ML19273A012

Environmental Assessment for the Proposed Renewal of Source Material License SUB–526 Metropolis Works Uranium Conversion Facility (Massac County, Illinois)

Honeywell International, Inc.
Docket No. 040-03392

October 2019

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

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EXECUTIVE SUMMARY

On February 8, 2017, Honeywell International, Inc. (Honeywell) submitted an application and accompanying environmental report (ER) (Honeywell 2017a; ENERCON 2017) to the U.S. Nuclear Regulatory Commission (NRC) to request renewal of Source Materials License SUB-526 (SUB-526) for a period of 40 years in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 40.43, "Renewal of Licenses." The NRC issued the current license in May 2007 for a 10-year period. Under the conditions of the license, Honeywell operates a uranium hexafluoride processing plant at the Metropolis Works Plant (MTW), located about 1.6 kilometers (1.0 mile) west of Metropolis, Illinois (IL), in Massac County. The purpose of this environmental assessment (EA) is to assess the potential environmental impacts of the proposed license renewal and of reasonable alternatives while reflecting regulatory changes and operational and environmental experience obtained for the most recent 10 years of facility operation.

The NRC staff prepared this EA in accordance with NRC regulations in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," that implement the National Environmental Policy Act of 1969, as amended (NEPA) (Title 42 of the United States Code (U.S.C.) Section (§) 4321), and NRC staff guidance in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," issued August 2003 (NRC, 2003a). This EA considers information from the licensee's license amendment application and independent sources to fulfill the requirements stated in 10 CFR 51.30(a). The NRC staff also considered public comments received on the draft EA.

The NRC's proposed Federal action is the decision to approve the renewal of SUB-526 for a period of 40 years. If approved, the renewed license would authorize Honeywell to continue current operations at the MTW in accordance with the requirements in 10 CFR Part 40, "Domestic Licensing of Source Material."

In this EA, the NRC analyzes the potential environmental impacts from the operation of the MTW. Chapter 1 presents background information, a description of the proposed action, the project's purpose and need, alternatives to the proposed action, and the review scope. Chapter 2 discusses the details of the proposed action; Chapter 3 discusses the affected environment; and Chapter 4 discusses the potential impacts to the environmental resource areas, identified as follows:

- land use (Sections 3.1 and 4.1.1)
- transportation (Sections 3.2 and 4.1.2)
- geology and soils (Sections 3.3 and 4.1.3)
- water resources (Sections 3.4 and 4.1.4)
- ecology (Sections 3.5 and 4.1.5)
- meteorology, climatology, and air quality (Sections 3.6 and 4.1.6)
- noise (Section 3.7 and 4.1.7)
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- socioeconomics and environmental justice (Sections 3.10 and 4.1.10)
- public and occupational health and safety (Section 3.11 and 4.11)
- waste management (Section 3.12 and 4.1.12)

Additionally, Chapter 4 discusses the potential environmental impacts associated with the reduced duration alternative (which consists of a license renewal period less than 40 years) and the no-action alternative, as well as decontamination and decommissioning. Chapter 5 analyzes potential cumulative impacts from past, present, and reasonably foreseeable future actions when combined with the potential environmental impacts from the proposed action.

Chapter 6 describes the agencies and persons consulted during the analysis, Chapter 7 presents the conclusions made from this analysis, Chapter 8 names the EA preparers, and Chapter 9 presents a bibliographic listing of references cited. Appendix A presents groundwater data from the MTW groundwater monitoring programs, and Appendix B is the Comment-Response Document for the draft EA.

In accordance with 10 CFR 51.33(a), the NRC staff issued a draft Finding of No Significant Impact (FONSI) in the *Federal Register* (FR) (Volume 83, page 54787 (83 FR 54787), October 31, 2018) and provided a 30-day public review and comment period on the draft EA and draft FONSI. The comments received, and the NRC staff's responses to the comments, are provided in Appendix B to this EA.

Based on its review of the proposed action relative to the requirements set forth in 10 CFR Part 51, and its consideration of all comments received on the draft EA, the NRC staff determined that renewal of SUB-526, which would authorize continued operations at the MTW for an additional 40 years, will not significantly affect resources and the quality of the human environment. Therefore, based on this assessment, an environmental impact statement is not warranted and a FONSI is appropriate, in accordance with 10 CFR 51.31, "Determinations Based on Environmental Assessment."

ABBREVIATIONS AND ACRONYMS

ADAMS	Agencywide Documents Access and Management System
AEP	American Electric Power Company
ALARA	as low as is reasonably achievable
AOC	area of concern
APE	area of potential effect
BNSF	Burlington Northern Santa Fe
°C	degree Celsius
CAAPP	Title V Clean Air Act Permit Program
CAP-88	Clean Air Act Assessment Package–1988
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EA	environmental assessment
EF	Enhanced Fujita
ELUC	environmental land use control
ENERCON	Enercon Services, Inc.
EPA	U.S. Environmental Protection Agency
EPF	environmental protection facility
ER	environmental report
ESA	Endangered Species Act of 1973, as amended
°F	degree Fahrenheit
FMB	feed materials building
FONSI	finding of no significant impact
ft^3/s	cubic feet per second
g	the acceleration due to gravity
GCRP	U.S. Global Change Research Program
GHG	greenhouse gas
HARGIS	Historic and Architectural Resources Geographic Information System
Honeywell	Honeywell International, Inc.
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
IL	Illinois
ILCS	Illinois Compiled Statute
IPaC	Information for Planning and Consultation
ISA	Integrated Safety Analysis
KAR	Kentucky Administrative Regulations
KHC	Kentucky Heritage Council
kph	kilometer per hour
KY	Kentucky
LBCS	Land-Based Classification Standards
µCi/ml	microcuries per milliliter
µg/g	micrograms per gram
m^3/s	cubic meter per second
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCL	maximum contaminant level
mg/L	milligrams per liter
mph	mile per hour
mrem	millirem
mrem/yr	milirem per year

mSv	milliSieverts
mSv/yr	milliSievert per year
MTW	Metropolis Works Plant
NEPA	National Environmental Policy Act of 1969, as amended
NHPA	National Historic Preservation Act
NMSZ	New Madrid seismic zone
NPDES	National Pollutant Discharge Elimination System
NR	nearest residence
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
pCi/L	picocurie per liter
PGDP	Paducah Gaseous Diffusion Plant
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
ppm	parts per million
PSD	prevention of significant deterioration
RAI	request for additional information
RCRA	Resource Conservation and Recovery Act
SER	safety evaluation report
SHPO	State Historic Preservation Office
STF	surface treatment facility
SUB-526	Source Materials License SUB-526
TEDE	total effective dose equivalent
TLD	thermoluminescence dosimeter
TSS	total suspended solids
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
U.S.C.	*United States Code*
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION

On February 8, 2017, Honeywell International, Inc. (Honeywell) submitted an application and accompanying environmental report (ER) (Honeywell 2017a; ENERCON 2017) to the U.S. Nuclear Regulatory Commission (NRC) to request renewal of Source Materials License SUB-526 (SUB-526) for a period of 40 years in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 40.43, "Renewal of Licenses." The NRC issued the current license in May 2007 for a 10-year period. Under the conditions of the license, Honeywell operates a uranium hexafluoride processing plant at the Metropolis Works Plant (MTW), located about 1.6 kilometers (1.0 mile) west of Metropolis, Illinois (IL), in Massac County. The NRC staff accepted the Honeywell license application for detailed technical review in May 2017, determining that the application contained sufficient information to conduct a detailed environmental and safety review (NRC 2017a). The NRC issued a formal request for additional information on October 25, 2017 (NRC 2017d), and Honeywell provided responses to that request on January 22, 2018 (Honeywell 2018a). Honeywell updated its application on July 9, 2019, to include content related to Honeywell's Integrated Safety Analysis (ISA) and to clarify its discussion of the license commitments and safety basis for the MTW (Honeywell 2019).

