ac) to 142 ha (350 ac)	
3-7	3.2	Revised Figure 3.2-1, Land Use 6-Mile Map	To correct the location of LSCS property ownership boundaries and update areas depicted for land cover types to be consistent with the 2011 NLCD.
3-8	3.2	Revised Figure 3.2-2, Land Use - Site	To correct the location of LSCS property ownership boundaries and update areas depicted for land use types to be consistent with the 2011 NLCD.
3-11	3.2	Revised Table 3.2-1, Land Use in the 10-km (6-mi) Radius of LSCS	To revise the values for land areas occupied by specific land cover types within the corrected LSCS property ownership boundaries.
3-18	3.4	Revised Section 3.4, Noise	To more accurately describe applicable state noise control standards as well as current ambient noise sources in the vicinity of LSCS.
3-24	3.5	Revised Figure 3.5-2, Agricultural Soil Characterization Map	To correct the location of LSCS property ownership boundaries.
3-32	3.6	Revised Figure 3.6-1, Surface Water and Groundwater Well Locations at LSCS	To correct the location of LSCS property ownership boundaries.
3-35	3.6	Revised Figure 3.6-2, Groundwater Flow Map	To correct the location of property LSCS ownership boundaries.
3-48	3.6	Revised Table 3.6-3, Wells within a 1-mi (1.6-km) Radius of LSCS, by changing the entry in the "Well Depth" column for row "8" in the "Well Id" column from "235 (7700)" to "235 (770) "	To correct a typographical error.
3-50	3.7	In 1 st paragraph, 1 st line on page, changed LSCS total land area from 1,568 ha (3,875 ac) to 1,528 ha (3,776 ac)	To revise the total land area values within the corrected LSCS property ownership boundaries.
3-61	3.7.1.7	Revised Section 3.7.1.7, Special Status Aquatic Species	To acknowledge the changed regulatory status of the American eel, which was listed as threatened in May 2015 by the Illinois Department of Natural

ER-LR Page #	ER-LR Section #	Description of Revision	Purpose of Revision
			Resources.
3-71	3.8.3	In 3 rd full paragraph, 9 th , 10 th and 11 th lines, deleted information about archaeological sites LS00533 and LS00252, and added information about archaeological site LS00527	To remove information about two archaeological sites that are not located within the corrected LSCS property ownership boundaries, and to add information about one archaeological site that was revisited in response to an NRC staff request for additional information and found not to be definitively outside the LSCS property ownership boundary.
3-71	3.8.3	In last partial paragraph, 2 nd , 4 th and 5 th lines, corrected text	To align the text with changes made elsewhere in section 3.8.3 regarding the locations of archaeological sites relative to the corrected LSCS property ownership boundaries.
3-72	3.8.3	Revised Table 3.8-2, Archaeological Sites Located Within the LSCS Property	To remove two archaeological sites that are not located within the corrected LSCS property ownership boundaries, and to add one archaeological site that is on or very near the LSCS property ownership boundary and was not previously listed in Table 3.8-2. The location of the latter site was revisited in response to an NRC staff request for additional information, and it has been added to Table 3.8-2 because available information is not sufficient to establish that its location is definitively outside the LSCS property boundary.
3-79	3.10.1	In 5 th paragraph, 4 th line on page, reversed the temperature values reported for 2011 and 2012	To correct a transposition error in this section's reporting of the highest maximum daily temperatures in the cooling pond discharge to the Illinois River during 2011 and 2012.
4-50 to 4-53	4.13	Revised Section 4.13, Impacts Common to All Alternatives: Uranium Fuel Cycle	To incorporate the results of reanalyzing the impacts of transporting LSCS high-burnup

ER-LR Page #	ER-LR Section #	Description of Revision	Purpose of Revision
			spent nuclear fuel under incident-free and accident conditions using the TRAGIS highway route controlled quantity (HRCQ) option and TRAGIS state-specific distances and population densities in urban, suburban, and rural areas, which were not available options at the time the ER-LR was initially prepared. The changes include modifying the transportation analysis to assume shipments of LSCS high-burnup spent fuel would contain 0.5 metric tons of uranium per cask.
5-4	5.2	In 2 nd paragraph, 8 th to 11 th lines, revised the description of impacts from transporting LSCS high-burnup spent fuel.	To align the text in Section 5.2 to the revisions made in Section 4.13.
6-10	6.5	In 1 st paragraph, 1 st line on page, changed LSCS total land area from 1,568 ha (3,875 ac) to 1,528 ha (3,776 ac)	To revise the total land area values within the corrected LSCS property ownership boundaries.
10-1 to 10-18	10.0	Revised Section 10.0, References	To insert new references associated with revisions in Sections 3.2, 3.7.1.7, and 4.13 into the list of references at alphabetically correct locations.

REPLACEMENT PAGES FOR LaSalle County Station ER-LR

REMOVE Page Number(s) in Original ER-LR	INSERT Replacement Page Number(s)
Cover Page	Cover Page
2-5	2-5
2-6	2-6
3-2	3-2
3-4	3-4
3-5	3-5
3-7	3-7
3-8	3-8
3-11	3-11
3-18	3-18
3-24	3-24
3-32	3-32
3-35	3-35
3-48	3-48
3-50	3-50
3-61	3-61
3-71	3-71
3-72	3-72
3-79	3-79
4-50, 4-51, 4-52, 4-53	4-50, 4-51, 4-52-a, 4-52-b, 4-52-c, 4-52-d, 4-53
5-4	5-4
6-10	6-10
10-1 through 10-18	10-1 through 10-20

NOTE: The replacement pages listed in the table, above, are provided as the last 47 (unnumbered) pages in this Enclosure to RS-15-221.

THIS PAGE INTENTIONALLY BLANK

Applicant's Environmental Report –
Operating License Renewal Stage
LaSalle County Station

Unit 1
License No. NPF-11

Unit 2
License No. NPF-18

Exelon Generation Company, LLC

Revision 1
July 2015

|

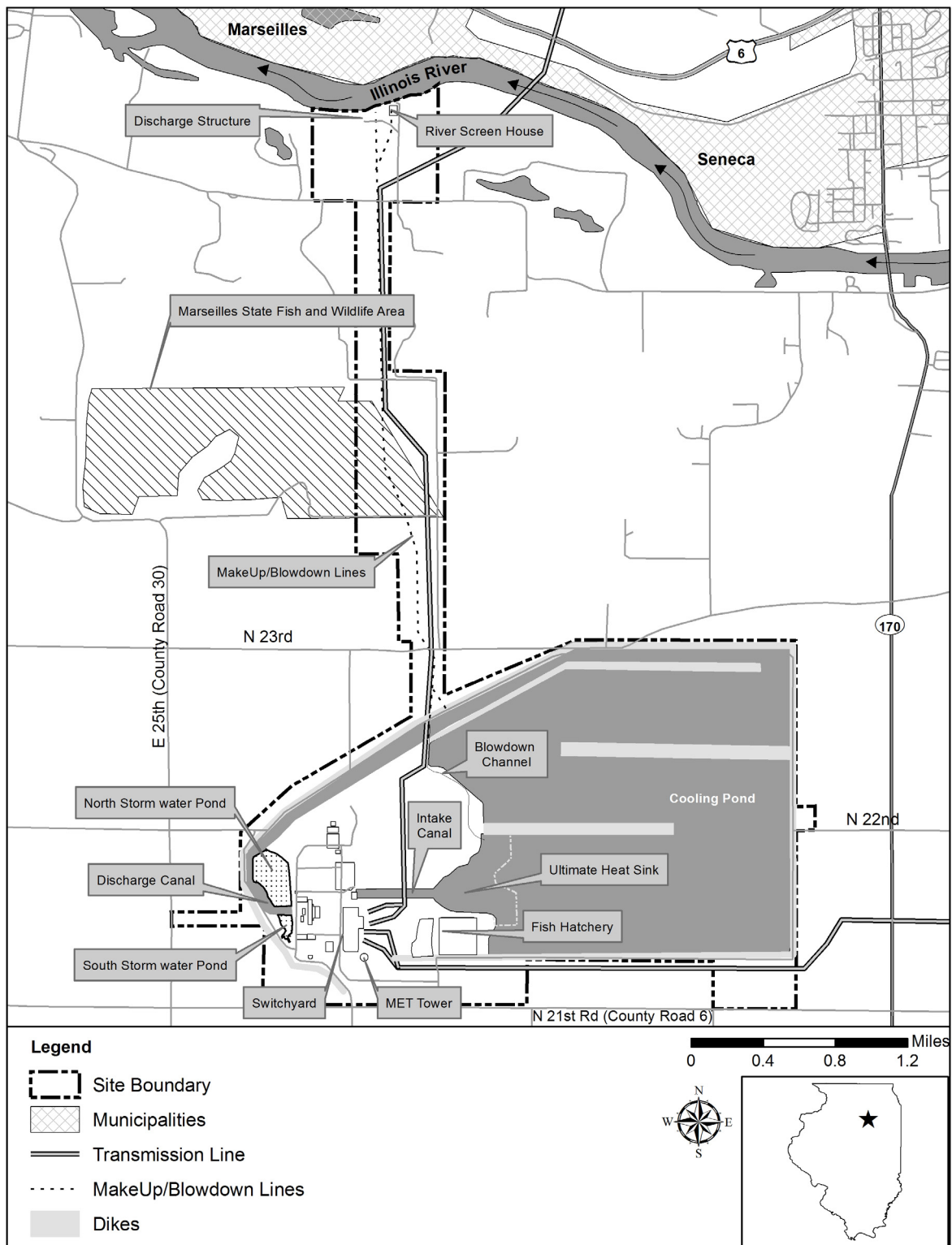


Figure 2.2-1 LSCS Site Layout

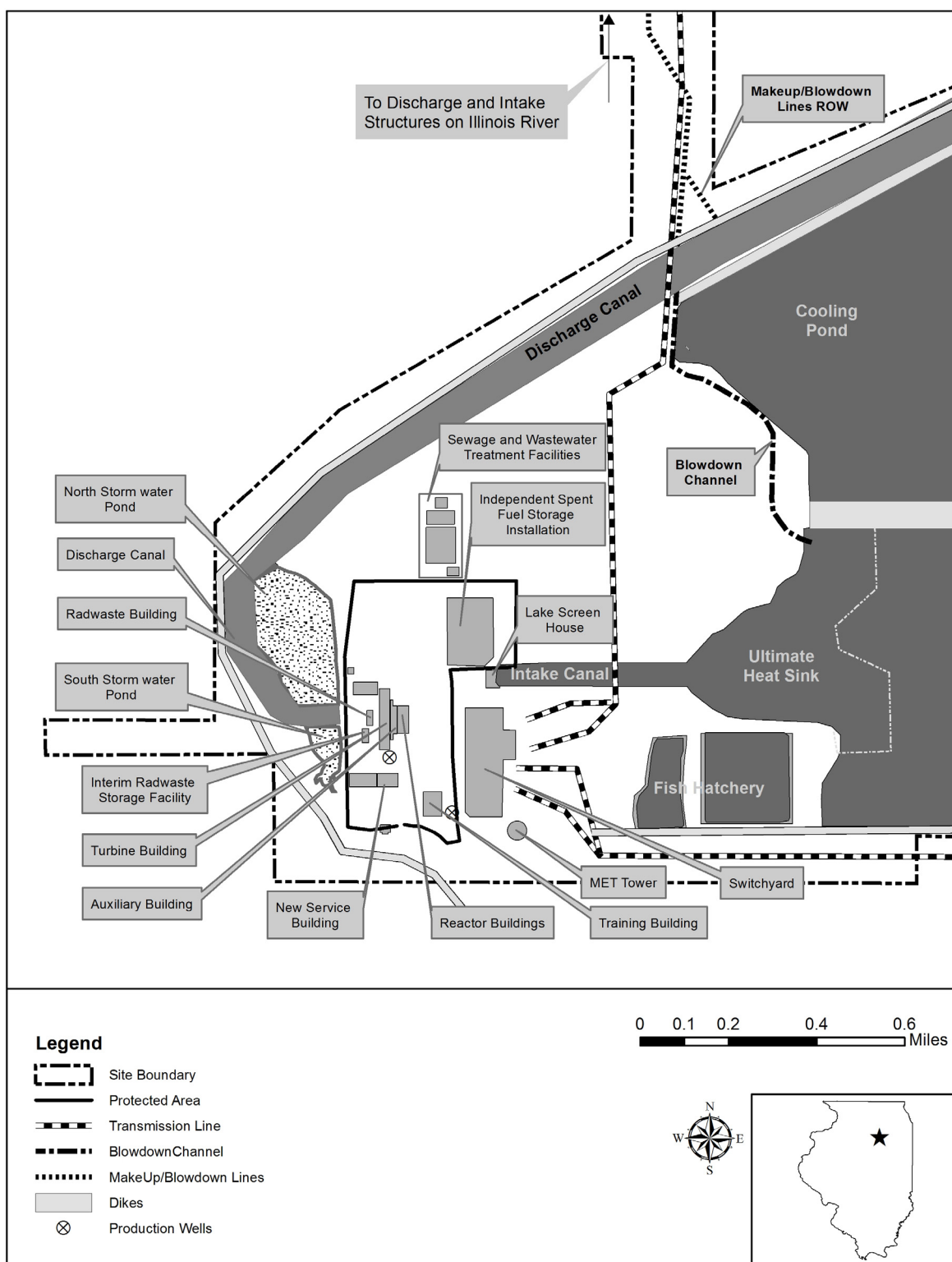


Figure 2.2-2 LSCS Plant Layout

3.1 Location and Features

LaSalle County Station (LaSalle) is in LaSalle County in northeastern Illinois, approximately 120 km (75 mi) southwest of downtown Chicago. [Figure 3.1-1](#) shows LSCS's 80 km (50 mi) radius and [Figure 3.1-2](#) shows the 10 km (6 mi) radius. LSCS is approximately 10 km (6 mi) southwest of Seneca, 11 km (7 mi) south-southeast of Marseilles, and 8 km (5 mi) south of the Illinois River. The area surrounding LSCS is rural and agricultural, with numerous wind turbines in the immediate vicinity and the region.

LaSalle occupies 1,528 ha (3,776 ac), of which approximately 833 ha (2,058 ac) comprise the cooling pond ([ComEd 1977](#)). The generating facilities are on the southwest portion of the site and include the reactor building and related structures, a switchyard, administration buildings, warehouses, and other structures ([Figure 2.2-2](#)).

The cooling pond was created by constructing dikes that rise above the surrounding land. The IDNR classifies the LSCS dike structure as a Class I dam ([IDNR 2000](#)). Class I dams are those for which failure has a high probability of causing loss of life or substantial economic loss, similar to that of US Army Corps of Engineers High Hazard Potential (17 Illinois Adm. Code, Ch. I, Sec. 3702, Jan 13, 1987). The cooling pond has an elevation of 213 m (700 ft) above mean sea level (msl) at normal pool elevation ([ComEd 1977](#)). IDNR leases the cooling pond, with the exception of the ultimate heat sink immediately in front of the intake canal, from Exelon Generation and manages it for public fishing ([IDNR 2013](#)). The cooling pond serves as a water supply for an IDNR fish hatchery on land adjacent to the pond that is also leased to IDNR by Exelon Generation ([Exelon Generation 2013b](#)) ([Figure 2.2-2](#)).

Underground makeup and blowdown pipelines approximately 5.6 km (3.5 mi) long connect the cooling pond to the Marseilles Pool portion of the Illinois River, which is the source of the cooling pond's makeup water and the receiving body of water for permitted discharges from the Station. The blowdown is subject to limitations established by National Pollutant Discharge Elimination System (NPDES) Permit IL0048151. The makeup and blowdown pipeline corridor right-of-way crosses the eastern portion of the Marseilles State Fish and Wildlife Area ([Figure 3.1-2](#)), a 1,032-ha (2,550-ac) area managed by IDNR for hunting and wildlife habitat. Marseilles State Fish and Wildlife Area (including the portion of the pipeline corridor that crosses it) also is used by the Illinois Army Reserve National Guard for training when hunting seasons are closed ([IDNR 2013](#)).