The purpose of this environmental assessment (EA) is to assess the potential environmental impacts of the proposed license renewal and of reasonable alternatives while reflecting regulatory changes and operational and environmental experience obtained during the most recent 10 years of facility operation. The NRC prepared this EA following NRC regulations in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," that implement the National Environmental Policy Act of 1969 (NEPA), as amended (Title 42 of the *United States Code* (42 U.S.C.) § 4321 et seq.), and pursuant to NRC staff guidance in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," issued August 2003 (NRC 2003).

In parallel with the ER described in this EA, the NRC is performing its detailed safety analysis to assess compliance with applicable regulations 10 CFR Part 20, "Standards for Protection Against Radiation," and 10 CFR Part 40, "Domestic Licensing of Source Material." The NRC's safety analysis will be documented in a separate safety evaluation report (SER). The NRC decision whether to renew the Honeywell license as proposed will be based on the results of the NRC's review, as documented in this EA and in the SER.

In early 2018, Honeywell, in response to market conditions, decided to temporarily idle the production of uranium hexafluoride and placed the MTW in a "ready idle" status. Honeywell is maintaining minimal operations to support a future restart when market conditions improve (Honeywell 2018b). When this EA identifies "current" or "existing" plant conditions, it refers to the conditions that can be observed when the plant is fully operational.

Note that in this document, the term "MTW" refers to the uranium hexafluoride processing plant and its support facilities, while the term "MTW site" refers to the 405-hectare (1,000-acre) Honeywell-owned property where the MTW is located.

1.1 Background

The MTW is located on a site of about 405 hectares (1,000 acres) of land in a mostly undeveloped, rural region of forested and cultivated areas. The MTW site is bordered on the north by U.S. Highway 45 and on the south by the Ohio River, as shown in Figures 1-1 and 1-2.

The site is bordered on the west by a coal blending plant and on the east by privately developed land (ENERCON 2017). As shown in Figure 1-2, the MTW occupies a small portion of the site, which is otherwise predominantly undeveloped forestland.

Figure 1-1 Regional Location of the MTW Site (Source: ENERCON 2017)

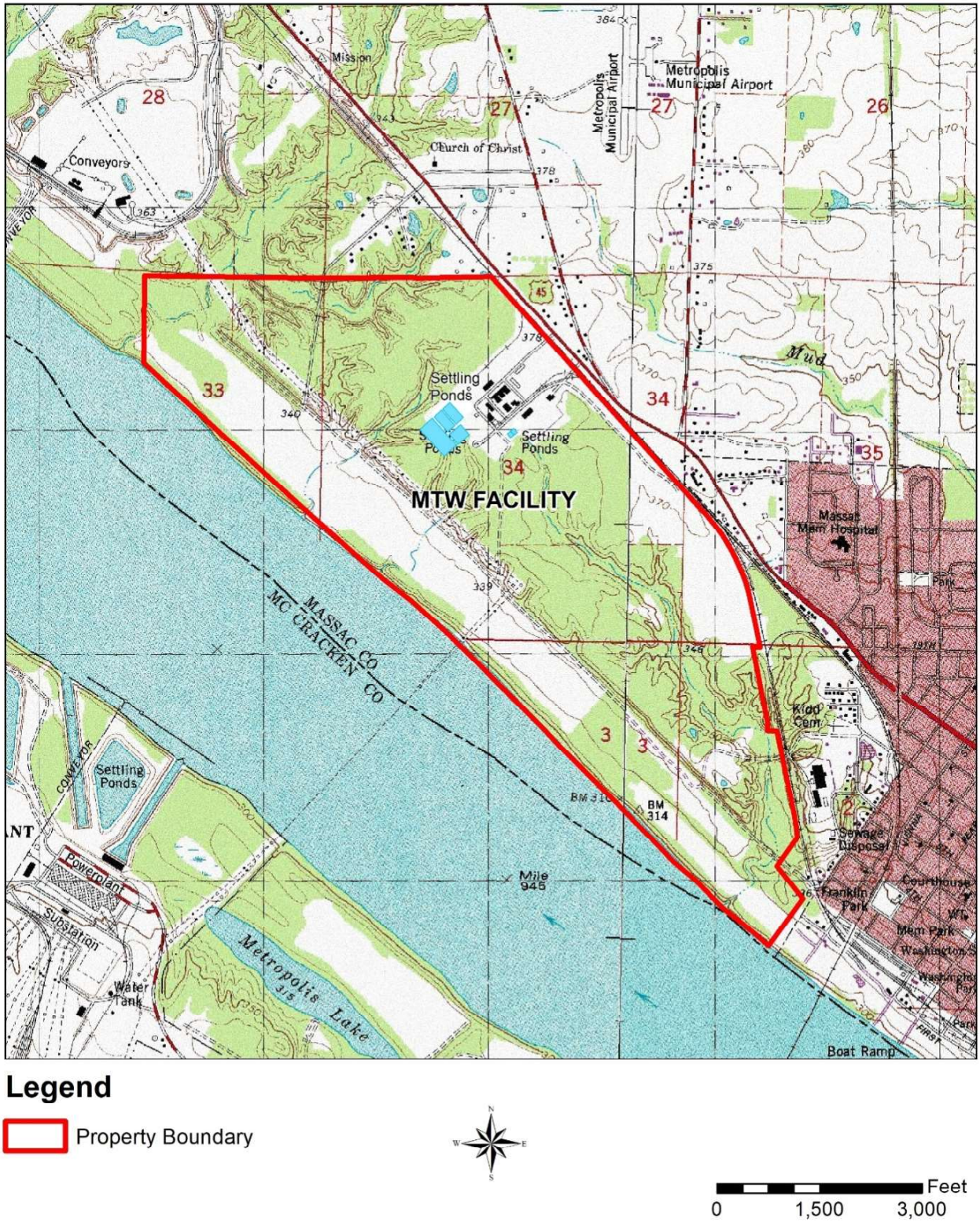

Figure 1-2 Local Map of the MTW Site (Source: Honeywell 2018a)

The initial facility was constructed in 1958, and uranium hexafluoride was first produced in 1959 as part of a 5-year contract for conversion services with the former Atomic Energy Commission. The conversion contract was completed in 1964, and the conversion process was suspended. Because of increasing demand for uranium hexafluoride, the facility was rehabilitated in 1967 with commercial conversion services beginning in 1968. From 1968–1969, the annual capacity of the facility reached about 9,000 metric tons (9,920 tons). The operator increased the annual capacity to 11,500 metric tons (12,677 tons) in 1975 and again to 12,700 metric tons (13,999 tons) in 1995. The licensee reengineered the facility in 2001 and 2007 to increase capacity to 14,000 metric tons (15,432 tons) and 15,000 metric tons (16,535 tons), respectively. To date, the highest production conducted is about 13,000 metric tons (14,330 tons) (Honeywell 2016). In 2013, Honeywell completed additional upgrades to the MTW to reduce the risks to human health and the environment from a seismic or high wind/tornado event (NRC 2014a). Section 2.2 of this EA describes such seismic and high wind/tornado upgrades.

1.2 Proposed Action

In its application (Honeywell 2017a), Honeywell requested authorization and provided a justification to continue licensed activities at its Metropolis, IL, facility for a 40-year period. In accordance with the provisions of 10 CFR Part 40, the current license authorizes Honeywell to receive, possess, store, use, and ship source material.[1] Under this proposed action, Honeywell would continue conversion of uranium ore concentrates, also known as yellowcake, to gaseous fluorine and uranium hexafluoride at an authorized capacity not to exceed 15,000 metric tons (16,535 tons). Honeywell would then ship the uranium hexafluoride to enrichment facilities for further processing into enriched uranium. The primary processing steps include feed ore sampling and preparation, triuranium octaoxide reduction, uranium oxide hydrofluorination, uranium tetrafluoride fluorination, and uranium hexafluoride distillation (product purification). These process steps are conducted in a sequential manner, with recycling used only for the recovery of uranium from secondary process streams. Current MTW major facilities and operations include the following:

- a storage area for uranium ore concentrates received from uranium recovery facilities
- a uranium sampling facility
- a bulk storage area for process chemicals, such as aqueous ammonia, sodium hydroxide, potassium hydroxide, ammonium hydroxide, anhydrous hydrogen fluoride, potassium bifluoride, sulfuric acid, and liquid hydrogen
- a facility for the production of uranium hexafluoride from yellowcake
- a facility for electrolytic production of gaseous fluorine from hydrogen fluoride
- treatment systems for liquid wastes

In its license renewal request, Honeywell is not proposing changes in how it processes uranium ore, and no significant changes in the MTW's authorized operations are planned during the proposed 40-year license period. If the NRC approves the license renewal, Honeywell could, in the future, decide that operational changes are necessary. Before making any changes to the

[1] In the case of processing at Honeywell, source material is generally material containing uranium that is not enriched in the isotope of uranium-235 above that found in nature.

site, structures, processes, systems, equipment, components, computer programs, or personnel activities, Honeywell must determine, in accordance with 10 CFR 40.44, "Amendment of Licenses at Request of Licensee," whether a license amendment is required at that time. In cases where a license amendment is required, Honeywell would submit the request to the NRC, and the NRC staff would undertake an EA and safety analysis at that time.

Chapter 2 of this EA, which describes the proposed action, provides more detail on the manufacturing process and the facilities used to support these processes.

Honeywell is proposing to continue its operations and, therefore, is not currently required to submit or have in place an approved, detailed site decommissioning plan for the MTW. However, in accordance with 10 CFR 40.36, "Financial Assurance and Recordkeeping for Decommissioning," Honeywell submitted a decommissioning funding plan that includes a decommissioning cost estimate (ENERCON 2016) that must be updated at intervals not to exceed 3 years. Chapter 4 of this EA includes a general assessment of the potential environmental impacts of decommissioning the entire site as part of its assessment of the impacts of the proposed action. The NRC would complete additional NEPA documentation in conjunction with its review of a detailed site decommissioning plan for the MTW.

1.3 Purpose and Need for the Proposed Action

The purpose for granting the license renewal is to enable Honeywell to continue its production of uranium hexafluoride for enrichment and, ultimately, fuel manufacturing. The NRC's review of the proposed action is to ensure the safe use of radioactive materials, in accordance with the NRC's authority under the Atomic Energy Act. Currently, the MTW is the sole uranium hexafluoride conversion facility operating within the United States. If the NRC denies the renewal of the license, the enrichment facilities in the United States would be reliant entirely on foreign sources of uranium hexafluoride.

1.4 Alternatives to the Proposed Action

This EA presents and analyzes two alternatives: (1) an alternative that allows the license renewal of SUB-526 for a period of less than 40 years, called the reduced duration alternative, and (2) the no-action alternative, which is the denial of the license renewal application.

1.4.1 Reduced Duration Alternative

Under the reduced duration alternative, the NRC would approve a license renewal period less than 40 years. For previous renewals of SUB-526, the NRC approved license periods of 10 years. Section 1.5.2 lists the EAs developed for the previous renewals. In 2016, the NRC approved a recommendation to increase the standard of a 10-year licensing period to a 15-year licensing period for materials licenses (NRC 2016a, 2016b). Under this alternative, the NRC could approve a renewal period for SUB-526 consistent with the last renewal term of 10 years, approve the newly adopted 15-year license renewal period, or approve another renewal period that the NRC finds is justified based on the environmental and safety reviews of Honeywell's application. This EA analyzes the environmental impacts of a reduced license duration relative to the impacts of the proposed action.

1.4.2 No-Action Alternative

Under the no-action alternative, the NRC would deny Honeywell's request for renewal of the MTW license. The alternative of no license renewal for the MTW would result in the cessation of conversion and manufacturing at MTW. In addition, Honeywell would be required to submit a decommissioning plan to the NRC for review before the commencement of decontamination and decommissioning of the facility.

1.5 Scope of the Environmental Analysis

1.5.1 Federal and State Authorities

The NRC has authorized Honeywell to conduct activities at the MTW in accordance with the license conditions in SUB-526 issued under 10 CFR Part 40. In addition to this EA, NRC staff is preparing an SER addressing Honeywell's compliance with the provisions in 10 CFR Parts 20 and 40. In preparing this EA and the SER, the NRC evaluates the potential impacts to public health and safety and the environment that are associated with the continuation of licensed operations at the MTW site for 40 years. The NRC's decision on the proposed action will be based on the results of both the EA and SER.

Other Federal and State agencies have authority through licenses and permits over certain activities taking place at MTW. Table 1-1 summarizes the major Federal and State agency licenses and permits issued to Honeywell for activities at the MTW.

Table 1-1 Federal and State Licenses and Permits for Activities at the MTW

Agency	Description
NRC	Radioactive Source Materials License SUM-526. Licenses the possession and use of radioactive source material.
U.S. Environmental Protection Agency (EPA)	Resource Conservation and Recovery Act (RCRA) (ID ILD006278170). Identifies Honeywell as a large quantity generator of hazardous and mixed waste.
	Toxic Substances Control Act (ID 100606388). Requires reporting, recordkeeping and testing requirements, and restrictions relating to chemical substances and/or mixtures.
Illinois Environmental Protection Agency (IEPA)	RCRA permit (#B-65R2). Regulates the storage of calcium fluoride sludge in surface impoundments (calcium fluoride Ponds B, C, D, and E) and storage of drummed hazardous waste in two hazardous waste container storage buildings.
	National Pollutant Discharge Elimination System (NPDES) permit (No. IL 0004421). Effective through June 30, 2020. Regulates liquid effluent releases to the Ohio River through three outfalls.
	Title V Clean Air Act permit (ID No. 127854AAD). Issued in December 2016. Regulates emissions to the air.

1.5.2 Basis for Review

The NRC prepared this EA in accordance with the requirements of 10 CFR Part 51 and staff guidance found in NUREG-1748.