Illini State Park is approximately 10 km (6 mi) north-northwest of LSCS, on the south side of the Illinois River. This 206-ha (510-ac) park has facilities for camping, picnicking, boating, and fishing ([ComEd 1977](#); [IDNR 2013](#)).

County Road 6, also known as North 21st Road and Grand Ridge-Mazon Road, runs parallel to LSCS's southern boundary and provides access to the site. State Highway 170 is 0.8 km (0.5 mi) east of the site and County Road 30, also known as East 25th Road, is slightly west of the site. Interstate Highway 80 is 13 km (8 mi) north of the site. The Chicago, Rock Island & Pacific Railroad, in this area parallel to and slightly north of the Illinois River, is the closest railroad line. A 10 km (6 mi) rail spur connects LSCS to the Atchison, Topeka, and Santa Fe Railroad south of the site ([ComEd 1977](#)).

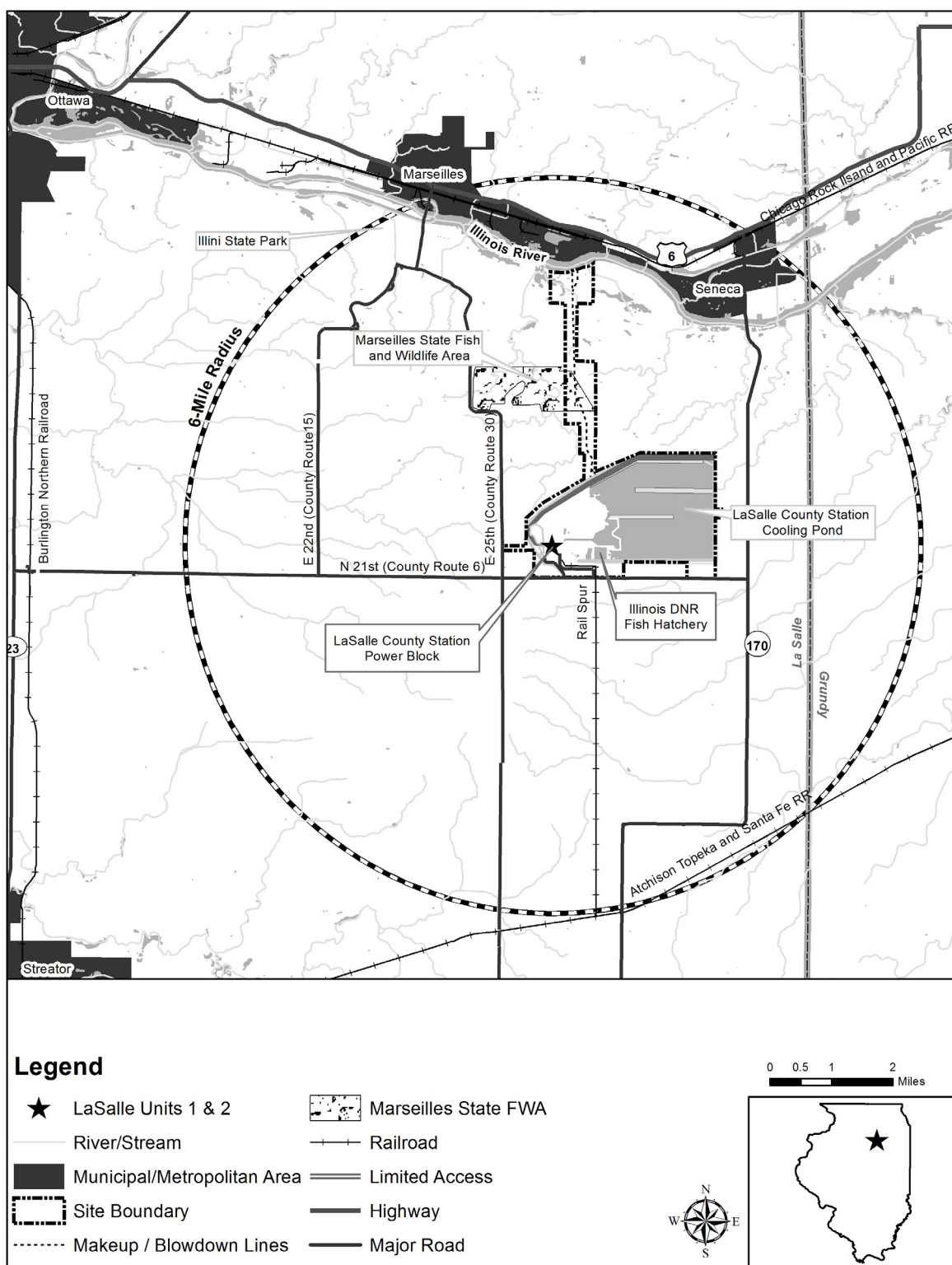


Figure 3.1-2 6 Mile (10 km) Radius Map

3.2 Land Use and Visual Resources

Offsite Land Use

Although less than 97 km (60 mi) from Chicago's southwestern city limits, LaSalle County is rural, comprised mostly (approximately 85 percent of total land area) of agricultural production (LEAMgroup and LaSalle County 2014). Land use within a 10-km (6-mi) radius of the Station is primarily agricultural, with cropland or pastures bordering the facility to the east, south, and west (see "pasture/hay" and "cultivated crop" legends on Figure 3.2-1). The bluffs overlooking the Illinois River north of the plant are mostly forested, with a scattering of residences and small farms. The broad south bank floodplain of the Illinois River is a mosaic of agricultural fields and woodlots, with more of the former than the latter. The north bank of the river is more developed, including parts of the incorporated towns of Seneca and Marseilles. Table 3.2-1 shows land cover in the 10-km (6-mi) region based on data downloaded from the National Land Cover Database 2011 and made available by the Multi-Resolution Land Characteristic's Consortium (NLCD 2012).

Three areas managed by the IDNR for public use and recreation are within 10 km (6 mi) of LaSalle: LaSalle Lake State Fish & Wildlife Area, Marseilles State Fish & Wildlife Area, and Illini State Park. The LaSalle Lake State Fish & Wildlife Area comprises the areas of the LSCS cooling pond that are open to the public and a small picnic and boat launch area, and provides recreational opportunities ranging from fishing to picnicking to bird watching (IDNR 2013). It is open to the public seven days a week in the spring, summer, and fall. Opening and closing dates change from year to year, based on agency personnel availability and funding, but it is generally open from mid-March until mid-October. The Marseilles State Fish & Wildlife Area is approximately 2.4 km (1.5 mi) north of the plant (see Figure 3.1-2). It is a 1,032-ha (2,550-acre) tract of mostly-wooded land managed by IDNR for wildlife and open to the public during certain times of the year (IDNR 2013). Illini State Park is approximately 10 km (6 mi) northwest of the plant. It is 206 ha (510-ac) along a 4.8-km (3-mi) strip of land on the south bank of the Illinois River, adjacent to the area known as the Great Rapids and directly across the river from the town of Marseilles (see Figure 3.1-2) (IDNR 2013).

The Illinois Department of Commerce and Economic Opportunity expect the population of LaSalle County to increase from an historic growth rate of 2 percent per decade, to 4 percent per decade by 2030. The LaSalle County Comprehensive Plan projects that the rate of land use for residential and commercial development will grow faster than the rate of population growth, and points out that new residential development and commercial growth are following established highway corridors, including Highways 6 between LaSalle and Ottawa, north of LSCS, 251 west of LSCS, and I-80, north of LSCS (see Figure 3.1-1). (LEAMgroup and LaSalle County 2014).

Onsite Land Use

As discussed in Section 3.1 and shown in Figure 3.2-2, the 833 ha (2,058 ac) cooling pond occupies more than half (52 percent) of the 1,528 ha (3,776 ac) LSCS site. The portion of the site that lies west of the cooling pond includes the generating facilities and associated infrastructure (roads, parking lots, warehouses, switchyard), but is surrounded by undeveloped areas that are maintained as buffer areas and natural areas for wildlife. These undeveloped areas contain grassland, old field, and scrub-shrub habitats as well as scattered "tree islands" (Exelon Generation 2013b). The generating facilities and associated infrastructure occupy approximately 65 ha (160 ac), while the surrounding undeveloped areas total approximately 142 ha (350 ac). The LaSalle Fish Hatchery, which is operated by the IDNR under a lease agreement with Exelon Generation, includes several small buildings and 16 fish-rearing pools

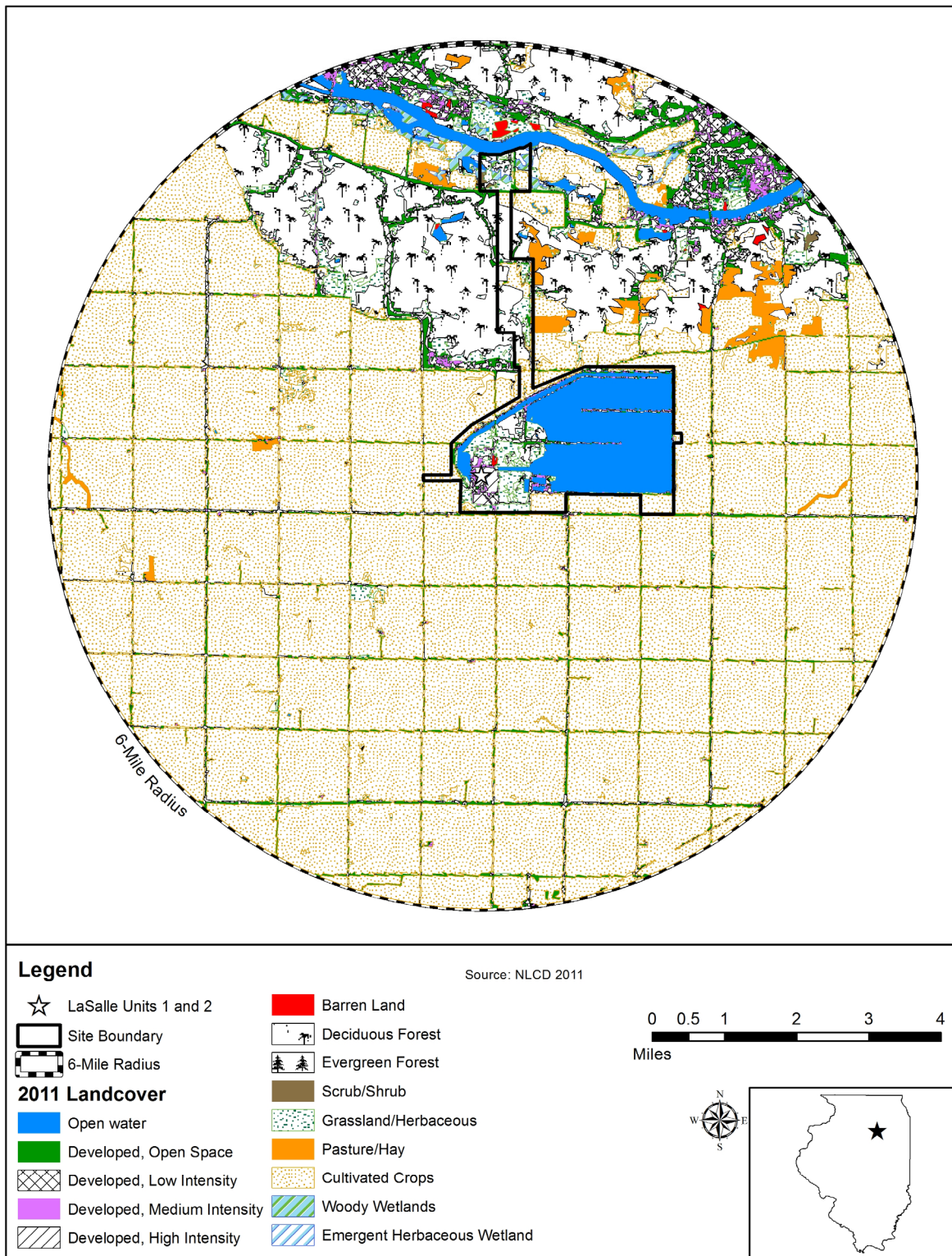


Figure 3.2-1 Land Use 6-Mile Map



Figure 3.2-2 Land Use - Site

Table 3.2-1 Land Use in the 10-km (6-mi) Radius of LSCS

Land Cover Class	Hectares (acres)	Percent of 10-km (6-mi) Radius
Open Water	1,180 (2,915)	4
Developed, Open Space	1,264 (3,124)	4
Developed, Low Intensity	1,083(2,676)	4
Developed, Medium Intensity	183 (451)	1
Developed, High Intensity	104 (256)	<1
Barren Land	34 (84)	<1
Deciduous Forest	3,431 (8,479)	12
Evergreen Forest	2 (4)	<1
Shrub/Scrub	17 (43)	<1
Grassland/Herbaceous	876 (2,165)	3
Pasture/Hay	391 (966)	1
Cultivated Crops	20,540 (50,755)	71
Woody Wetlands	172 (425)	1
Emergent Herbaceous Wetlands	3 (8)	<1
Total	29,279 (72,351)	100

In the GEIS, the NRC determined that onsite land use impacts, offsite land use impacts, and aesthetic impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated these Category 1 issues ([NRC 2013b](#)). Because the new and significant analysis identified no information regarding LSCS that is different from the assumptions in the GEIS or that would change the conclusions of the GEIS regarding land use or visual resources, no further analyses are required.

3.4 Noise

LSCS pumps, turbines, generators, switchyard equipment, transformers, and loudspeakers all generate intermittent or constant noise. Most equipment is inside structures, reducing the outdoor noise level. LSCS facilities that produce noise are more than 300 m (1,000 ft) from the nearest site boundary and 1.1 km (0.7 mi) from the nearest residence ([Exelon Nuclear 2012a](#)). The Illini State Park is approximately 10 km (6 mi) from LSCS, well beyond the range of LSCS noise.

Title 35, Subtitle H, of the Illinois Code (Illinois Noise Pollution Control Regulations) contains the state's noise regulations which are based on the relative sensitivity of adjacent properties. Class A land is the most sensitive and includes county/state/national parks, recreation areas, residential areas, nursing homes, retirement homes, hospitals, hotels, and motels. Class B lands are generally those occupied by retail businesses. Class C lands are those occupied by agricultural operations, manufacturing facilities, mines, refineries, and power plants, including nuclear plants. LSCS and the adjacent properties are considered Class C. The closest Class A property is the Marseilles State Fish and Wildlife Area, approximately 1.5 mi north of the plant boundary and more than 2 mi from the power block.

Section 5.6 of the 1977 operating license stage Environmental Report (ComEd 1977) confirms the applicability of Title 35, Subpart H of the Illinois Code and concludes that:

Although predictions indicate that existing ambient noise levels near the plant boundary will be increased because of plant operation, the predicted levels are well within the federal guidelines, and the applicable environmental regulations of the State of Illinois.

Since 1977 no equipment changes have occurred at LSCS that would change this conclusion.

No record of an offsite noise survey since plant operations began has been found. However, since 2008, more than 100 wind turbines have been installed within a 10-km (6-mi) radius of LSCS. Exelon Generation believes that the wind turbines likely have increased offsite ambient noise in the vicinity of LSCS, but the increase seems imperceptible. No data have been collected by Exelon Generation to verify an increase in ambient noise, or support an assessment of its significance.

In the GEIS, the NRC determined that impacts of noise from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated these Category 1 issues ([NRC 2013b](#)). Because the new and significant analysis identified no information regarding LSCS operations that would change the conclusions of the GEIS regarding noise, no further analyses are required.