The NRC reviewed and considered the following documents in the development of this EA:

- Honeywell's license application dated February 8, 2017 (Honeywell 2017a) and accompanying ER (ENERCON 2017)
- Honeywell's responses to NRC requests for additional information (Honeywell 2018a, 2018c)
- Honeywell's RCRA closure plan for the onsite surface impoundments referred to as calcium fluoride Ponds B through E (Honeywell 2018d)
- selected previous NRC environmental review documents for the MTW site (NRC 2006a, 1995)
- information gathered from NRC site visits (NRC 2017b)
- other publicly available documents and databases as referenced in this EA

Previous License Renewal Environmental Analyses

Because the Atomic Energy Commission had licensed the MTW in 1958, prior to the implementation of NEPA, no environmental review was performed for the construction and initial operation of the MTW. However, since 1958, the NRC has evaluated multiple license renewals for the continued operation of the MTW, which included environmental reviews as follows:

- Environmental Impact Appraisal of the Allied Chemical Corporation Nuclear Services Division Uranium Hexafluoride Conversion Facility Metropolis, Illinois, August 1977 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16236A155)
- Environmental Impact Appraisal for Renewal of Source Material License No. SUB-526, NUREG-1071, issued May 1984 (ADAMS Accession No. ML16236A154)
- Environmental Assessment for Renewal of Source Material License No. SUB-526 Docket 40-3392, April 10, 1995 (ADAMS Accession No. ML16231A195)
- Environmental Assessment for Renewal of Source Material License No. SUB-526 for the Honeywell Specialty Materials Metropolis Work Facility, June 2006 (ADAMS Accession No. ML061780260)

1.5.3 Issues Outside the Scope of the EA

As discussed further below, the NRC determined the following listed areas to be outside the scope of this EA:

- material control and accountability
- criticality safety controls
- equipment failures
- plant building stability
- seismic risk analysis (likelihood)
- accidents (in part)
- safety culture

- terrorism
- license violations
- NRC enforcement actions

The potential environmental impacts from postulated accidents are addressed in Chapter 4. To the extent that postulated accidents raise safety issues, such issues would be addressed in the SER.

Through an NRC Confirmatory Order, Honeywell was subject to an assessment of its safety culture as conducted by an independent organization (NRC 2015a). In 2015, the NRC issued a report on the safety culture at the MTW (NRC 2015b). In response to this assessment and in compliance with the Confirmatory Order, Honeywell made changes to strengthen the safety culture at the site; these actions are subject to continued NRC oversight. Safety culture at the MTW is evaluated as part of the NRC staff's safety review and documented in the SER.

Concerning terrorism, it is the NRC's position that NEPA does not require analysis of the potential environmental impacts associated with acts of terrorism. While the NRC recognizes that the United States Court of Appeals for the Ninth Circuit ruled to the contrary, the NRC has determined not to analyze the potential environmental impacts of terrorism when the proposed action is located outside the jurisdiction of that court (see Commission Memorandum and Orders CLI-07-08, CLI-07-09, and CLI-07-10, ADAMS Accession Nos. ML070570511, ML070570526, ML070570736, all dated February 26, 2007) (NRC 2007a, 2007b, 2007c). Because the geographic location of the MTW site is not within that court's jurisdiction, this EA does not address the environmental impacts of terrorist acts.

The remaining topics listed above concern aspects of facility design and operation; as such, the NRC staff addresses them in its safety review, as documented in the SER, and addresses only their environmental effects in this EA.

2 PROPOSED ACTION

This chapter describes the site and ongoing activities at the MTW that comprise the proposed action. As discussed previously, Honeywell requests renewal of its NRC license for a period of 40 years. Sections 1.3.1 and 1.3.2 discuss two alternatives to the proposed action, the reduced duration alternative and the no-action alternative, respectively. Unless otherwise referenced, the primary source of information is the ER submitted as part of the license application (ENERCON 2017).

2.1 General Site Location

The MTW is situated on about 405 hectares (1,000 acres) of mostly forested land. As stated in Chapter 1 of this EA, the MTW is bordered on the north by U.S. Highway 45 (with a small portion of the site extending beyond Highway 45), on the south by the Ohio River, on the west by a coal blending plant, and on the east by privately developed land (Figure 1-1 in Chapter 1 of this EA). The restricted area, shown in Figure 2-1, is a 24-hectare (59-acre) area that is secured by two security fences. U.S. Highway 45 provides access to the site. A railroad parallels the highway with a rail spur entering the MTW site. The Metropolis Municipal Airport is about 1.6 kilometers (1 mile) north-northeast of the MTW site.

The MTW is located at 2768 North U.S. 45 Road, approximately 400 meters (1,300 feet) from the northeast corner of the outer fence to the city limits of Metropolis, IL (Honeywell 2018a, Response to Request for Additional Information (RAI) PA-6). Farther east of Metropolis is Brookport, IL, which is about 12.1 kilometers (7.5 miles) from the MTW site. Joppa, IL, is located downstream on the Ohio River, about 8.9 kilometers (5.5 miles) west of the MTW site. Paducah, KY, is about 17.7 kilometers (11 miles) southeast of the MTW site, upstream and across the Ohio River. Kevil, KY, is about 14.5 kilometers (9 miles) southwest of the MTW site.

The nearest residence is 538 meters (1,765 feet) north-northeast from the center of the MTW site. The nearest lodging is 3.6 kilometers (2.3 miles) southeast of the MTW. The nearest school is 3 kilometers (1.9 miles) southeast of the MTW site.

Section 2.2 and 2.3 describe the MTW and the processes it supports.

2.2 Facilities and Other Site Features

The restricted area within which access to the site is controlled is located between U.S. Highway 45 and the Ohio River (Figure 2-1). All process, support, storage, and treatment buildings and facilities are located within the restricted area. The primary process buildings in the restricted area include the feed materials building (FMB) and associated pads, wet process/sodium removal building, potassium hydroxide muds building, and sampling plant.

Support facilities include the ore storage building, ore sampling building, bed material filter fines building, pond muds filter calciner building, cylinder wash building, drum dumping building where yellowcake was removed from the drums, gaseous fluoride plant building, south gaseous fluoride plant, liquid nitrogen facility, calcium fluoride building, liquid hydrogen system, powerhouse, drum shredder building, and drum crusher.

Storage and treatment facilities include five ore storage pads, the RCRA hazardous waste storage buildings, uranium hexafluoride cylinder storage area, long-term cylinder storage area, environmental protection facility (EPF), sanitary wastewater treatment facility, and uranium

settling Ponds 3 and 4. The surface impoundment calcium fluoride Ponds B, C, D, and E are all inactive and undergoing closure activities that are scheduled to be completed in 2020.

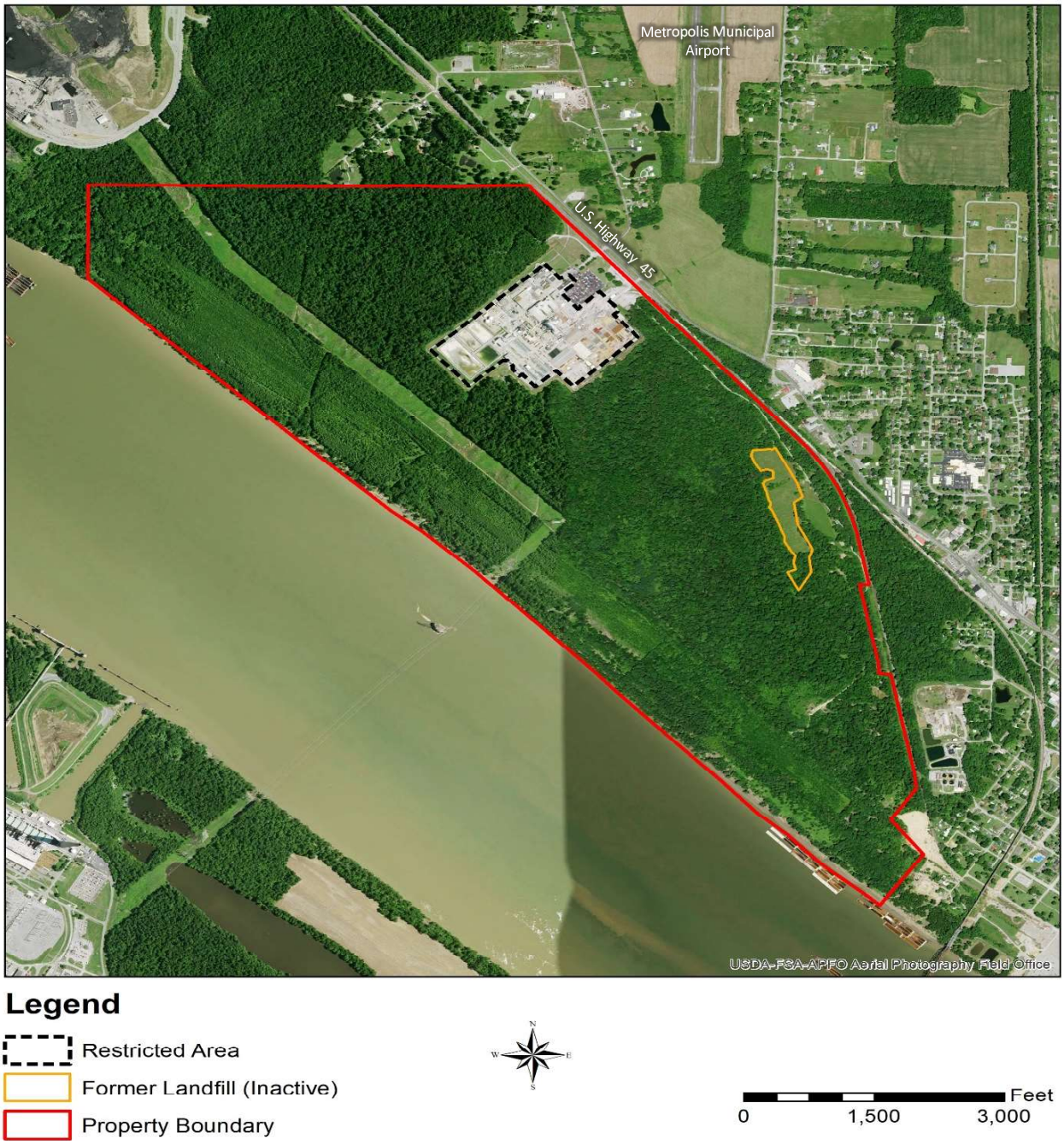

Figure 2-1 Facility Site Features at the MTW Site (Honeywell 2018a)

Section 2.3 describes these facilities.

Honeywell has upgraded and modified the process facilities and site infrastructure since the NRC issued the most recent license renewal EA in 2006. The upgrades and modifications are listed below.

- The existing EPF was expanded in 2006, when construction of the surface treatment facility (STF) was completed. This expansion increased the capacity of the existing EPF and added an additional clarifier and sand filter. The STF is considered part of the EPF.

- Outdated oil-cooled rectifiers in the fluoride production facility were replaced with new water-cooled units.

- A new cooling tower was installed to cool the waste heat from the new rectifiers before discharging to the Ohio River.

- A new sewage treatment facility was put into operation in 2015.

- Seismic/tornado protection upgrades were completed in 2013. These upgrades strengthened the FMB structure, piping supports, and vessel restraints to prevent possible releases of uranium hexafluoride and hydrogen fluoride; increase the protection of the liquid uranium hexafluoride inventory through implementation of seismic actuated shutoff valves and tornado missile shielding; and provide additional measures to confine the distillation area to reduce the release rate of any uranium hexafluoride and hydrogen fluoride releases (NRC 2013b, 2014a).

- The production of hydrogen gas from catalytic cracking of aqueous ammonia was terminated and replaced with vendor-supplied liquid hydrogen, thus eliminating a nonradiological air emission source.

The NRC evaluated the effects of these upgrades and modifications in assessing the impacts identified in Chapter 4 of this EA. Major upgrades or mitigation systems are not anticipated during the proposed license renewal term (Honeywell 2018a, Response to RAI PA-3).

An inactive landfill (shown in Figure 2-1) and a site near the landfill called the "Old Creosoter Area," formerly a wood treatment facility predating the establishment of the MTW, are also located on the MTW site (IEPA 2015b). These areas are in the northeast portion of the property and are approximately 4.5 hectares (11 acres) in area. Honeywell reports that the landfill received waste in the form of empty drums between 1959 and 1998 and disposal occurred as needed. Honeywell is currently working with the Illinois Environmental Protection Agency (IEPA) to certify closure of the landfill (Honeywell 2018a, Response to RAI LU-1).

2.3 Processes and Operations

Figure 2-2 provides a schematic of the production process, followed by information describing the production process at MTW.

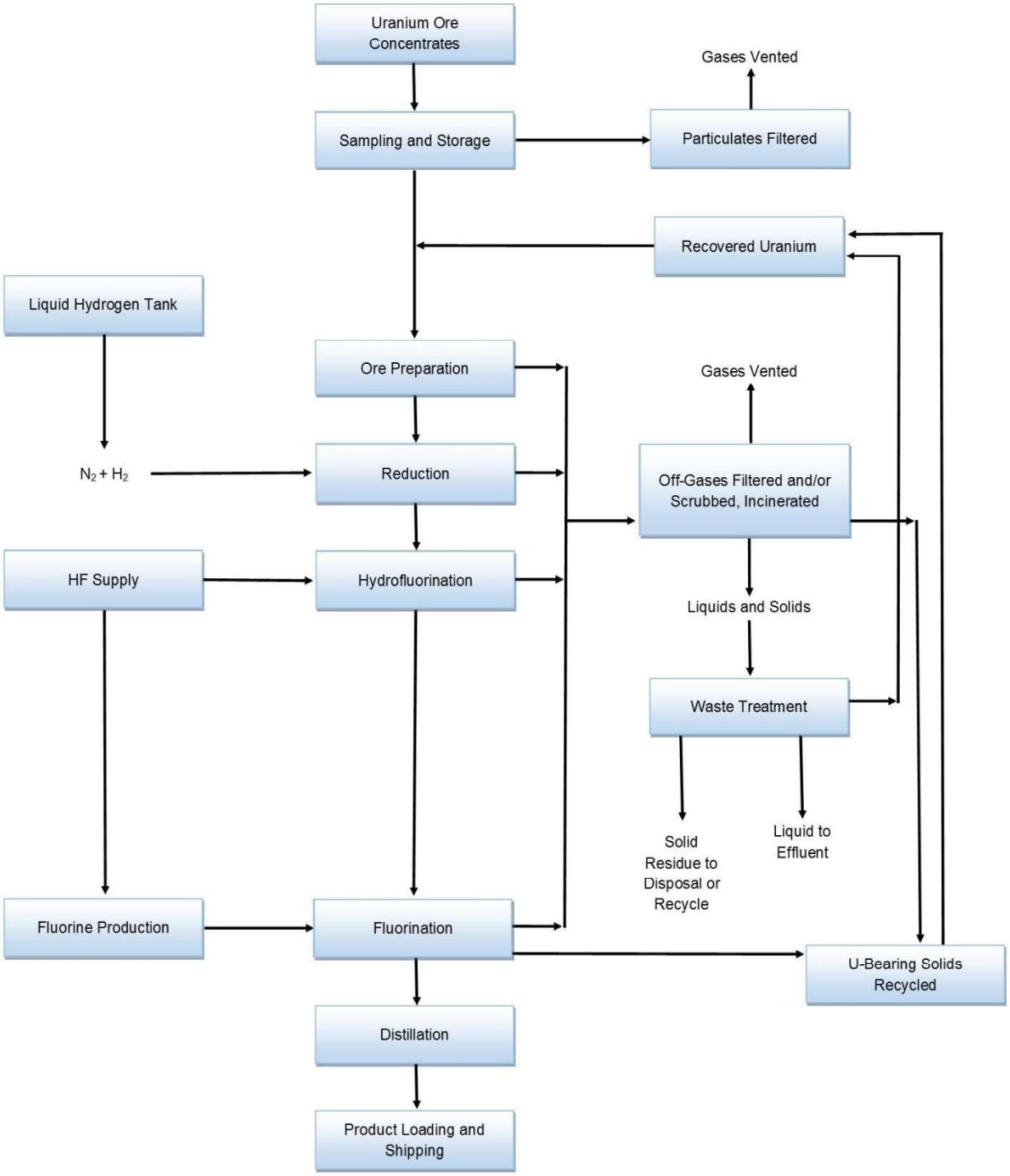

Figure 2-2 Schematic of the Uranium Oxide to Uranium Hexafluoride Conversion Process (Source: ENERCON 2017)