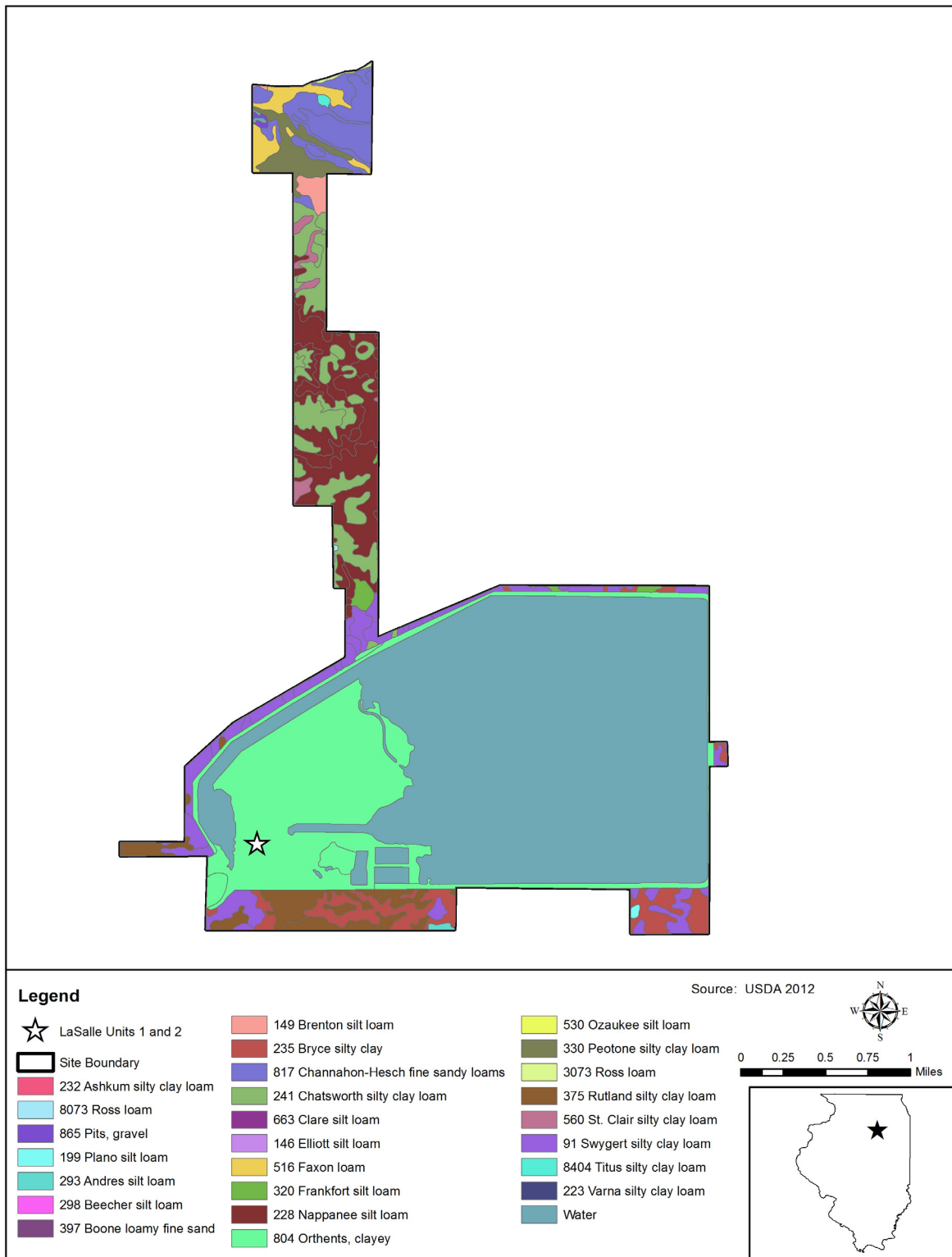


Figure 3.5-2 Agricultural Soil Characterization Map

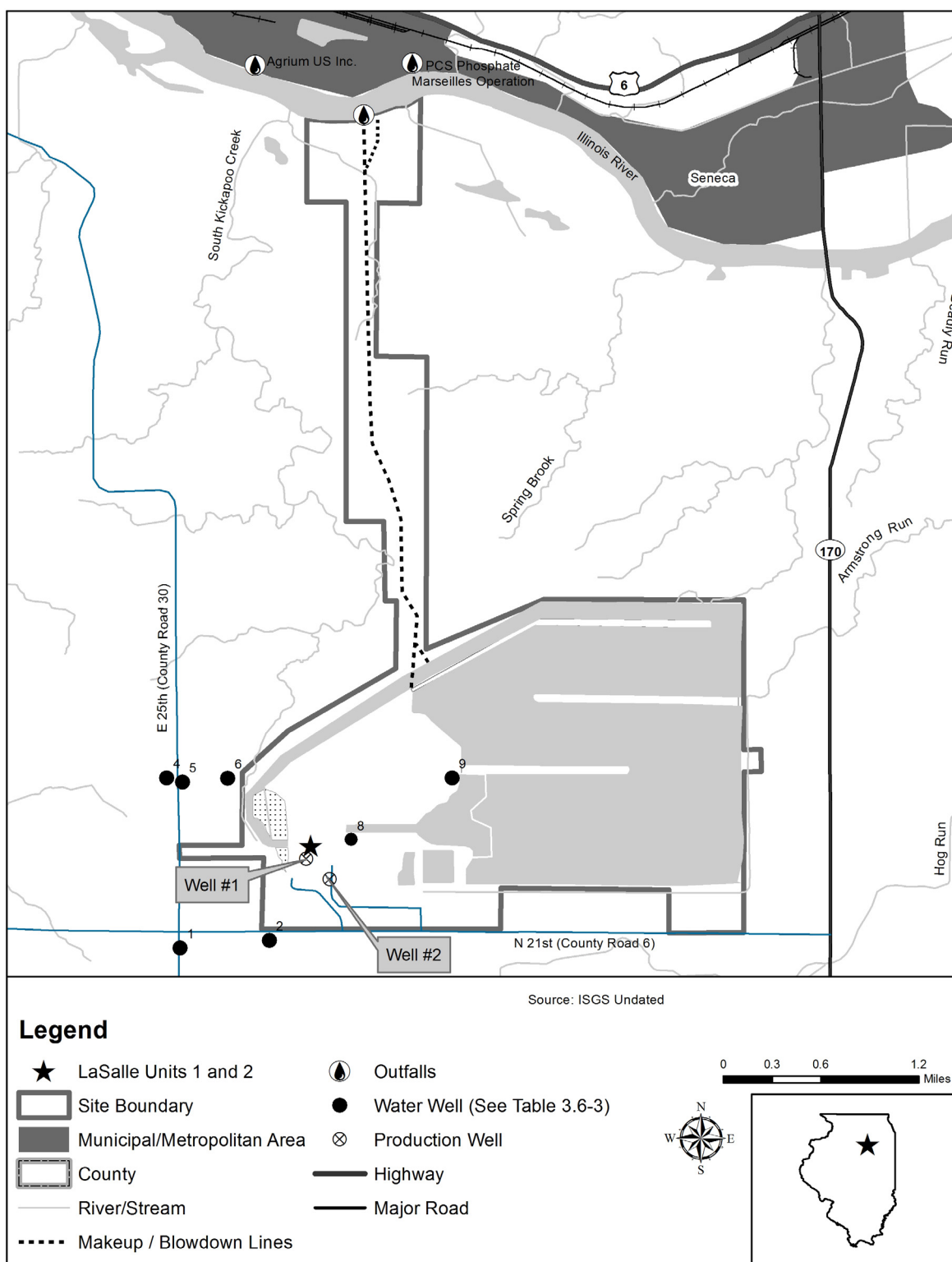


Figure 3.6-1 Surface Waters and Groundwater Well Locations at LSCS

Table 3.6-3 Wells within a 1-mi (1.6-km) Radius of LSCS

Well Id ^a	ISGS API ID	Owner	Use	Date Installed	Well Depth [m] (ft)	Aquifer / Bedrock Type
1	120992820900	Gage, Duane & Kathy	Private	2011	91 (300)	Gray shale & limestone
2	120992547800	David, Mike	Private	1997	152 (500)	St. Peters Sandstone
Well #2	120990234900	Commonwealth Edison	Not Available	1972	494 (1620)	Ironton-Galesville Sandstone
4	120992744500	Frye, Richard	Private	2004	165 (540)	Sandstone
5	120992811400	Invenergy LLC	Commercial	2009	171 (560)	St. Peters Sandstone
6	120990041700	Rose, A. D.	Not Available	1916	57(187)	Not Available
Well #1	120992245100	Commonwealth Edison	Not Available	1974	496.5 (1629)	Ironton-Galesville Sandstone
8	120992464100	Commonwealth Edison	Surface Water Recharge Well	1992	235 (770)	Limestone
9	120990041600	Marsh, J. J.	Not Available	1916	81 (265)	Not Available

Source: [ISGS Undated](#)

^a The well ID refers to the numbers on [Figure 3.6-1](#).

API – American Petroleum Institute

Wells #1 and #2 are the LaSalle production wells

3.7 Ecological Resources

LSCS occupies 1,528 ha (3,776 ac) in LaSalle County, Illinois. The Station's 833 ha (2,058 ac) cooling pond, which serves as the heat sink for dissipation to the atmosphere of waste heat from LSCS, was created by constructing dikes that rise above the surrounding land ([ComEd 1977](#)), and by pumping water into the dry, diked area through a pipeline from the Illinois River, which is located approximately 5.6 kilometers (km) (3.5 miles [mi]) north from the cooling pond.

According to the land classification system used by the U.S. Forest Service, which is based on climate, geology, topography, and vegetation, LSCS is within the Central Loess Plains Section of the Prairie Parkland (Temperate) Province of the Prairie Division of the Humid Temperate Domain. The classification Humid Temperate Domain describes a region that is affected by both tropical and polar air masses, resulting in pronounced seasons and strong annual cycles of temperature and precipitation. The Prairie Division is dominated by tall grasses with subdominant broad-leaved plants (forbs). Rates of precipitation and evapotranspiration are roughly equal, leaving little moisture available for tree growth. The vegetation consists primarily of tall prairie grasses and forbs, with trees nearly absent, except in depressions and valleys where tree roots can reach the water table. The Prairie Parkland (Temperate) Province is typically a gently rolling area of plains and low hills, with some higher hills and steep bluffs bordering river valleys. Dominant vegetation in the Prairie Parkland (Temperate) Province originally consisted of alternating prairie and deciduous forest, but much of this region has been converted to agriculture. In addition, many of the native prairies have become overgrown with trees and shrubs, and no longer resemble prairie habitats. The climate within the Prairie Parkland (Temperate) Province consists of hot summers and cold winters, with precipitation ranging from 50 to 100 cm (20 to 40 in) annually. The Central Loess Plains Section is composed of smooth and irregular plains covered with loess, which is wind-deposited fine-grained silt or clay. Vegetation communities in The Central Loess Plains were historically bluestem prairie on uplands and floodplain forests in river and creek drainages. Most small wetlands were drained when the land was converted to agriculture. Today, the Central Loess Plains is predominantly highly productive farmland, with approximately 60 percent in crops and 25 percent used for grazing ([Exelon Generation 2013b](#)).

Land use in LaSalle County is primarily agricultural, and soybeans is the most abundant crop ([Exelon Generation 2013b](#)). The area surrounding the Station is rural and agricultural, with numerous wind turbines.

3.7.1 Aquatic Communities

3.7.1.1 Introduction

The Illinois River is formed by the confluence of the Des Plaines and Kankakee Rivers in eastern Grundy County, Illinois. From its origin, the Illinois River flows west, then southwest, for 439 km (273 mi) before emptying into the Mississippi River ([Lerczak, et.al 1994](#)). Six major tributaries --- the Fox River, the Vermillion River, the Mackinaw River, the Spoon River, the Sangamon River, and the La Moine River -- and many smaller streams join the Illinois River downstream of LSCS as the Illinois River flows to the Mississippi ([ISWS 2003](#)).

The Illinois River is part of the Illinois Waterway, which provides a navigable link between Lake Michigan and the Mississippi River, and ultimately the Gulf of Mexico. This waterway consists of the Illinois River, the Des Plaines River, the Chicago Sanitary & Ship Canal, and part of the Chicago River, and is made navigable by a series of eight locks and dams along the Illinois River and its tributaries ([ISWS 2002](#)). The waterway ends at Grafton, Illinois, about 35 mi (56 km) upstream of St. Louis, Missouri, where the Illinois River joins the Mississippi River.

species, reflecting poor water quality in this reach of the river. The FES noted that “there are no records, either old or recent, of any rare or endangered fishes in this stretch of the Illinois River” (NRC 1978).

However, the improved water quality and restoration efforts discussed earlier in this section have resulted in an increase in abundance of sensitive, pollution-intolerant species. Several darter and dace species, the blackstripe topminnow (*Fundulus notatus*) and the state-listed banded killifish (*F. diaphanus*) have appeared in INHS collections over the last 10 to 15 years (McClelland, et al. 2012). The banded killifish normally occurs in shallows of glacial lakes and in clear, sandy streams with weedy margins. Locally common in New England, Minnesota, Wisconsin, and Michigan, the species is rare in Illinois, found mostly in clear lakes in Lake and Cook counties. According to Illinois DNR records, banded killifish were collected in the Illinois River immediately upstream of its confluence with the Vermillion River between 2000 and 2010 (IDNR 2012a).

The Illinois Natural Heritage Database for LaSalle County has two state-listed mussels and three-state listed fish (IDNR 2012b), but does not provide locations. U.S. Fish and Wildlife Service’s (USFWS) Midwest Region website indicates no federally listed aquatic species occur in LaSalle County (USFWS 2012).

Biologists conducting impingement studies at the LSCS river screen house observed a single American eel (*Anguilla rostrata*) in screenwash samples in June 2014 (EA 2015). The American eel was nominated for listing by Illinois DNR staff in 2012 due to declining statewide abundance and was listed as Threatened in May 2015 (IDNR 2014a, 2015). The Illinois Natural Heritage Database (IDNR 2014b) does not show the American eel occurring in LaSalle County, but since 1977, eels have been recorded from locations all along the lower and middle reaches of the Illinois River, from its mouth to Marshall County (south of the Big Bend) (INHS 2012).

The American eel is not listed by the U.S. Fish and Wildlife Service (USFWS) as either a threatened or endangered species or a candidate species. USFWS reviewed the status of the American eel in 2007, but determined that federal listing as either threatened or endangered was not warranted at that time (72 FR 4967). In September 2011, however, USFWS announced a 90-day finding (76 FR 60432) on another petition to list the species, having determined that there was substantial information indicating that listing was warranted, and a more comprehensive status review, which is still ongoing, was initiated. The USFWS is scheduled to complete a finding on whether listing is warranted by September 30, 2015. The USFWS finding could determine that (1) listing is not warranted, (2) listing is warranted but precluded by other higher-priority listing actions, or (3) listing is warranted and will be combined with a proposed rule to list the species. A “warranted but precluded” finding (i.e., option 2) would place the American eel on the USFWS “candidate species” list.

the area are consistent with the trend noted throughout the Prairie Peninsula of early farmers settling along the ecotone and accessing the forest for wood for fuel and building materials, using the prairie as open range for cattle, and plowing the more easily tillable forest soils with newly introduced steel-tipped plows. Historical sites are in very different locations compared to prehistoric sites. Whereas prehistoric sites are found along rivers, historic sites are predominantly in the uplands.