2.3.1 Uranium Oxide Ore Storage, Sampling, and Preparation

Uranium oxide ore concentrates, often referred to as yellowcake, are shipped to MTW via truck in 208-liter (55-gallon) drums and stored on asphalt pads. About 650 uranium oxide ore shipments are received each year and approximately 30,000 metric tons (33,000 tons) of ore are currently stored on site. The MTW's license (SUB-526, Sections 6A, 7A, and 8A) limits the amount of natural uranium to 68,000 metric tons (74,800 tons). Each drum is transported to the sampling plant where it is weighed, and a representative sample is collected to determine the general composition of the ore and to characterize impurities in the ore sampling building. After sampling, the drum lid is replaced and the drum is moved to a storage area until needed as process feed.

Feed containing high levels of sodium or potassium is leached with sulfuric acid. Uranium feed is removed from the rinse solution by filtration and transferred to the ore preparation system. The filtered rinse solution is pumped to uranium settling Ponds 3 and 4 and some particulates are released to the atmosphere. Ore with an acceptable purity level is calcined, crushed, and sized to produce uniform solid particles, which are processed in fluidized bed reactors. Ventilation air from the feed preparation building is filtered before release to the atmosphere at an efficiency greater than 95 percent (Honeywell 2018a, Response to RAI PA-10A). Solid waste filter bags are produced in this operation. The contaminated liquid stream produced in drum washing is routed to uranium settling Ponds 3 and 4.

2.3.2 Reduction (Triuranium Octaoxide to Uranium Oxide)

The initial step in the conversion process is reduction of solid triuranium octaoxide to solid uranium oxide, which is accomplished by contacting feed triuranium octaoxide with hydrogen gas in a fluidized bed reactor at 565 degrees Celsius (°C) (1,050 degrees Fahrenheit (°F)) in the FMB. A liquid hydrogen system maintained by a vendor is used as a source of hydrogen, with the tank located to the west of the FMB, next to the STF. The liquid hydrogen system is located within a gated enclosure south of the maintenance building and consists of a 68,100-liter (18,000-gallon) cryogenic storage tank and vaporizers. A nitrogen/hydrogen mixing station, located outside the liquid hydrogen system fence, provides fluidizing and reactive gas mixtures to the reactor. Four hydrogen gas analyzers are placed in and around the fenced area to monitor for leaks. If two or more detectors sense a leak exceeding action levels, the hydrogen supply automatically shuts down. Reduction off-gases consist of hydrogen sulfide, hydrogen, nitrogen, and metallic sulfides. These are processed through a gas-fired incinerator to burn off the excess hydrogen and convert hydrogen sulfide and other sulfides. The off-gas is run through a sintered metal filter bowl to remove the particulates from the stream. The stream is processed through a gas-fired incinerator to produce carbon dioxide, which then exits the incinerator stack (Honeywell 2018a, Response to RAI PA-10B).

2.3.3 Hydrofluorination (Uranium Oxide to Uranium Tetrafluoride)

In the FMB, solid uranium oxide is converted to solid uranium tetrafluoride by contacting the uranium oxide with gaseous hydrogen fluoride in two series-arranged fluidized bed reactors. The hot (455°C (851°F)) reactor off-gas is filtered and scrubbed with water, then scrubbed with potassium hydroxide solution before release to the atmosphere. The spent scrubber liquid is processed through the EPF for neutralization and recovery of fluorine as calcium fluoride. The uranium tetrafluoride solids filtered from the off-gas are combined with the uranium tetrafluoride product stream for transfer to fluorination reactors.

2.3.4 Fluorination (Uranium Tetrafluoride to Uranium Hexafluoride)

The final chemical reaction in the conversion process is fluorination of solid uranium tetrafluoride in the FMB using fluorine gas to generate gaseous and then liquid uranium hexafluoride. The gaseous fluorine is produced by decomposition of hydrogen fluoride in electrolytic cells located in a building near the FMB. The fluorination reaction is accomplished at a temperature of 480°C (900°F) in a fluidized bed containing calcium fluoride bed material. The bed material, which gradually becomes too fine and contaminated with uranium, is continuously removed along with residual uranium deposits from the process, while fresh bed material is continuously added. Contaminated bed material may either be processed on site, as described in Section 2.3.6 below, or shipped off site for uranium recovery. The reactor effluent gas stream containing the uranium hexafluoride product is passed through two filters in series and three cold traps in series. The uranium hexafluoride is condensed in the cold traps to create liquefied crude uranium hexafluoride that is transferred to the distillation area.

Gases exiting the cold traps are scrubbed with potassium hydroxide solution in series-arranged spray and packed towers. Potassium fluoride mud is removed from the scrubber solution, washed, and recycled to the uranium recovery system. The spent scrubber solution is transferred to the EPF for neutralization, recovery of potassium hydroxide, and recovery of fluorine as calcium fluoride. Filtered and scrubbed off-gases (primarily hydrogen fluoride) are released to the atmosphere.

2.3.5 Distillation and Product Packaging

In the FMB, impurities are removed from the liquefied crude uranium hexafluoride in two series-arranged distillation columns. Crude uranium hexafluoride is fed to the first column and impurities with high vapor pressure are removed as the overheads from this column. The bottoms from the first column are fed to the second column, where impurities with low vapor pressure are removed, as the bottoms and the purified uranium hexafluoride product that meets or exceeds ASTM C787, “Standard Specification for Uranium Hexafluoride for Enrichment,” purity requirements are collected in the overheads. Each column is fitted with temperature and pressure indicators, a relief valve, and a rupture disk to prevent accidental release of uranium hexafluoride. Gaseous effluents from the distillation process are fed back to the fluorination system and treated with the fluorination off-gas. The purified product uranium hexafluoride vapor is condensed and transferred as liquid to cylinders for shipment. Flow meters are used to measure the amount of uranium hexafluoride transferred to the cylinders, and the uranium hexafluoride entering the cylinders is continuously sampled. On occasion, filled cylinders are heated in a steam chest for vaporization and sampling. The filled cylinders are moved to cooling and storage areas.

2.3.6 Uranium Recovery

Fluorinator filter fines and bed material, solids from settling Ponds 3 and 4, and process liquids may be routed and processed for uranium recovery. The uranium recovery system is a series of mixing, settling, and separation tanks in which uranium is precipitated as a sodium uranyl carbonate salt through contact with sodium carbonate and sodium hydroxide. The settled or filtered uranium solids are dried and recycled to ore preparation. The spent liquid is transferred to the EPF, just north of the FMB, for neutralization and fluoride recovery.

2.3.7 Industrial Chemical Storage

The primary industrial chemicals used in the conversion process, sulfuric acid, aqueous ammonia, potassium hydroxide, sodium hydroxide, liquid hydrogen, potassium bifluoride, and hydrogen fluoride, are stored on site. Table 2-1 summarizes the tank storage capacities and quantity of chemicals stored. Sulfuric acid, potassium hydroxide, and sodium hydroxide are stored as liquids in horizontal tanks just south of the ore storage building; centrifugal pumps transfer these chemicals to the process, as needed. Honeywell had previously stored ammonia as a liquid under pressure, but it currently is not used in the manufacturing process; it has been replaced with aqueous ammonia (Honeywell 2018a, Response to RAI POH-2). Anhydrous hydrogen fluoride is stored on site in railcars (up to seven), with one railcar connected to the process at a given time (on the southeast side of the FMB, between the FMB and ore storage building) and is transferred to the process under inert gas pressure.

Table 2-1 Industrial Chemical Maximum Quantities at MTW

Chemical	Storage Tank Capacity (kilograms (pounds))
29 percent aqueous ammonia	45,115 (99,461)[a]
Anhydrous hydrogen fluoride	1,100,000 (2,400,000)[b]
45 percent potassium hydroxide	177,290 (390,850)[c]
20 percent sodium hydroxide	74,658 (164,592)[d]
93 percent sulfuric acid	59,940 (132,145)[e]
Liquid hydrogen	4,182 (9,219)[f]
Potassium bifluoride	9,090 (20,000)

a 95 percent volume in tank U-467. Shipments received in the anhydrous form.
b Contained in up to seven 80-ton railroad cars inside the restricted area fence; up to eight 80-ton railroad cars outside the restricted area fence.
c 104,710 kilograms (230,850 pounds) 95 percent volume in storage tank U-436 and one 80-ton railcar inside of the restricted area fence.
d 95 percent volume in Tank U-28.
e 95 percent volume in Tanks U-440, U-852, and U-921.
f Vendor-supplied storage tank.
Sources: Honeywell 2018a, Response to RAI TRN-1; ENERCON 2017, Table 2.1-1

2.3.8 Gaseous and Liquid Waste Confinement and Effluent Controls

2.3.8.1 Gaseous Waste Confinement and Effluent Controls

The MTW has 53 individual stacks and exhaust fans used for the release of radioactive material and 14 emission units for the release of nonradioactive material. These emission sources are at various elevations, with most of the emission sources associated with operations in the FMB. Stack heights at the MTW range from 3 meters (10 feet) for the FMB first floor exhaust fan to 47 meters (154 feet) for the hydrogen sulfide incinerator stack located on the southwest side of the FMB. Table 2-2 presents the annual uranium emissions combined for all emission points for five recent years of operation (2010 through 2014).

Table 2-2 Uranium Emissions from MTW (curies)
(total for all emission sources)

2010	2011	2012	2013	2014
0.0836	0.0779	0.0471	0.0594	0.255

Source: ENERCON 2017

Gaseous effluents from the MTW contain radioactive and nonradioactive constituents. Uranium is the primary radiological constituent released through the MTW's stacks. Uranium processing areas that produce dusts, mists, or fumes containing uranium or other toxic materials are provided with dust collectors or scrubbers to reduce employee or environmental exposure to as low as is reasonably achievable (ALARA) levels.

The ventilation system used in the FMB process area consists of a series of fresh-air intake units and a series of window and roof exhaust fans for cleaning workroom air. The total air flow through the process building is sufficient to ensure a complete air exchange approximately once every 5 minutes. A separate air-conditioning system supplies fresh air to the main control room. The control room is kept under a slight positive pressure.

Four process stacks are associated with the uranium recovery system and the drum dumping building. Hydrogen fluoride and particulates are the primary nonradiological constituents released through stacks on the FMB. Gaseous effluent streams containing nonradioactive pollutants discharge in accordance with IEPA-issued operating permits. Honeywell submits emissions reports to the IEPA in accordance with the requirements of the Title V Clean Air Act Permit Program (CAAPP) Permit (IEPA 2016a) issued December 2016 by the IEPA Division of Air Pollution Control. Table 2-3 summarizes annual nonradiological emissions from the MTW for the same five-year period.

Table 2-3 Nonradiological Air Emissions from the MTW (metric tons)

Air Emissions	2010	2011	2012	2013	2014
Carbon monoxide	10.53	13.84	5.42	3.53	14.65
Carbon dioxide	Not reported	16,964.9	6,844.84	4,457.33	18,489.8
Hydrogen fluoride	1.73	2.38	1.12	1.41	4.19
Lead	5.52×10^{-5}	6.02×10^{-5}	2.91×10^{-5}	2.10×10^{-5}	6.21×10^{-5}
Methane	Not reported	0.32	0.13	0.08	0.34
Nitrous oxide	Not reported	0.04	0.01	0.01	0.04
Nitrogen oxides	12.56	16.47	6.45	4.20	17.44
Particulates	5.06	5.86	2.55	2.97	7.93
PM_{10}	5.03	5.86	2.55	2.97	7.93
PM2.5	5.03	5.86	2.55	2.97	7.93
Sulfur dioxide	290.94	318.05	147.91	53.22	130.01
Volatile organic material	0.94	1.15	0.56	0.43	1.15

PM_{10} = particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than 2.5 micrometers in diameter.
Note: To convert metric tons to tons, multiply by 0.907.
Source: ENERCON 2017

2.3.8.2 Liquid Waste Management

Liquid waste streams generated at the MTW are categorized as low-level radioactive and nonradioactive waste streams. Each of the waste streams is recycled or treated separately. IEPA has permitted three NPDES outfalls (Outfalls 002, 003, and 005) for Honeywell's use (see Figure 3-1 of this EA for the outfall locations). Uranium hexafluoride process-related liquid effluents from the plant discharge to the Ohio River via an unlined channel and flow from the restricted area to Outfall 002 located at the Ohio River. Outfall 002 has an average discharge rate of 10.86 million liters per day (2.87 million gallons per day) in 2014). Outfalls 003 and 005

are used for nonradioactive stormwater discharges to the Ohio River. Some liquid wastes may be containerized and sent to an appropriate disposal facility. Figure 2-3 is a flow diagram showing liquid waste streams and their disposition.