Based on the results of Exelon Generation's 2013 search of the Illinois State Archaeological Site Files, a proprietary database maintained by the Illinois State Historic Preservation Office (SHPO) and open only to cultural resource professionals, the Illinois Archaeological Survey (IAS) completed a Phase I Archaeological Survey of the LSCS site (originally proposed as the Collins Generating Station) in 1972 and concluded that the construction of the facility would have no significant impact on archaeological resources. The findings apparently were reported by Stuever in a 1972 report that has been lost². Locations LS00207, LS00208, and LS00209 were three of five isolated finds identified in the 1972 survey. At the time of the Phase I survey, IAS did not recognize isolated finds as sites, and the isolated finds were not recorded or assigned IAS accession numbers. Because isolated finds LS00207, LS00208, and LS00209, by definition, were not eligible for inclusion on the NRHP, they were not evaluated. The NRC's Final Environmental Statement relating to the operation of LSCS, which was published in November 1978 (NUREG-0486), stated that "[t]here are no historical and cultural sites recorded in the National Registry of National Landmarks, as supplemented 8 June 1976, or the National Register of Historic Places, as supplemented 3 January 1978, located on the LaSalle County Station site."

3.8.3 Post-Construction Known Historical and Archaeological Resources

For this Environmental Report, the National Register Information System (NRIS) on-line database was used to locate historic properties listed on the National Register of Historic Places (NRHP) within a 10 km (6-mi) radius of LSCS. Seven properties listed on the NRHP were identified ([Table 3.8-1](#)).

In 1993, the Illinois State Museum Society (ISMS) contracted with the Illinois Department of Military Affairs to document and analyze prehistoric and historic cultural resources in the Marseilles Training Area, which is located immediately northwest of LSCS, and is used by the Illinois Army Reserve National Guard ([Ferguson, et al. 1995](#)). A portion of the Marseilles Training Area intersects the right-of-way for the LSCS makeup and blowdown pipelines and is leased to the National Guard by Exelon Generation. Fieldwork was conducted during 1993-1994. The ISMS previously conducted a survey in portions of the project area in 1983, the results of which are discussed in the [Ferguson, et al. 1995](#) report. Forty-eight prehistoric archaeological sites and four historic archaeological sites were found in the project area during the 1993-1994 survey, including prehistoric archaeological site LS00514 and historic archaeological site LS00527. Both sites were determined not NRHP-eligible ([Table 3.8-2](#)).

The search of the Illinois State Archaeological Site Files identified 146 previously recorded archaeological sites within 10 km (6 mi) of LSCS. Five sites are on LSCS property, including the three isolated finds identified in the 1972 survey discussed above. The remaining two sites were identified in archaeological surveys conducted during 1993-1994 for the Marseilles Training Area ([Struever 1975](#); [Ferguson, et al. 1995](#)). No additional archaeological resources have been

² Exelon Generation ascertained this information from extant reports at the Illinois SHPO and from information in the LSCS operating license stage FES ([NRC 1978](#))

recorded on the LSCS property since the completion of these surveys. [Table 3.8-2](#) lists the known archaeological resources on the LSCS property.

Table 3.8-1 Sites listed on National Register of Historic Places within approximately 6 mi (10 km) of LSCS

Site Name/Number	Address	City, County	Distance from LSCS (km [mi])
Sacred Heart Church (NR165052)	221 W. Emmet St.	Kinsman, Grundy	10.2 (6.3)
Hay Barn (NR165106)	2319 N. 14th Rd.	Streator, LaSalle	12.4 (7.7)
Ransom Water Tower (NR200859)	Plumb St.	Ransom, LaSalle	9.7 (6.0)
Marseilles Hydro Plant (NR200999)	Commercial St.	Marseilles, LaSalle	9.8 (6.0)
Armour's Warehouse (NR201063)	William & Bridge Sts.	Seneca, LaSalle	9.0 (5.6)
Rock Island & Pacific Railroad Depot (NR201098)	151 Washington St.	Marseilles, LaSalle	10.4 (6.5)
Illinois & Michigan Canal (NR200462)	U.S. 6 in Channahon State Park	Lockport to LaSalle- Peru; Will, Grundy, LaSalle	7.8 (4.7)

Table 3.8-2 Archaeological Sites located within the LSCS Property

Site Number/Name	Site Types	NRHP Eligibility
LS00207/ Collins Station Site #1	Unknown Prehistoric	Isolated, Not Eligible
LS00208/ Collins Station Site #2	Unknown Prehistoric	Isolated, Not Eligible
LS00209/ Collins Station Site #3	Unknown Prehistoric	Isolated, Not Eligible
LS00514/ Boog Powell	Unknown Prehistoric	Not Eligible
LS 00527	Historic	Not Eligible

3.10 Human Health

3.10.1 Microbiological Hazards

As discussed in [Section 2.2](#), LSCS uses a cooling pond for condenser cooling. Under an NPDES permit ([Appendix C](#)), the Station continually releases blowdown water from the cooling pond to the Illinois River to prevent the buildup of salts and solids in the cooling pond. Most of the cooling pond is managed by the Illinois Department of Natural Resources as a recreational resource that is open to the public for fishing from approximately mid-March through mid-October. Some areas of the cooling pond are off-limits to the public; these areas are clearly marked with either buoys or signs. Swimming, wading, water skiing, and sailing are not allowed.

The license renewal GEIS ([NRC 2013b](#)) discusses microbiological hazards around nuclear power plants, including background information, results of studies of microbiological hazards in cooling towers, hazards to plant workers, and hazards to members of the public. The discussion of specific hazards focuses on the thermophilic microorganisms, *Legionella* spp. and *Naegleria fowleri*, which can be a hazard, respectively, in cooling towers and cooling water discharge. There have been no Exelon Generation or state studies done to determine the presence of these microorganisms in waters influenced by LSCS.

Legionella can be a hazard to plant workers performing maintenance in cooling towers and on condenser tubes. Although LSCS does not use cooling towers, condenser tube maintenance may occur. Plant workers cleaning condenser tubes are protected by a plant procedure that provides a standard methodology for identifying industrial hazards prior to performance of jobs. Under this procedure, possible factors that may influence safe execution of the job, including chemical and biological hazards, would be considered and appropriate worker protection measures would be designated for use during performance of the work. Exposure of members of the public to *Legionella* from LSCS operations would not be expected because there is no opportunity for these pathogens to be sufficiently concentrated at expected exposure points.

Naegleria fowleri in heated plant effluent can be a hazard to recreational water users. Potential for exposure by recreational users exists in the cooling pond and in the discharge to the Illinois River. *Naegleria* infection is the cause of primary amebic meningoencephalitis, an extremely rare disease that is usually fatal: only 28 cases involving recreational surface water were reported in the entire US from 2003 to 2012 ([CDC 2013](#)).

The GEIS ([NRC 2013b](#)) states that *Naegleria* is rarely found in water cooler than 35°C (95°F), but it thrives in temperatures ranging from 35°C (95°F) to 41°C (106°F) or higher. During 2011 and 2012, the highest maximum daily temperatures in the cooling pond discharge to the Illinois River occurred in August and were 38°C (101°F) and 37°C (99°F), respectively ([Exelon Nuclear 2011b](#); [Exelon Nuclear 2012b](#)). LSCS's NPDES permit allows a zone of mixing in the river and limits the temperature at the edge of the mixing zone to less than 5°F higher than the ambient river temperature. Furthermore, the temperature beyond the mixing zone cannot exceed specified monthly limits for longer than 1 percent of any 12-month period, and cannot at any time exceed the specified monthly limit by more than 1.7°C (3°F). The specified limit in August is 32°C (90°F). Hence, in extremely hot weather, plant operations must be adjusted, if necessary, to assure that the river temperature outside the mixing zone does not exceed 34°C (93°F) (See Special Condition C of the NPDES permit, [Appendix C](#)). A 2009 Exelon Generation thermal evaluation indicates that the average August river temperature is 24.7°C (76.5°F) ([Exelon Nuclear 2009b](#)) and that well-mixed river water temperatures would not approach the permit limits at any time ([Exelon Nuclear 2009b](#)).

4.13 Impacts Common to All Alternatives: Uranium Fuel Cycle

Non-radiological impacts of the uranium fuel cycle, which the GEIS ([NRC 2013b](#)) designates as a Category 1 issue, were reviewed for new and significant information that could make the generic finding for a resource as described in the 2013 GEIS inapplicable at LSCS. No new and significant information was identified. Therefore, Exelon Generation adopts the non-radiological impacts of the uranium fuel cycle on environmental resources that are described in the GEIS, and no further analysis is needed for LSCS.

The final spent fuel continued storage rule and Generic EIS for Continued Storage of Spent Nuclear Fuel (79 *Federal Register* 56238, 56250 (September 19, 2014)) update the 2013 GEIS evaluation of the effects of onsite storage of spent fuel during the term of an extended license (resulting from the renewal of the plant's operating license). The updated evaluation concludes that impacts, including radiological impacts, of onsite storage of spent fuel during the term of an extended license would be SMALL. Exelon Generation is aware of no new and significant information that could make the generic finding regarding radiological impacts of onsite storage of spent fuel during the term of an extended license invalid for LSCS. Therefore, Exelon Generation adopts the conclusion described in the Generic EIS for Continued Storage of Spent Nuclear Fuel for this Category 1 issue ([NRC 2013b](#)), and no further analysis is needed for LSCS.

The final spent fuel continued storage rule and Generic EIS for Continued Storage of Spent Nuclear Fuel also update the evaluation in the 2013 GEIS regarding the radiological impacts to the environment from the offsite disposal of spent nuclear fuel and high-level waste and reclassify the issue from an uncategorized issue to a Category 1 issue (79 *Federal Register* 56238, 56263 (September 19, 2014)). The updated evaluation concludes that radiological impacts of offsite disposal of spent nuclear fuel and high-level waste would not be sufficiently large to require elimination of the option of extended operation under 10 CFR Part 54. Exelon Generation is aware of no new and significant information that could make the generic finding regarding radiological impacts of offsite disposal of spent nuclear fuel and high-level waste invalid for LSCS-generated spent nuclear fuel. Therefore, Exelon Generation adopts the conclusion described in the Generic EIS for Continued Storage of Spent Nuclear Fuel for this Category 1 issue, and no further analysis is needed for LSCS.

Information regarding the impacts of transporting spent nuclear fuel, which is a Category 1 issue, was also reviewed. Some information for LSCS was found to be new but is not significant for the reasons explained below.

NRC has standardized the analysis of impacts for transporting radioactive materials to and from nuclear reactors in Table S-4 of 10 CFR 51.52. Table S-4 provides the impacts for transport of fresh fuel to and spent fuel from a reference 1,100-MWe reactor operating at 80 percent capacity factor under normal and accident conditions ([AEC 1972](#)). The 2013 GEIS ([NRC 2013b](#)) concluded that such impacts would be SMALL for fresh fuel enriched up to 5 percent uranium-235 and for spent fuel with an average burnup for the peak rod of up to 62,000 MWd/MTU (megawatt-days per metric ton uranium). Also, the cumulative impacts of transporting spent fuel to a single repository, such as Yucca Mountain, Nevada were found to be consistent with the impact values contained in Table S-4. Accordingly, the GEIS concluded that transportation of radiological materials was a Category 1 issue with SMALL impacts, regardless of the nuclear plant being considered.

As [Section 2.2.2](#) indicates, both LSCS units are licensed for low-enriched, uranium dioxide fuel with enrichment not exceeding a nominal 5.0 percent by weight of uranium-235. However, the average peak rod fuel burn-up for both LSCS units is projected to exceed 62,000 MWd/MTU in some rods in some fuel cycles. Accordingly, Exelon Generation has assessed the implications for the environmental impact values reported in Table S-4 of 10 CFR 51.52. Results of the assessment are summarized below.

Spent Fuel Characteristics

Both LSCS units have fuel in the core that includes part-length rods. The fuel includes the Global Nuclear Fuel (GNF) 2 and AREVA ATRIUM-10 nuclear fuel assemblies. ([Weggeman 2014](#); [BWR 2008](#))

- The GNF2 design is a 10×10 array with 92 fuel rods and two large central water rods, eight long part-length rods and six short part-length rods. ([Exelon Generation 2013d](#)).
- The ATRIUM-10 design is a 10×10 array with 83 full-length fuel rods, 8 part-length fuel rods, and one centrally located water channel ([Exelon Nuclear 2012a](#)).

The part-length fuel rods are attached to the fuel bundle lower tie plate and typically experience higher burnups and higher power than full-length rods due to the bottom-peaked axial power shapes that exist throughout a large portion of a BWR fuel cycle. Average peak rod burnup for some LSCS Unit 1 part-length rods has been estimated to reach approximately 63,600 MWd/MTU in a near-term fuel cycle. Average peak rod burnup for full-length rods is not expected to exceed 62,000 MWd/MTU.

Methodology

Exelon Generation evaluated the radiological effects of transporting either GNF2 or ATRIUM-10 spent fuel assemblies with high burnup. The ORIGEN code was used to estimate radionuclide inventories for the fuel. A representative high-burnup case was identified for the GNF2 fuel at a burnup level of 75,000 MWd/MTU and enrichment of 5.0 percent by weight of uranium-235. The radionuclide inventory for this case was used in the RADTRAN analysis to estimate the radiological impacts of transportation of high-burnup spent fuel to a repository for disposal. For purposes of analysis, the destination for the shipments was assumed to be Yucca Mountain Nevada. Exelon Generation assumed that all spent fuel shipments would be made using legal weight trucks. Fuel shipments were assumed to take place 5 years after discharge from the reactor. The average annual quantity of spent fuel shipped is assumed to equal the average annual reload quantity (approximately 138 fuel assemblies per year per reactor) for a 24-month refueling cycle.

Environmental Impacts of Transportation

Incident-free Transportation

An evaluation of incident-free transportation of LSCS spent fuel was performed. It considered whether the environmental effects of normal (incident-free) spent fuel shipments of LSCS spent fuel would be within the bounds established by Table S-4 in 10 CFR 51.52. The Table S-4 cumulative doses to the exposed populations are:

Transportation workers	4 person-rem/reactor-year
General public (onlookers) ⁴	3 person-rem/reactor-year
General public (along route) ⁵	3 person-rem/reactor year

The RADTRAN analysis output provides the population doses for LSCS spent fuel as person-rem per shipment. These doses have been converted to person-rem per reactor-year of operation, as summarized in the table below, for comparison with the Table S-4 values. The per-shipment results are independent of burnup because the external radiation dose rate emitted from the shipping cask was set to the regulatory limit established by U.S. Department of Transportation regulation 49 CFR §173.441(b) and is independent of the actual cask contents. The characteristics of the LSCS reactors (annualized number of fuel assemblies discharged, combined electrical output of 2,327 MW(e), capacity factor of 92 percent) were used to normalize the results to a reference reactor year for comparison to Table S-4.

The population dose estimates for LSCS spent fuel shipments are summarized below.

Population dose (person-rem per shipment)		
Transportation workers	General public (onlookers)	General public (along route)
0.0357	0.439	0.0335
Population dose (person-rem per reactor year)		
Transportation workers	General public (onlookers)	General public (along route)
1.43	17.6	1.34

Annual population doses associated with incident-free transportation of LSCS spent fuel with burnup to 75,000 MWD/MTU are within the bounds of the doses given in 10 CFR 51.52, Table S-4, for transportation workers and members of the general public living near the highway along the route. For onlookers along the transportation route, however, the population dose is higher than the Table S-4 value. For the reasons discussed below, Exelon Generation does not consider impacts to human health or the environment caused by these higher onlooker population doses to be so different from the impacts for incident-free spent fuel transport envisioned in the 2013 GEIS as to be significant.

⁴ Persons at stops and sharing the highway

⁵ Persons living near the highway (within 800-meter buffer on each side)

Two key reasons for the higher onlooker population dose relative to Table S-4 are the number of spent fuel shipments and the shipping distances assumed for the LSCS analysis relative to the assumptions used in WASH-1238, which was the basis for the Table S-4 values.

- The analyses in WASH-1238 used a “typical” distance for a spent fuel shipment of 1,000 miles. The shipping distance used in this LSCS assessment is about 1,800 miles.
- The number of spent fuel shipments evaluated in WASH-1238 is based on shipping casks designed to transport 0.5 MTU/cask while meeting the regulatory limit for dose rate from the cask. Accordingly, for the purpose of comparison with Table S-4 values, the LSCS analysis also assumes a shipping capacity of 0.5 MTU per cask with a limit of one cask per legal-weight truck shipment. However, the actual number of spent fuel shipments from LSCS is likely to be smaller than is predicted by this assumption for the following reasons.
 1. Because LSCS spent fuel will have undergone much longer cooling times before being transported than was assumed in WASH-1238 (i.e., at least 5 years versus 150 days), it will in reality be shipped in casks with newer designs that have larger capacities than were assumed in WASH-1238. For example, spent fuel shipping cask capacities used in the Yucca Mountain environmental impact statement ([DOE 2002](#)) were approximately 1.8 MTU with a limit of one cask per legal-weight truck shipment. Also, the spent fuel shipping cask expected to actually be used to ship LSCS spent fuel is designed to hold approximately 1.6 MTU. Hence, if the transportation analysis is completed using this newer shipping cask design, the number of assumed spent fuel shipments for LSCS spent fuel decreases by a factor of approximately three.
 2. Allowing higher fuel burnup in the reactor core reduces the annual number of spent fuel shipments needed to support generation of a given amount of power because the length of time between refueling outages would be lengthened to reach the higher burnup level, which would result in removal of fewer spent fuel assemblies on an annual basis.

If the number of spent fuel shipments from LSCS in the transportation analysis is reduced to a more likely smaller number than is predicted by assuming shipments limited to 0.5 MTU per cask, the associated environmental impacts are reduced correspondingly (since the dose rates used to assess impacts are fixed at the regulatory limit rather than based on the contents). Such an approach is supported by the 1999 addendum to the 1996 GEIS ([NRC 1999](#)), in which NRC considered transportation impacts associated with higher enrichment fuel irradiated to higher burnup levels. Therein, NRC concluded higher burnup fuel could be accommodated without increasing the number of single-cask shipments (and hence without increasing the transportation impacts) through dose control measures such as increasing spent fuel storage times prior to shipment (15 years instead of 5 years), blending higher burnup and lower burnup fuel assemblies in the same shipping cask, or using inserts to reduce the external dose and enable shipping casks to be certified for higher burnup fuel without impacting cask capacity.

Other conservative assumptions in the spent fuel transportation impacts calculation for LSCS include:

- Use of the regulatory maximum dose rate (10 millirem per hour at 2 meters) in the LSCS RADTRAN calculations. In reality, most spent fuel from LSCS will have cooled for much longer than 5 years before it is shipped to a possible geologic repository. In the Yucca Mountain environmental impact statement (DOE 2002), NRC developed a probabilistic distribution of dose rates based on fuel cooling times that indicates that approximately three-fourths of the spent fuel to be transported to a possible geologic repository will have dose rates less than half of the regulatory limit (Sprung et al. 2000) as a result of cooling times being longer than 5 years. Consequently, the estimated population doses could be divided in half if more realistic dose rate projections are used for LSCS spent fuel shipments.
- Use in the LSCS RADTRAN calculations of 30 minutes as the average time at a truck stop. Many stops made for actual spent fuel shipments are short duration stops (i.e., 10 minutes) for brief visual inspections of the cargo (checking the cask tie-downs). These stops typically occur in minimally populated areas, such as an overpass or freeway ramp in an unpopulated area. Based on data for actual truck stops, NRC concluded that the assumption of a 30-minute stop for every 4 hours of driving time used in Early Site Permit applications to evaluate spent fuel shipments from potential nuclear plant sites would overestimate public doses at stops by at least a factor of two (NRC 2006a, 2006b, 2006c). Consequently, the estimated doses to onlookers along the transportation route during transport of LSCS spent fuel could be reduced by a factor of two if more realistic truck shipping conditions were assumed.

In conclusion, if (1) the shipping distance to a repository was reduced for LSCS spent fuel to 1,000 miles, (2) conservative assumptions affecting the number of spent fuel shipments were replaced in the dose estimates with more realistic assumptions specific to LSCS, and (3) other conservative assumptions about dose rates and the length of truck stops were changed to be more realistic, then the onlooker population doses from LSCS high-burnup fuel shipments would be expected to fall within Table S-4 values. Therefore, because the predicted population doses to transportation workers and persons living near the highway are within the bounds of the Table S-4 population dose values, and the conservatively predicted population dose to onlookers would likely also be below Table S-4 values if more realistically estimated, Exelon Generation concludes that impacts to human health or the environment from incident-free LSCS high-burnup spent fuel transport would be similar to the impacts envisioned in the 2013 GEIS, and would therefore be SMALL.

Accidents during Transportation

Exelon Generation evaluated the environmental effects of accidents during transport of LSCS high-burnup spent fuel. Accident risks are the multiplicative product of the likelihood of an accident involving a spent-fuel shipment and the consequences of a release of radioactive material resulting from the accident. The consequences of such a transportation accident are represented by the population dose risk from a release of radioactive material, assuming that an accident occurs that results in the breach of a shipping cask's containment systems. The consequences are a function of the total amount of radioactive material in the shipment, the fraction that escapes from a shipping cask, the existence of a pathway that introduces radioactive material to humans, and the characteristics of the exposed population.

Exelon Generation used the RADTRAN code to estimate impacts of transportation accidents involving spent fuel shipments. In the RADTRAN analysis, increasing burnup affects both the likelihood of transportation accidents and the potential consequences of a release. The likelihood of an accident is directly proportional to the number of spent fuel shipments.

Assuming shipments containing 0.5 MTU of spent fuel at the peak rod burnup, the postulated accident risks associated with transportation of spent fuel are provided below.

Population dose-risk (person-rem per shipment) ⁶	Population dose-risk (person-rem per reference reactor year)
5.64×10^{-7}	2.25×10^{-5}

Table S-4 characterizes the radiological effects of transportation accidents as SMALL, but does not numerically quantify these effects. The accident collective dose-risk consequences from shipments of spent fuel from LSCS are very small, as shown in the table above. For comparison, the U.S. average background radiation is approximately 620 mrem per year, with roughly half of the dose (310 mrem per year) coming from natural radiation exposure and the other half from man-made sources (NRC 2014). The total population within the 800-meter buffer zone along the transport route is 521,025 people. Thus, the population along the transport route receives an average collective dose-risk of approximately 162,000 person-rem per year from exposure to natural sources of radiation. Given that the probability of occurrence of this dose is one, the dose-risk is also 162,000 person-rem per year. Comparing the average annual collective dose-risk to the probability-weighted collective dose-risk from the annualized spent fuel shipments shows that the contribution of fuel shipments from LSCS to the total population collective dose is extremely small. Therefore, no detectable increase in environmental effects is expected as a result of the population dose caused by accidents that may result from shipments of high-burnup spent fuel from LSCS to a repository. Accordingly, Exelon Generation concludes that impacts to human health or the environment from accidents during LSCS high-burnup spent fuel transport would be similar to the impacts envisioned in the 2013 GEIS and would therefore be SMALL.

Heat Load

Table S-4 characterizes the heat load for a spent fuel cask as 250,000 Btu/hr. Exelon Generation used the ORIGEN code to estimate the decay heat 5 years after discharge for spent fuel with burnup of 75,000 MWD/MTU. The estimated heat load for a cask containing 0.5 MTU of such high-burnup fuel is approximately 7,370 BTU/hr. This amount of heat is small and released over the entire transportation route. Accordingly, Exelon Generation concludes that impacts during shipment of LSCS high-burnup spent fuel would be similar to the impacts envisioned in the 2013 GEIS, and would therefore be SMALL.

⁶ The value presented is the product of probability times collective dose.

Conclusion

Based on the analyses above, Exelon Generation concludes that, overall, impacts of transporting LSCS's high-burnup spent nuclear fuel would be consistent with the impacts from doses given in 10 CFR 51.52, Table S-4, and hence, would be SMALL. Accordingly, while the expectation that average peak rod burnup in some part-length fuel rods at LSCS will exceed 62,000 MWd/MTU is new information, it is not significant because it does not provide a seriously different picture of the environmental consequences of transporting spent fuel than previously considered in the 2013 GEIS ([NRC 2013b](#)) for all plants. Therefore, no further mitigation would be required based on this new information.

5.2 Uranium Fuel Cycle – Transportation

In 1999, the NRC issued an addendum to the 1996 GEIS ([NRC 1999b](#)) in which the agency concluded that the values given in 10 CFR 51.52, Table S-4 would bound the environmental impacts of transporting spent fuel and waste to and from one nuclear power plant, as long as (1) enrichment of the fresh fuel was 5 percent or less, (2) burn-up of the spent fuel was 62,000 MWd/MTU or less, and (3) spent fuel was cooled for at least 5 years before being shipped offsite. In the 2013 GEIS ([NRC 2013b](#)), the NRC noted that a later study found that the impacts presented in Table S-4 would also bound the potential environmental impacts that would be associated with transportation of spent nuclear fuel with up to 75,000 MWd/MTU burnup, provided that the fuel is cooled for at least 5 years before shipment ([NRC 2013b](#)).

As noted in [Section 2.2.2](#), the peak fuel burnup at LSCS is projected to exceed 62,000 MWd/MTU in some part-length fuel rods during some fuel cycles. Accordingly, Exelon Generation assessed the potential impacts of the fuel burnup of partial-length rods exceeding 62,000 MWd/MTU and compared the results with the environmental impact values reported in 10 CFR 51.52, Table S-4. Based on this analysis, which is described in [Section 4.13](#) of this environmental report, Exelon Generation concludes that, while this information for LSCS is new, it is not significant because impacts from transporting LSCS spent fuel with higher burnup would be SMALL and similar to the values presented in 10 CFR 51.52, Table S-4. Therefore, future transportation of LaSalle-generated spent fuel with burnup exceeding 62,000 MWd/MTU does not present a seriously different picture of environmental consequences from the spent fuel transportation circumstances generically resolved in the 2013 GEIS to be a Category 1 issue.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

NRC

The environmental report shall discuss the “...relationship between local short-term uses of man’s environment and the maintenance and enhancement of long-term productivity...” 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at LSCS was established with the decision to convert approximately 1,528 ha (3,776 ac) to energy production. The Final Environmental Statement related to operation ([NRC 1978](#)) evaluated the impacts of operating LSCS. Natural resources that would be subjected to short-term use include land and water. Land in the immediate vicinity of LSCS is largely rural and agricultural.

At 100 percent load, LSCS’s net consumptive loss rate of Illinois River water is less than 0.5 percent of the 92-year annual average mean flow at Marseilles. LSCS withdraws approximately 99 L/min (26.1 gpm) of groundwater from the Cambrian-Ordovician Ironton-Galesville Sandstone Aquifer.

Tritium from historic releases is present in shallow groundwater beneath LSCS. The contaminated plume does not extend offsite. Exelon Generation is performing mitigation that will avoid any long-term adverse impacts to groundwater. LSCS has a radiological groundwater protection program that includes groundwater monitoring and provides for timely identification and remediation of spills to groundwater or soils. Impacts to groundwater have been minor and would cease once reactor operations, including decommissioning, cease.

After decommissioning of the nuclear facilities at the site, most environmental disturbances would cease and restoration of the natural habitat could occur. Thus, the “trade-off” between the production of electricity and changes in the local environment is reversible to some extent. The cooling pond cannot be maintained without input from the Illinois River to replace water lost to naturally-occurring surface evaporation and seepage (although seepage is minimal, some seepage does occur). Because the cooling pond is an important recreational facility in the area and supports aquatic waterfowl, Exelon Generation and Illinois would decide its fate at the time of decommissioning.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use. The degree of dismantlement will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impacts. However, decisions on the ultimate disposition of these lands have not yet been made. Continued operation for an additional 20 years would not increase the short-term productivity impacts described here.

Chapter 10

References

LaSalle County Station Environmental Report

10.0 References

- (AEC 1972) U.S. Atomic Energy Commission. 1972. WASH-1238. Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants. December 1972.
- (Arcadis 2012) Arcadis. 2012. 10 CFR 50 Appendix E Evacuation Time Estimate Analysis for LaSalle County Station. Evacuation time estimates for LaSalle County Generating Station Plume Exposure Pathway Emergency Planning Zone. Chelmsford, MA. December 12, 2012.
- (Archer and Jacobson 2007) Archer, C. L., and M. Z. Jacobson. 2007. Supplying Baseload Power and Reducing Transmission Requirements by Interconnecting Wind Farms. *Journal of Applied Meteorology and Climatology*, 46: 1701-1717. November 2007. ©.
- (Associated Press 2012) The Associated Press. 2012. Feds, 5 states to push for Great Lakes wind farms. March 30, 2012. Retrieved from http://blog.mlive.com/chronicle/news_impact/print.html?entry=/2012/03/feds_5_states_to_push_for_grea.html on February 23, 2014.
- (BEA 2013) Bureau of Economic Analysis. 2013. Regional Economic Accounts. Accessed June at <http://www.bea.gov/regional/reis/>.
- (BLM/DOE 2010) Bureau of Land Management and U.S. Department of Energy. 2010. Draft Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States. DES 10-59; DOE/EIS-0403. December 2010.
- (Brattle Group 2010) The Brattle Group. 2010. Potential Coal Plant Retirements Under Emerging Environmental Regulations. December 8, 2010. ©.
- (Buinickas 2013) Buinickas, B. 2013. Telecon: P.M. Moore, Tetra Tech, Regarding Possible Limits on Withdrawals of Illinois River for Cooling Pond Makeup during Low-flow and Drought Periods. August 13, 2013.
- (Burch 2008) Burch, S. L. 2008. A Comparison of Potentiometric Surfaces for the Cambrian-Ordovician Aquifers of Northeastern Illinois, 2000 and 2007. Data/Case Study 2008-04. Illinois State Water Survey. University of Illinois at Urbana-Champaign. December 2008.
- (BWR 2008) BWR Owner's Group, Alternative Source Team Committee. 2008. Interpretation of Footnote 11 to Regulatory Guide 1.183. BWROG-TP-08-018, Rev. 0. July 2008.
- (Byrant 2013) Byrant, T.P. 2013. Email: to K. Dearing, Tetra Tech. Re: Illinois River users. June 17, 2013.
- (CDC 2013) Centers for Disease Control and Prevention. 2013. "Primary Amebic Meningoencephalitis (PAM) - *Naegleria fowleri*". Retrieved from <http://www.cdc.gov/parasites/nawgleria/general.html> on June 13, 2013.
- (CEC 2011) California Energy Commission. 2011. Ocean Energy. Retrieved from <http://www.energy.ca.gov/oceanenergy/index.html> on January 30, 2012.

- (Changon, et al. 2004) Changon, S. A., J. R. Angel, K. E. Kunkel, and C. M. Lehmann. 2004. Climate of Illinois. Illinois State Water Survey. Champaign, Illinois.
- (Coal Age 2012) Coal Age. 2012. Prospects Dim for CCTs, Only Southern and Duke Continue with IGCC. Retrieved from <http://www.coalage.com/index.php/news/latest/61-uncategorised/2004-prospects-dim-for-ccts-only-southern-and-duke-continue-with-igcc.html> on October 7, 2013.
- (ComEd 1977) Commonwealth Edison Company. 1977. LaSalle County Station Environmental Report Operating License Stage. Volume 1. May 10, 1977.
- (ComEd 1994a) Commonwealth Edison Company. 1994. LaSalle County Nuclear Power Station, Individual Plant Examination and Individual Plant Examination (External Events) Draft Submittal Report. April.
- (ComEd 1994b) Commonwealth Edison Company. 1994. LaSalle County Nuclear Power Station, Individual Plant Examination and Individual Plant Examination (External Events) Submittal. NRC Dockets 50-373 and 50-374. December.
- (ComEd 2013) Commonwealth Edison. 2013. A company shaped by customers and employees. Retrieved from <https://www.comed.com/about-us/company-information/Pages/profiles.aspx> on September 5, 2013. ©.
- (CRA 2006) Conestoga-Rovers & Associates. 2006. Hydrogeologic Investigation Report - Fleetwide Assessment, LaSalle Generating Station, Marseilles, IL. Revision 1. Prepared for Exelon Generation Company. LLC. September 2006.
- (CRE 2013) Center for Renewable Energy. 2013. Illinois Wind Farm Database - Completed Projects. Illinois Wind Working Group. Center for Renewable Energy, Illinois State University. Normal, IL. Retrieved from <http://renewableenergy.illinoisstate.edu/wind/> on September 4, 2013.
- (Crone and Wheeler 2000) Crone, A. J., and R. L. Wheeler. 2000. Data for Quaternary faults, liquefaction features, and possible tectonic features in the Central and Eastern United States, east of the Rocky Mountain front - Open File Report 00-260. U.S. Geological Survey U.S. Department of the Interior. Denver, Colorado.
- (DNR 2014) Illinois Department of Natural Resources. 2014. Fish Hatcheries in Illinois. Retrieved from <http://www.ifishillinois.org/programs/hatchery.html> on February 5, 2014.
- (DOE 2008) U.S. Department of Energy. 2008. 20% Wind Energy by 2030 - Increasing Wind Energy's Contribution to U.S. Electricity Supply. Office Energy Efficiency and Renewable Energy. July 2008.
- (DOE 2010) U.S. Department of Energy. 2010. Next Generation Nuclear Plant. A Report to Congress. Office of Nuclear Energy. Washington, DC. April 2010.

- (DOE 2011) U.S. Department of Energy. 2011. Wind And Water Power Program. Water Power for a Clean Energy Future. DOE/GO-102011-3287. DOE Office of Energy Efficiency and Renewable Energy. June 2011.
- (DOE 2002) U.S. Department of Energy. 2002. Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. DOE/EIS-0250. Washington Office of Civilian Radioactive Waste Management, D.C.
- (DSIRE 2013a) Database of State Incentives for Renewables & Efficiency. 2013. Renewable Portfolio Standard Policies. March 2013. Retrieved from <http://www.dsireusa.org/incentives/> on February 23, 2014. ©.
- (DSIRE 2013b) Database of State Incentives for Renewables and Efficiency. 2013. Incentives/Policies for Renewables & Efficiency. Authority: 26 USC § 45. October 2, 2013. Retrieved from <http://www.dsireusa.org/incentives/> on February 8, 2014. ©.
- (EA 2002) EA Engineering, Science and Technology. 2002. Assessment of the LaSalle County Station Cooling Pond. Deerfield, IL.
- (EA 2014) EA Engineering, Science, and Technology, Inc. 2014. LaSalle County Station 2013 Fish and Benthos Monitoring and Historical Fish and Benthos Comparisons. Deerfield, IL. March 2014.
- (EA 2015) EA Engineering, Science, and Technology, Inc. 2015. (Draft) Impingement and Entrainment Characterization Study, LaSalle County Nuclear Station). Deerfield, Illinois.
- (ECW 2009) Energy Center of Wisconsin. 2009. A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest. A Policy White Paper in Support of the Midwestern Governors Association Energy and Climate Change Platform. DOE/GO-102009-2823. August 2009. ©.
- (EERE 2006) DOE Office of Energy Efficiency and Renewable Energy. 2006. Feasibility Assessment of the Water Energy Resources of the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants. DOE-ID-11263. January 2006.
- (EERE 2009) DOE Office of Energy Efficiency and Renewable Energy. 2009. Ocean Energy Technology Overview. DOE/GO-102009-2823. July 2009.
- (EERE 2013) DOE Office of Energy Efficiency and Renewable Energy. 2012. Fuel Cell Technologies Market Report. DOE/GO-102009-2823. October 2013.
- (EIA 2008) U.S. Energy Information Administration. 2008. Electricity: Michigan Restructuring Active. September 2008. Retrieved from <http://www.eia.gov/cneaf/electricity/page/restructuring/michigan.html> on February 22, 2012.

- (EIA 2009) U.S Energy Information Administration. 2009. Electricity: Illinois Restructuring Active. September 2009. Retrieved from <http://www.eia.gov/cneaf/electricity/page/restructuring/illinois.html> on February 22, 2012.
- (EIA 2010a) U.S. Energy Information Administration. 2010. Status of Electricity Restructuring by State. September 2010. Retrieved from http://205.254.135.24/cneaf/electricity/page/restructuring/restructure_elect.html on January 19, 2012.
- (EIA 2010b) U.S. Energy Information Administration. 2010. Levelized Cost of New Generation Resources in the Annual Energy Outlook 2011. Docket No(s). DOE/EIA-0383(2010). December 2010.
- (EIA 2011) U.S. Energy Information Administration. 2011. EIA 423 Monthly Nonutility Fuel Receipts and Fuel Quality Data, 2002-2007 and EIA 923 (Schedule 2) - Monthly Utility and Nonutility Fuel Receipts and Fuel Quality Data. Retrieved from <http://www.eia.gov/cneaf/electricity/page/eia423.html> on February 2, 2012.
- (EIA 2014) U.S. Energy Information Administration. 2014. State Electricity Profiles Data for 2012. Retrieved from <http://www.eia.gov/electricity/state/> on July 10, 2014.
- (EIA 2013a) U.S. Energy Information Administration. 2013. U.S. Nuclear Generation and Generating Capacity Monthly Nuclear Utility Generation by State and Reactor, 2011. August 27, 2013. Retrieved from <http://www.eia.gov/nuclear/generation/index.html> on September 5, 2013.
- (EIA 2013b) U.S. Energy Information Administration. 2013. Table A8 - Electricity supply, disposition, prices and emissions and Table A9 - World consumption of hydroelectricity and other renewable energy by region, Reference case. Annual Energy Outlook 2013.
- (EIA 2013c) U.S. Energy Information Administration. 2013. Electric Power Annual 2011. Table 10-1 - Demand-side management program annual effects by program category and Table 10.5 - Demand-side management program direct and indirect costs. January 30, 2013. Retrieved from <http://www.eia.gov/electricity/annual/> on September 16, 2013.
- (EPA 1998a) U.S. Environmental Protection Agency. 1998. AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. Section 1.1 Bituminous and Subbituminous Coal Combustion. September 1998.
- (EPA 1998b) U.S. Environmental Protection Agency. 1998. Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone; Final Rule. Federal Register 63 (207). 57355-57404. Washington, DC. October 27, 1998.
- (EPA 2000) U.S. Environmental Protection Agency. 2000. AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. 3.1 Stationary Gas Turbines. April 2000.
- (EPA 2007) U.S. Environmental Protection Agency. 2007. Biomass Combined Heat and Power Catalog of Technologies. Combined Heat and Power Partnership (CHP). September 2007.

- (EPA 2010) U.S. Environmental Protection Agency. 2010. Mercury - Controlling Power Plant Emissions: Control Technology. October 1, 2010. Retrieved from http://www.epa.gov/hg/control_emissions/technology.htm on February 1, 2012.
- (EPA 2011) U.S. Environmental Protection Agency. 2011. Subpart D - Identification of Mandatory Class I Federal Areas Where Visibility is an Important Value. 40 CFR Parts 81.400.
- (EPA 2012) U.S. Environmental Protection Agency. 2012. Climate Change - Regulatory Initiatives Greenhouse Gas Reporting Program. Retrieved from <http://www.epa.gov/climatechange/emissions/ghgrulemaking.html> on February 22, 2012.
- (EPA Undated) U.S. Environmental Protection Agency. Undated. Fact Sheet: The Cross-State Air Pollution Rule: Reducing the Interstate Transport of Fine Particulate Matter and Ozone.
- (EPRI 2010) Electric Power Research Institute. 2010. Electricity Energy Storage Technology Options - A White Paper Primer on Applications, Costs, and Benefits. Technical Update. December 2010. ©.
- (Evolution Markets 2014) Evolution Markets. 2014. Emission Reduction Credits: Illinois. Retrieved from <http://www.evomarkets.com/environment/> on February 15, 2014. ©.
- (Exelon 2009) Exelon Nuclear. 2009. 2008 Annual Emission Report - FESOP Permit No. 75040086. LaSalle County Station. February 8, 2009.
- (Exelon 2011a) Exelon Nuclear. 2011. 2010 Annual Emission Report - FESOP Permit No. 75040086. LaSalle County Station. April 28, 2011.
- (Exelon 2011b) Exelon Corporation. 2011. LaSalle U1 CY Tank Leak - 10CFR50 75(g) entry June 2010. May 17, 2011.
- (Exelon 2011c) Exelon Corporation. 2011. 2020: a low-carbon roadmap, 2011 Update. 2011. ©.
- (Exelon 2012) Exelon Corporation. 2012. Maximizing the resources we use. Retrieved from <http://www.exeloncorp.com/environment/results/land.aspx> on August 16, 2013. ©.
- (Exelon 2013) Exelon. 2013. 2012 Annual Emission Report - FESOP Permit No. 75040086. April 29, 2013.
- (Exelon Corporation 2013a) Exelon Corporation. 2013. Annual Report Pursuant to Section 13 or 15(d) of the Securities and Exchange Act of 1934 for the Fiscal Year Ended December 31, 2012. February 21, 2013.
- (Exelon Corporation 2013b) Exelon Corporation. 2013. LaSalle County Generating Station Fact Sheet. Retrieved from <http://www.exeloncorp.com/PowerPlants/lasalle/Pages/profile.aspx> on September 5, 2013. ©.
- (Exelon Generation 2005) Exelon Generation. 2005. 2004 Annual Environmental Operating Report - LaSalle County Station. April 2005.

- (Exelon Generation 2008a) Exelon Generation. 2008. Illinois Water Inventory Program: Water Withdrawals for Year 2008.
- (Exelon Generation 2008b) Exelon Generation. 2008. Potentiometric Surface Contours - July 2008 LaSalle Generating Station. July 2008. Withhold from Public Disclosure under 10 CFR 2.390.
- (Exelon Generation 2009) Exelon Generation. 2009. Illinois Water Inventory Program: Water Withdrawals for Year 2009.
- (Exelon Generation 2010a) Exelon Generation. 2010. Illinois Water Inventory Program: Water Withdrawals for Year 2010.
- (Exelon Generation 2010b) Exelon Generation Company, LLC. 2010. 2009 Annual Radiological Environmental Operating Report. 1 January through 31 December 2009. Marseilles, IL. May 12, 2010.
- (Exelon Generation 2011a) Exelon Generation. 2011. Illinois Water Inventory Program: Water Withdrawals for Year 2011.
- (Exelon Generation 2011b) Exelon Generation. 2011. LaSalle County Station Units 1 and 2, 2010 Annual Radiological Environmental Operating Report, 1 January through 31 December 2010. May 2011.
- (Exelon Generation 2011c) Exelon Generation. 2011. Application to Renew NPDES Permit No. IL0048151 for LaSalle County Station. Marseilles, IL. December 29, 2011.
- (Exelon Generation 2012a) Exelon Generation. 2012. Illinois Water Inventory Program: Water Withdrawals for Year 2012.
- (Exelon Generation 2012b) Exelon Generation. 2012. 2011 Annual Emission Report - FESOP Permit No. 75040086. April 27, 2012.
- (Exelon Generation 2012c) Exelon Generation. 2012. LaSalle County Station, Units 1 and 2, 2011. Annual Radiological Environmental Operating Report. 1 January through 31 December 2011. May 9, 2011.
- (Exelon Generation 2012d) Exelon Generation. 2012. LaSalle Spill Prevention Control and Countermeasures. Revision 16. June 2012.
- (Exelon Generation 2013a) Exelon Generation Company, LLC. 2013. Email: FW: Human Resources Issue for Next Week. Email Wood to Ranek, and associated email change. May 31, 2013.
- (Exelon Generation 2013b) Exelon Generation. 2013. LaSalle County Generating Station Wildlife Management Plan.
- (Exelon Generation 2013c) Exelon Generation. 2013. LaSalle County Station Units 1 and 2, 2012 Annual Radiological Environmental Operating Report, 1 January through 31 December 2012. May 15, 2013.

- (Exelon Generation 2013d) Exelon Generation. 2013. Response to Request for Additional Information Regarding NRC Review of LaSalle County Station Unit 2 Cycle 15 Core Operating Limits Report. Revision 0. October 31, 2013.
- (Exelon Generation 2014). Exelon Generation. 2014. LaSalle County Units 1 and 2 2013 Annual Radiological Environmental Operating Report. 1 January through 31 December 2013. May 2014.
- (Exelon Nuclear 2009a) Exelon Nuclear. 2009. Document Based Instruction Guide: LaSalle Station Sewage Treatment Lagoon System TQ-AA-223-F070, Revision 1.
- (Exelon Nuclear 2009b) Exelon Nuclear. 2009. Evaluation 2009-8466, Rev. 0, Final Issue, Task Report 47 - Environmental Impact Non- Safety Related. LaSalle County Generation Station Units 1 & 2. September 2009.
- (Exelon Nuclear 2010) Exelon Nuclear. 2010. 2009 Annual Emissions Report - FESOP Permit No. 75040086. April 28, 2010.
- (Exelon Nuclear 2011a) Exelon Nuclear. 2011. Storm Water Pollution Prevention Plan. NPDES Permit No. IL0048151. LaSalle County Station. October 2011.
- (Exelon Nuclear 2011b) Exelon Nuclear. 2011. LaSalle County Nuclear Station NPDES-DMR for January 2011. Marseilles, IL. February 25, 2011.
- (Exelon Nuclear 2012a) Exelon Nuclear. 2012. Updated Final Safety Analysis Report, Rev. 19. April 2012.
- (Exelon Nuclear 2012b) Exelon Nuclear. 2012. LaSalle County Nuclear Station NPDES-DMR for February 2012. Marseilles, IL. March 13, 2012.
- (Exelon Undated) Exelon Generation. Undated. RGPP Reference Material for LaSalle Generating Station EN-LA-408-4160, Revision 3.
- (Feller 2003) Feller, G. 2003. Wind, Waves & Tides: Economically Viable Energy from the World's Oceans. August 9, 2003. Retrieved from <http://www.ecoworld.com/home/articles2.cfm?tid=334> on February 4, 2008. ©.
- (FERC 2012) Federal Energy Regulatory Commission. 2012. Hydropower Licensing - All Issued Preliminary Permits. April 10, 2012. Retrieved from <http://www.ferc.gov/industries/hydropower/gen-info/licensing/pre-permits.asp> on May 3, 2012.
- (Ferguson, et al. 1995) Ferguson, J.A., E.K. Schroeder, R.E. Warren, E.R. Hajic, and J.S. Oliver. 1995. Cultural Resources of the Marseilles Training Area, North-Central Illinois. Technical Report No. 95-859-10. Illinois State Museum Quaternary Studies Program. Springfield, IL. November 1995.
- (Fester undated) Fester, R. undated. The Illini Confederation: Lords of the Mississippi Valley. Retrieved from <http://rfester/tripod.com> on August 16, 2012.
- (Fritts 2013) Fritts, M. W. 2013. RE. Request: Illinois River Reports. Illinois River Biological Station and Illinois Natural History Survey. Havana, Illinois. June 24, 2013.

- (FCE 2013) Fuel Cell Energy. 2013. Fuel Cell Energy Completes 14.9 Megawatt Fuel Cell Park on Schedule for Dominion, the Project Owner. Press Release dated December 27, 2013. Downloaded from <http://fcel.client.shareholder.com/releases.cfm> on September 4, 2014.
- (FCE 2014) Fuel Cell Energy. 2014. World's Largest Fuel Cell Park Completed in South Korea. Press Release dated February 19, 2014. Downloaded from <http://fcel.client.shareholder.com/releases.cfm> on September 3, 2014.
- (GE Energy 2007) GE Energy. 2007. Gas Turbine and Combined Cycle Products. Atlanta, GA. May 2007.
- (GE Energy 2009) GE Energy. 2009. 1.5 MW Wind Turbine. General Electric Company. June 2009. ©.
- (GLWC 2009) Great Lakes Wind Collaborative. 2009. Offshore Siting Principles and Guidelines for Wind Development on the Great Lakes. Great Lakes Commission. October 2009.
- (HDR Engineering 2010) HDR Engineering. 2010. Zebra Mussel Monitoring Program at LaSalle Nuclear Station, 2009. February 2010.
- (HDR Engineering 2011) HDR Engineering. 2011. Zebra Mussel Monitoring Program at LaSalle Nuclear Station, 2010. February 2011.
- (HDR Engineering 2012) HDR Engineering. 2012. Zebra Mussel Monitoring Program at LaSalle Nuclear Station, 2011. ©
- (HDR Engineering 2013) HDR Engineering. 2013. Zebra Mussel Monitoring Program at LaSalle Nuclear Station, 2012. ©
- (HDR Engineering 2014) HDR Engineering. 2014. Zebra Mussel Monitoring Program at LaSalle Nuclear Station, 2013. ©
- (Huysken, et al. 2008) Huysken, K. T., K. Fujita, J. M. Eyermann, and K. A. Weyer. 2008. Paper No. 30-2, 42nd Annual Meeting, North-Central Section, 24-25 April 2008, Geological Society of America, . Abstracts with Programs, Vol. 40, No. 5, p. 80.
- (ICC 2009) Illinois Commerce Commission. 2009. Retail and Wholesale Competition in the Illinois Electric Industry: Fourth Triennial Report. November 2009.
- (ICC 2013) Illinois Commerce Commission. 2013. 2013 Annual Report. Office of Retail Market Development. June 2013.
- (ICF International) La-Salle-544 ICF International. 2011. Firming Renewable Electric Power Generators: Opportunities and Challenges for Natural Gas Pipelines. March 16, 2011.
- (IDNR 2000) Illinois Department of Natural Resources. 2000. Permit No. DS2000237 Proposed Operation and Maintenance of the LaSalle County Nuclear Station Cooling Pond Dam. December 20, 2000.

- (IDNR 2012a) Illinois Department of Natural Resources. 2012. Illinois Wildlife Action Plan: Species We Address (Fish). Retrieved from <http://www.dnr.illinois.gov/conservation/IWAP/Pages/default.aspx> on September 27, 2013.
- (IDNR 2012b) Illinois Department of Natural Resources. 2012. List of Endangered and Threatened Species in Illinois by County. Illinois Endangered Species Protection Board. Retrieved from <http://www.dnr.illinois.gov/ESPB/Pages/default.aspx> on August 6, 2013.
- (IDNR 2013) Illinois Department of Natural Resources. 2013. Illinois State Parks and Other Natural Areas. Retrieved from <http://dnr.state.il.us/lands/landmgt/parks/> on Various dates in June, July, and August 2013.
- (IDNR 2014a) Illinois Department of Natural Resources. 2014. Illinois List of Endangered and Threatened Animal Species 5-year Review and Revision Ending in 2014. Available on line at <http://www.dnr.illinois.gov/ESPB/Documents/ET%20List%20Review%20and%20Revision/compiled%20animal%20spp%20reviews%202014%20proposed%20changes%20061614.pdf>.
- (IDNR 2014b) Illinois Department of Natural Resources. 2014. Illinois Threatened and Endangered Species by County (as of October 2014). Illinois Natural Heritage Database. Available on line at http://www.dnr.illinois.gov/ESPB/Documents/ET_by_County.pdf.
- (IDNR 2015) Illinois Department of Natural Resources. 2015. Checklist of Illinois Endangered and Threatened Animals and Plants. Illinois Endangered Species Protection Board (Effective May 19, 2015). http://www.dnr.illinois.gov/ESPB/Documents/2015_ChecklistFINAL_for_webpage_051915.pdf.
- (IDOT 1985) Illinois Department of Transportation 1985. Illinois Groundwater Law: The Rule of Reasonable Use. Division of Water Resources. Joliet, Illinois. October 8, 1985.
- (IDPH 2013a) Illinois Department of Public Health. 2013. Illinois Fish Advisory, 2013. Retrieved from <http://www.idph.state.il.us/envhealth/fishadvisory/index.htm> on August 4, 2013.
- (IDPH 2013b) Illinois Department of Public Health. 2013. Health Beat - Primary Amebic Meningoencephalitis (PAM) and Naegleria fowleri. Retrieved from <http://webcache.googleusercontent.com/search?q=cache:NOBYbPM4HTYJ:www.idph.> on June 12, 2013.
- (IDPH 2014) IDPH. 2014. Marshall Email: to Ranek. RE: LaSalle County Station Units 1 and 2 -- Consultation about thermophilic organisms. February 19, 2014.
- (IEMA Undated) Illinois Emergency Management Agency. Undated. Earthquake. Division of Nuclear Safety. Retrieved from <http://www.state.il.us/iema/disater/eQuakeMain.htm> on May 15, 2013. ©.
- (IEPA 2000) Illinois Environmental Protection Agency. 2000. Federally Enforceable State Operating Permit for LaSalle County Generating Station No. 75040086. December 11, 2000.

- (IEPA 2009) Illinois Environmental Protection Agency. 2009. NPDES Facilities in Illinois. Number 10. Kankakee River Watershed NPDES Facilities. Bureau of Water Permit Programs. September 2009. Retrieved from <http://www.epa.state.il.us/water/permits/index.html> on February 20, 2014.
- (IEPA 2013) Illinois Environmental Protection Agency. 2013. NPDES Permit No. IL0048151. Division of Water Pollution Control. Springfield, IL. July 5, 2013.
- (IEPA 2014a) Illinois Environmental Protection Agency. 2014. Illinois Integrated Water Quality Report and Section 303(d) List, 2014. Clean Water Act Sections 303(d), 305(d) and 314. Water Resource Assessment Information and List of Impaired Waters. Bureau of Water. Vol.: Surface Water. March 24, 2014.
- (IEPA 2014b) Illinois Environmental Protection Agency. 2014. Good Email: to Ranek. RE: LaSalle County Station Units 1 and 2 -- Consultation about thermophilic organisms. February 28, 2014.
- (IEPA Undated) Illinois Environmental Protection Agency. Undated. Regional Groundwater Protection Planning Program. Retrieved from <http://www.epa.state.il.us/water/groundwater/protection-planning.html> on August 13, 2013.
- (IER 2012) Institute for Energy Research. 2012. Electric Generating Costs: A Primer. August 22, 2012. Retrieved from <http://www.instituteforenergyresearch.org/2012/08/22/electric-generating-costs-a-primer/> on February 6, 2013. ©.
- (INHS 2012) Illinois Natural History Survey. 2012. INHS Technical Report 2012. Status Revision and Update for Illinois' Fish Species in Greatest Need of Conservation. State Wildlife Grant. Project Number (T-69-R-001). Prepared by: B.A. Metzke, L.C. Hinz, Jr., and A.C. Hulin July 31, 2012.
- (IHPA 1993) Illinois Historic Preservation Agency. 1993. A Tour Guide to the Prehistory and Native Cultures of Southwestern Illinois and the Greater St. Louis Area. Illinois Archaeology Educational Series Number 2. Springfield. January 1993.
- (IL SOS 2011) Office of Illinois Secretary of State. 2011. Illinois Fact Sheet. Retrieved from http://www.cyberdriveillinois.com/publications/pdf_publications/com24.pdf on September 5, 2013.
- (IL SOS 2012) Office of the Illinois Secretary of State. 2012. 2011-2012 Illinois Blue Book - History of Illinois. Retrieved from http://www.cyberdriveillinois.com/publications/illinois_bluebook/home.html on May 1, 2012.
- (INEEL 1998) Idaho National Engineering and Environmental Laboratory. 1998. U.S. Hydropower Resource Assessment Final Report. DOE/ID-10430.2. December 1998.
- (ISGS 1995) Illinois State Geological Survey. 1995. Earthquake Occurrence in Illinois. Earthquake Facts. Department of Natural Resources.
- (ISGS Undated) Illinois State Geological Survey. Undated. Illinois Water Well Logs. Illinois Water Well Internet Map Service. Retrieved from <http://www.isgs.illinois.edu/r/maps-data-pub/wwdb/launchims.shtml> on July 15, 2013.

- (ISM Undated) Illinois State Museum. Undated. Of Time and the River: 12,000 years of Human Use of the Illinois River - 1877 to 1930. Retrieved from www.oftimeandtheriver.org/resources/industrial/fr1877to1930.htm on September 22, 2013.
- (ISWS 1993) Illinois State Water Survey. 1993. 7-Day, 10-Year Low Flows of Streams in Northeastern Illinois. Contract Report 545. Hydrology Division. Champaign, IL. January 1993.
- (ISWS 2002) Illinois State Water Survey. 2002. Illinois Rivers Decision Support System. Illinois Natural History Survey, Illinois State Geologic Survey, and Waste Management and Research Center Illinois Department of Natural Resources. Illinois Department of Natural Resources. February 2002.
- (ISWS 2003) Illinois State Water Survey. 2003. Illinois River Watershed (Map Series 2003-1). Prepared by: Illinois State Water Survey, University of Illinois, Champaign-Urbana.
- (ISWS 2012) Illinois State Water Survey. 2012. Illinois Water Supply Planning, Kaskaskia Region Planning Area. Prairie Research Institute. Retrieved from <http://www.isws.illinois.edu/wsp/priorityplan.asp> on March 16, 2013. ©.
- (ISWS 2013) Illinois State Water Survey. 2013. Illinois State Water Survey IWIP Database, Report 1. May 31, 2013.
- (Katzenstein, et al. 2010) Katzenstein, W., E. Fertig, and J. Apt. 2010. The Variability of Interconnected Windplants. Energy Policy 38 (2010): 4400-4410. April 18, 2010. Retrieved from http://www.sustainable.gatech.edu/sustspeak/apt_papers/60%20The%20variability%20of%20interconnected%20wind%20plants.pdf. c.
- (Kinzer 2013) Kinzer, L. 2013. Kinzer Email: to Connor, Tetra Tech. FW: Levels of Service. LaSalle County Highway Department. May 20, 2013.
- (Knapp Undated) Knapp, H. V. Undated. Trends in Illinois River Streamflow and Flooding (PowerPoint presentation). Center for Watershed Science, Illinois State Water Survey. University of Illinois at Urbana-Champaign. Retrieved from <http://ilrdss.sws.uiuc.edu/pubs/govconf2009/session3c/Knapp.pdf>.
- (LEAMgroup and LaSalle County 2014) LEAMgroup, Inc. and LaSalle County. Draft - LaSalle County Comprehensive Plan: LaSalle County, Illinois. Original prepared by LEAMgroup, Inc., June 2008. Updated by LaSalle County - June 2014.
- (Lerczak 1996) Lerczak, T. V. 1996. Illinois River Fish Communities: 1960s vs. 1990s. Illinois Natural History Survey. April 4, 1996. Retrieved from <http://www.inhs.illinois.edu/resources/inhsreports/may-jun96/fish/> on August 20, 2013. ©.
- (Lerczak, et.al 1994) T.V. Lerczak, R.E. Sparks, K.D. Blodgett. 1994. The Long Term Illinois River Fish Population Monitoring Program: Final Report. Project F-101-R. Illinois Natural History Survey. River Research Laboratory. Havana, IL. June 1994.

- (McClelland, et al. 2012) McClelland, M.A., G.G. Sass, T.R. Cook, T.R. Cook, K.S. Irons, N.M. Michaels, T.M. O'Hara, and C.S. Smith. 2012. The Long-Term Illinois River Fish Population Monitoring Program. *Fisheries* 37(8): 340-350.
- (Merino, et al. 2010) Merino, M., S. Stein, M. Liu, and E. Okal. 2010. Comparison of Seismicity Rates in the New Madrid and Wabash Valley Seismic Zones. *Seismological Research Letters*. Volume 81, Number 6. Department of Earth and Planetary Sciences, Northwestern University. Evanston, IL. November/December 2010.
- (MISO 2011) Midwest Independent Transmission System operator, Inc. 2011. System Wind Capacity Credit. 2012 Wind Capacity Credit Update with CPnode Results. Item 2 LOLEWG. November 9, 2011.
- (MISO Undated) Midwest Independent Transmission System Operator. Undated. Renewable Energy. Retrieved from <https://www.misoenergy.org/WhatWeDo/StrategicInitiatives> on March 27, 2014.
- (MIT 2006) Massachusetts Institute of Technology. 2006. The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century. INL/EXT-06-111746. ©.
- (MPSC 2012) Michigan Public Services Commission. 2012. History of Commission. Department of Licensing and Regulatory Affairs (LARA). Retrieved from <http://www.michigan.gov/mpsc/0,4639,7-159-16400-40512--,00.html> on February 22, 2012. ©.
- (MPSC 2013) Michigan Public Services Commission. 2013. Status of Electric Competition in Michigan; Report for Calendar Year 2012. February 1, 2013.
- (MPSC 2014) Michigan Public Service Commission. 2014. Status of Electric Competition in Michigan, Report for Calendar Year 2013, Department of Licensing and Regulatory Affairs. January 31, 2014.
- (NCDC 2004) National Climatic Data Center. 2004. Climatology of the United States No. 20 1971-2000 Station: OTTAWA 5 SW IL. U.S. Department of Commerce, National Oceanic & Atmospheric Administration. February 2004.
- (NCSL 2013) National Conference of State Legislatures. 2013. State Water Withdrawal Regulations: Illinois. Retrieved from <http://www.ncsl.org/issues-research/env-res/state-water-withdrawal-regulation.aspx>.
- (NEAC 2011) Nuclear Energy Advisory Committee. 2011. Response to the request of the Assistant Secretary of Nuclear Energy in his August 20, 2010 letter to the Nuclear Energy Advisory Committee (NEAC) to review the Next Generation Nuclear Plant activities and to advise whether the Project is ready to proceed to its second phase. Letter to Dr. Steven Chu, U.S. Department of Energy. June 30, 2011
- (NEI 2007) Nuclear Energy Institute 2007. Industry Groundwater Protection Initiative – Final Guidance Document. NEI 07-07. August 2007.

- (NLCD 2012) National Land Cover Database. 2012. NLCD 2011 Land Cover. Multi-Resolution Land Characteristics Consortium. Retrieved from http://www.mrlc.gov/nlcd2011_data.php on May 19, 2015.
- (NOAA 2012) National Oceanic and Atmospheric Administration. 2012. Record of Decision for Federal Approval of the Illinois Coastal Management Program. January 31, 2012.
- (NOAA/IDNR 2011) National Oceanic and Atmospheric Administration and Illinois Department of Natural Resources. 2011. Final Environmental Impact Statement for the Illinois Coastal Management Program. NOAA Office of Ocean and Coastal Resource Management, Silver Spring, MD and IDNR Office of Resource Conservation, Chicago, IL. December 2011.
- (NRC 1978) U.S. Nuclear Regulatory Commission. 1978. Final Environmental Statement related to operation of LaSalle County Nuclear Power Station, Units Nos. 1 and 2. 50-373 and 50-374; Commonwealth Edison Company. Office of Nuclear Reactor Regulation. Vol. NUREG-0486. Washington, DC. November 1978.
- (NRC 1996a) U.S. Nuclear Regulatory Commission. 1996. Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. NUREG-1440. Office of Nuclear Regulatory Research. Washington, DC. May 1996.
- (NRC 1996b) U.S. Nuclear Regulatory Commission. 1996. Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. Federal Register 61(244): 66537-66554. Washington, DC. December 18, 1996.
- (NRC 1996c) U.S. Nuclear Regulatory Commission. 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Volumes 1 and 2. NUREG-1437. Office of Nuclear Regulatory Research. Washington, DC. May 1996.
- (NRC 1997). U.S. Nuclear Regulatory Commission. 1997. Regulatory Analysis Technical Evaluation Handbook. NUREG/BR-0184.
- (NRC 1999a) U.S. Nuclear Regulatory Commission. 1999. Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules. 10 CFR Part 51. Federal Register 64 (171). 48496-48507. Washington, DC. September 3, 1999.
- (NRC 1999b) U.S. Nuclear Regulatory Commission. 1999. Generic Environmental Impact Statement - License Renewal of Nuclear Plants. Main Report Section 6.3 - Transportation, Table 9.1 Summary of Findings of NEPA Issues for License Renewal of Nuclear Power Plants. Final Report. NUREG-1437. Volume 1, Addendum 1. Office of Nuclear Reactor Regulation. Washington, DC. August 1999.

- (NRC 2002) U.S. Nuclear Regulatory Commission. 2002. Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Final Report. Division of Regulatory Improvement Programs. Washington, DC. November 2002.
- (NRC 2006a) U.S. Nuclear Regulatory Commission. 2006. Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site, NUREG-1817. Vol. I. Office of Nuclear Reactor Regulation. Washington, DC. April 2006.
- (NRC 2006b) U.S. Nuclear Regulatory Commission. 2006. Final Report. Environmental Impact Statement for an Early Site Permit (ESP) at the Exelon ESP Site. NUREG-1815. Vol. I. Office of Nuclear Reactor Regulation. Washington, DC. July 2006.
- (NRC 2006c) U.S. Nuclear Regulatory Commission. 2006. Final Report. Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site, NUREG-1811. Vol. I. Office of Nuclear Reactor Regulation. Washington, DC. December 2006.
- (NRC 2009) U.S. Nuclear Regulatory Commission. 2009. Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues. Office Instruction No. LIC-203, Revision 2. Office of Nuclear Reactor Regulation. Vol. Office Instruction No. LIC-203, Revision 2. Washington, DC. February 11, 2009.
- (NRC 2011a) U.S. Nuclear Regulatory Commission. 2011. Issuance of Amendments to Allow Receipt and Storage of Low-Level Radioactive Waste (TAC Nos. ME3054 and ME3055). July 21, 2011.
- (NRC 2011b) U.S. Nuclear Regulatory Commission. 2011. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Supplement 45 Regarding Hope Creek Generating Station and Salem Nuclear Generating Station, Units 1 and 2, Final Report. Office of Nuclear Reactor Regulation. Washington, DC. March 2011.
- (NRC 2012a) Nuclear Regulatory Commission. 2012. Commission Order CLI-12-16. August 7, 2012.
- (NRC 2012b) U.S. Nuclear Regulatory Commission. 2012. Staff Requirements - COMSECY-12-0016 - Approach for Addressing Policy Issues Resulting from Court Decision to Vacate Waste Confidence Decision and Rule. September 6, 2012.
- (NRC 2013a) U.S. Nuclear Regulatory Commission. 2013. Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. 10 CFR Part 51. Federal Register 78 (119). 37281-37324. Washington, DC. June 20, 2013.
- (NRC 2013b) U.S. Nuclear Regulatory Commission. 2013. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Office of Nuclear Reactor Regulation. Vol. NUREG-1437. Volume 1, 2, and 3. Revision 1. Rockville, MD. June 2013.
- (NRC 2013c) U.S. Nuclear Regulatory Commission. 2013. Supplement 1 to Regulatory Guide 4.2. Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications. Revision 1. Office of Nuclear Regulatory Research. Rockville, MD. June 2013.

- (NRC 2013d) U.S. Nuclear Regulatory Commission. 2013. Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2011. Vol. NUREG-0713. Oak Ridge, TN. April 2013.
- (NRC 2014) U.S. Nuclear Regulatory Commission. 2012. Advanced Reactors and Small Modular Reactors. July 8, 2013. Retrieved from <http://www.nrc.gov/reactors/advanced.html> on March 27, 2014.
- (NREL 2005) National Renewable Energy Laboratory. 2005. A Geographic Perspective on the Current Biomass Resource Availability in the United States. Technical Report (NREL/TP-560-39181). DOE Office of Energy Efficiency and Renewable Energy. December 2005.
- (NREL 2006) National Renewable Energy Laboratory. 2006. Creating Baseload Wind Power Systems Using Advanced Compressed Air Energy Storage Concepts. DOE Office of Energy Efficiency and Renewable Energy. October 3, 2006.
- (NREL 2008a) National Renewal Energy Laboratory. 2008. Dynamic Maps, GIS Data, and Analysis Tools - Solar Maps. Retrieved from <http://www.nrel.gov/gis/solar.html> on January 23, 2012.
- (NREL 2008b) National Renewable Energy Laboratory. 2008. Status of Wave and Tidal Power Technologies for the United States Technical Report (NREL/TP-500-43240). DOE Office of Energy Efficiency and Renewable Energy. August 2008.
- (NREL 2009) National Renewable Energy Laboratory. 2009. Land-Use Requirements of Modern Wind Power Plants in the United States. Technical Report. NREL/TP-6A2-45834. DOE Office of Energy Efficiency and Renewable Energy. August 2009.
- (NREL 2010a) National Renewable Energy Laboratory. 2010. The Role of Energy Storage with Renewable Electricity Generation. NREL/TP-6A2-47187. DOE Office of Energy Efficiency and Renewable Energy. January 2010.
- (NREL 2010b) National Renewable Energy Laboratory. 2010. Large-Scale Offshore Wind Power in the United States: Assessment of Opportunities and Barriers (NREL/TP-500-49229). DOE Office of Energy Efficiency and Renewable Energy. September 2010.
- (NREL 2010c) National Renewable Energy Laboratory. 2010. The Value of Concentrating Solar Power and Thermal Energy Storage (NREL-TP-6A2-45833). Technical Report. DOE Office of Energy Efficiency and Renewable Energy. February 2010.
- (NREL 2010d) National Renewal Energy Laboratory. 2010. Solar Power and the Electric Grid (NREL/FS-6A2-45653). DOE Office of Energy Efficiency & Renewal Energy. March 2010.
- (NREL 2011a) National Renewable Energy Laboratory. 2011. Wind Maps. DOE Office of Energy Efficiency and Renewable Energy. January 10 and April 1, 2011.
- (NREL 2011b) National Renewable Energy Laboratory. 2011. Current Installed Wind Power Capacity (MW). DOE Office of Energy Efficiency and Renewable Energy. September 1, 2011.

- (NREL 2011c) National Renewable Energy Laboratory. 2011. Updated U.S. Geothermal Supply Characterization and Representation for Market Penetration Model Input (NREL/TP-6A20-47459). DOE Office of Energy Efficiency and Renewable Energy. October 2011.
- (NREL 2011d) National Renewable Energy Laboratory. 2011. Policymakers' Guidebook for Geothermal Electricity Generation (NREL/BR-6A20-49476). DOE Office of Energy Efficiency and Renewable Energy. February 2011.
- (NREL 2012) National Renewable Energy Laboratory. 2012. Learning About Renewable Energy. DOE Office of Energy Efficiency and Renewable Energy. May 18, 2012.
- (NREL 2013) National Renewable Energy Laboratory. 2013. State Rankings for Distributed Solar Capacity. DOE Office of Energy Efficiency and Renewable Energy. October 17, 2013.
- (NWW 2009) National Wind Watch. 2009. Cost of Pumped Hydro Storage. January 27, 2009. Retrieved from <http://www.wind-watch.org/documents/cost-of-pumped-hydro-storage/> on January 16, 2012. ©.
- (NWW Undated) National Wind Watch. Undated. FAQ – Size, How Big is a Wind Turbine. Retrieved from <http://www.wind-watch.org/faq-size.php> on January 31, 2012. ©.
- (PEI 2008) Princeton Environmental Institute. 2008. Compressed Air Energy Storage: Theory, Resources, and Applications for Wind Power. April 8, 2008.
- (PJM 2010a) PJM Interconnection. 2010. PJM Manual 21: Rules and Procedures for Determination of Generating Capability, Revision 9. May 1, 2010. ©.
- (PJM 2010b) PJM Interconnection. 2010. Demand Resource Saturation Analysis. May 2010.
- (PJM 2012) PJM Interconnection. 2012. 2015/2016 RPM Base Residual Auction Results. PJM Doc#699093.
- (PJM 2014) PJM Interconnection. 2014. Renewable Energy Dashboard. December 3, 2013. Retrieved from <http://www.pjm.com/about-pjm/renewable-dashboard.aspx?p=1> on March 27, 2014. ©.
- (Progress Illinois 2013) Progress Illinois. 2013. IL Advances Offshore Wind Energy Research, But Lake Turbines Still 'Light-Years' Away, Experts Say. August 23, 2013. Retrieved from <http://www.progressillinois.com/quick-hits/> on February 23, 2014.
- (Ramsdell, et al. 2001) Ramsdell, J.V. Jr, C. E. Beyer, D. D. Lanning, U. P. Jenquin, R. A. Schwarz, D. L. Strenge, P.M. Daling, and R. T. Dahowski. 2001. Environmental Effects of Extending Fuel Burnup Above 60 GWd/MTU. NUREG/CR-6703, PNPL-13257. Prepared by: Pacific Northwest National Laboratory, Richland, WA. Prepared for U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation. Washington, DC. January 2001.
- (RNP 2007) Renewable Northwest Project. 2007. Wave and Tidal. March 2007.

- (S&L 2009) Sargent & Lundy. 2009. New Coal-Fired Power Plant Performance and Cost Estimates. Project 12301-003. August 28, 2009.
- (SCE&G 2012) South Carolina Electric & Gas Company. 2012. NRC Approves COLs for SCE&G, Santee Cooper Nuclear Units. March 30, 2012. ©.
- (SNC 2012) Southern Nuclear Operating Company. 2012. Southern Nuclear Company Subsidiary Receives Historic License Approval for New Vogtle Units, Full Construction Set to Begin. February 9, 2012.
- (SNL 2012) Sandia National Laboratory. 2012. Lessons from Iowa: Development of a 270 Megawatt Compressed air Energy Storage Project in Midwest Independent System Operator, A Study for the DOE Energy Storage Systems Program. Sandia Report SAND2012-0388. January 2012.
- (Struever 1975) Struever, S. 1975. An Archeological Survey of the Transmission Line Corridor and Pipeline Areas of the LaSalle County Station of the Commonwealth Edison Company. The Foundation for Illinois Archeology. Evanston, Illinois.
- (SUFG 2007) State Utilities Forecasting Group. 2007. Clean Coal Technologies. Energy Center at Discovery Park and Purdue University. July 2007.
- (Sullivan 2000) Sullivan, D. J. 2000. Nutrients and Suspended Solids in Surface Waters of the Upper Illinois River Basin in Illinois, Indiana, and Wisconsin, 1978-97. Water Resources Investigations Report 99-4275. U. S. Geological Survey.
- (Talkington 1991) Talkington, L. M. 1991. The Illinois River: Working for Our State. Illinois State Water Survey. Champaign, Illinois.
- (Tetra Tech 2013a) Tetra Tech. 2013. Calculation Package for LaSalle Units 1 & 2 Environmental Justice ER Section 3.11, Rev. 0. Aiken, SC. September 9, 2013.
- (Tetra Tech 2013b) Tetra Tech. 2013. Air Emissions and Solid Waste from Coal- and Gas-Fired Alternatives for LaSalle Units 1 and 2. License Renewal Chapter 7 Energy Alternatives. Exelon. August 2013.
- (Tetra Tech 2014) Tetra Tech, Inc. Connor Telecon to Selected government agencies and private social welfare organizations. Compilation of Telephone Logs Investigating Potential Existence of Subsistence-Like Populations in LaSalle and Grundy counties, Illinois. March 13, 2014.
- (Tetra Tech Undated) Tetra Tech. Undated. Assignment of Zip Codes.
- (U.S. Court of Appeals for the Seventh Circuit 2006) U.S. Court of Appeals for the Seventh Circuit. 2006. Environmental Law and Policy Center et.al. v. U.S. Nuclear Regulatory Commission and Exelon Generation Company, LLC. No. 06-1442 (7th Cir. 2006). Decision date: December 5, 2006.
- (USACE 1998) U.S. Army Corps of Engineers. 1998. Illinois Waterway Navigation Charts. Retrieved from <http://www3.mvr.usace.army.mil/NIC2/ilwwcharts.cfm> on August 22, 2013.

- (USCB 2010) U. S. Census Bureau. 2010. How We Count America. Retrieved from <http://www.census.gov/2010census/about/how-we-count.php> on February 26, 2013.
- (USDA 2008) U.S. Department of Agriculture. 2008. Soil Survey of LaSalle County, Illinois. Natural Resources Conservation Service. 2008.
- (USDA 2009) U.S. Department of Agriculture. 2009. 2007 Census of Agriculture – Volume 1 Geographic Area Series, Part 13. December.
- (USDA 2014a) U.S. Department of Agriculture. 2014. Soil Metadata i1099. Natural Resources Conservation Service.
- (USDA 2014b) U.S. Department of Agriculture. 2014. 2012 Census of Agriculture - County Data. Volume 1, Chapter 2: County Level Data. National Agricultural Statistics Service.
- (USFWS 2012) U.S. Fish and Wildlife Services. 2012. Federally Endangered, Threatened, and Candidate Species. Revised October 2012. Retrieved from <http://www.fws.gov/midwest/endangered/index> on May 22, 2013.
- (USFWS 2013) U.S. Fish and Wildlife Services. 2013. National Wetlands Inventory Maps. Retrieved from <http://www.fws.gov/wetlands/index.html> on July 24, 2013.
- (USGS 2004) U.S. Geological Survey. 2004. Water Quality in the Upper Illinois River Basin, Illinois, Indiana, Wisconsin, 199-2001. Circular 1230.
- (USGS 2005) U.S. Geological Survey. 2005. Significant United States Earthquakes 1568 - 2004. Natural Disaster ArcGIS Shapefile Map Layer Series. National Atlas of the United States. Reston, VA. January 2005. Retrieved from <http://www.mapcruzin.com/natural-disaster-shapefiles/earthquake-metadata> on August 7, 2013.
- (USGS 2013a) U.S. Geological Survey. 2013. Historic Earthquakes Southern Illinois, Largest Earthquake in Illinois. Earthquake Hazards Program. Retrieved from http://earthquake.usgs.gov/earthquakes/states/events/1968_11_09.php on August 6, 2013.
- (USGS 2013b) U.S. Geological Survey. 2013. Water Resources Data for the United States, Water Year 2012. US Geological Survey Water-Data Report WDR-US-2012, site 05543500. Illinois River at Marseilles, IL. Retrieved from <http://wdr.water.usgs.gov/wy2012/pdfs/05543500.2012.pdf>.
- (USGS 2008) U.S. Geological Survey. 2008. Illinois Seismic Hazard Map. Earthquake Hazards Program. Retrieved from <http://earthquake.usgs.gov/earthquakes/states/illinois/hazards.php> on August 7, 2013.
- (USGS Undated) USGS. Undated. Radium in Ground Water from Public-Supply Aquifers in Northern Illinois. USGS-IEPA Fact Sheet. Retrieved from <http://il.waterusgs.gov/proj/gwstudies/radium/> on August 26, 2013.
- (UTA 2009) University of Texas at Austin. 2009. Sustainable Energy Options for Austin Energy, Volume II. Policy Research Project Report Number 166. Prepared by: Policy Research Project on Electric Utility Systems and Sustainability. 2009. ©.

(Visocky, et al. 1985) Visocky, A. P., M. G. Sherrill, and K. Cartwright. 1985. Geology, Hydrology, and Water Quality of the Cambrian and Ordovician Systems in Northern Illinois. Cooperative Groundwater Report 10. Department of Energy and Natural Resources. Champaign, IL. 1985.

(Weggeman 2014) Weggeman, P.A. 2014. Response to data request Nuclear Fuels Transmittal of Design Information. NF140227. APRIL 16, 2014.