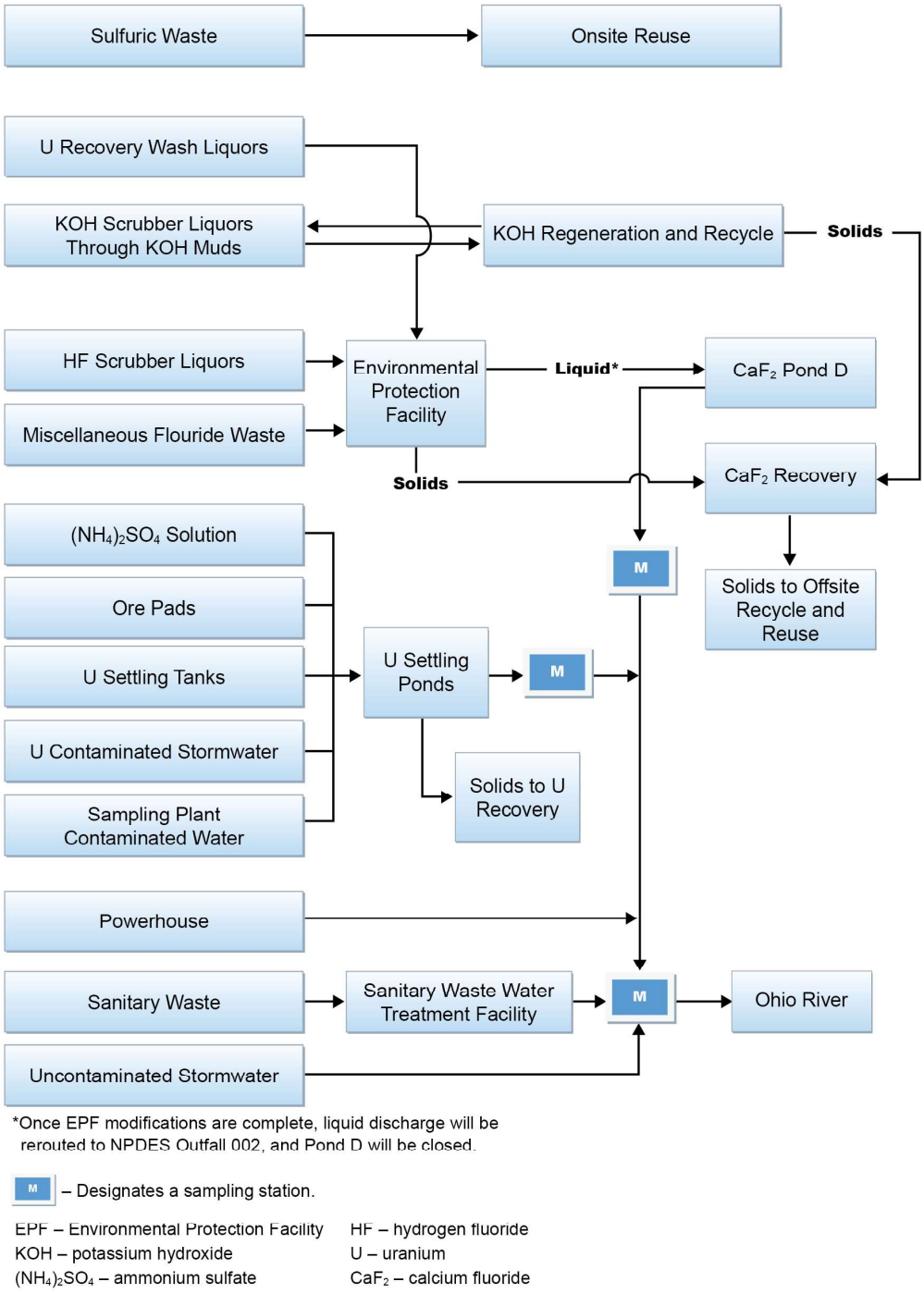

Figure 2-3 Flow Diagram for Wastewater Disposition (Source: ENERCON 2017)

Low-Level Radioactive Liquid Waste Streams and Treatment

Low-level radioactive liquid wastes the MTW produces consist of wash water from the drum dumping building (where yellowcake is introduced into the process), ammonium sulfate process solutions from the pretreatment facility, hydrogen fluoride scrubber liquors from the hydrofluorinators, potassium hydroxide scrubbing solutions from air pollution abatement equipment, sodium hydroxide leach liquors from uranium recovery and uranium hexafluoride cylinder washing, and uranium-contaminated stormwater from the FMB area.

The potassium hydroxide scrubbing solutions are recycled, with the solids removed to recover calcium fluoride. Wash waters from the drum dumping building and ammonium sulfate solutions from the preparation process are routed to uranium settling tanks within the wet process or uranium settling ponds. Solids that have settled out in the tanks are routed to uranium recovery, while the liquids are routed to uranium settling Ponds 3 and 4. Treated effluent from the ponds, which averages about 95 liters per minute (25 gallons per minute), mixes with other MTW effluents and discharges to Outfall 002. Sludge from the ponds is periodically drummed and processed in a mud calciner, drummed again, and either moved to the ore preparation building for recovery of additional uranium or sent off site for disposal.

Wastewaters containing significant quantities of fluoride (i.e., scrubbing liquors and uranium recovery leach liquors) are routed to the EPF for lime treatment and recovery of the fluoride as calcium fluoride. Honeywell added the STF to the EPF in 2006 to increase the EPF's capacity and capability to treat and remove fluoride (see Section 2.2 of this EA). These improvements allowed calcium fluoride Pond D to be removed from operation in the spring of 2018 (Patterson 2019a). Calcium fluoride that is recovered through the STF is recycled by the commercial industry and used as a substitute for natural fluorspar. Treated effluent from the EPF, stormwater from the calcium fluoride ponds undergoing closure, and liquids generated from the pond closure activities flow in an unlined channel to Outfall 002, where the effluent finally discharges to the Ohio River under the terms of the MTW's NPDES permit.

Sanitary Wastewater

A sanitary wastewater treatment system is located on site. Treated wastewater discharges to the Ohio River through an unlined channel that flows to Outfall 002 after comingling with other wastewater and natural discharges, as described above. Sanitary wastewater discharges are monitored for flowrate, total suspended solids, biological oxygen demand, and coliform.

2.3.9 Monitoring Programs

MTW's monitoring programs include effluent monitoring of air and water; environmental monitoring of air, surface water, groundwater, soil, vegetation, and direct gamma radiation; and occupational monitoring for workers. The NRC staff will evaluate the occupational monitoring program in the SER. Data from the effluent and environmental monitoring programs provide background information for the descriptions of the affected environment presented in Chapter 3 of this EA and the bases for the impact analysis presented in Chapter 4. The following subsections describe monitoring activities in more detail.

2.3.9.1 Effluent Monitoring Program

The MTW produces gaseous and liquid effluent streams. Each of these effluent streams is monitored at or just before the point of release. Honeywell reviews the results from the gaseous

and liquid radiological effluent monitoring program weekly and reports undesirable trends to plant management via ALARA meetings, quarterly health physics audits, or immediately depending on the severity of the condition. Honeywell also reports the results of its monitoring program in semiannual effluent reports submitted to the NRC. The following paragraphs describe the monitoring programs for gaseous and liquid releases.

Gaseous Release Monitoring

Gaseous effluents released from the facility contain radiological and nonradiological constituents, as described in Section 2.3.8 of this EA. Stack monitoring is the primary method used to measure gaseous effluents containing uranium. MTW workers sample pertinent stacks for uranium continuously at isokinetic flow conditions using particulate filters to capture uranium. Stack emissions are sampled and analyzed for alpha radioactivity either once or twice per 24 hours, depending on the process being monitored and as informed by the results of 45 years of historical data. The dust collectors typically have primary and secondary (backup) units arranged in series. Honeywell has established an investigation level, which, if exceeded on three successive samples, would result in an informal investigation and, if needed, corrective actions to decrease radioactive emissions. When corrective action does not reduce emissions below the investigation limit, additional actions are taken, including shutdown of the unit. In accordance with the requirements of 10 CFR 40.65(a), Honeywell submits the results of the effluent monitoring analyses to the NRC in semiannual monitoring reports (see Table 2-2 in this EA for a summary of the annual uranium air emissions for the years 2010 through 2014).

Ambient air monitoring is also conducted as part of the environmental monitoring program. Honeywell has established an investigation level for ambient air monitoring and it is based on the average of four continuous air samples collected along the restricted area fence line. The samples are collected and analyzed for trends on a weekly basis. The investigation level is established as a quarterly uranium concentration that would produce an annualized dose of 0.1 milliSieverts (mSv) (10 millirem (mrem)). Air monitoring under the environmental monitoring program is further described in Section 2.3.9.2.

Uranium in the air is also monitored at air sampling location NR-7, located adjacent to the nearest residence downwind of the MTW (see Figure 2-4). Air samples are collected weekly at sampling location NR-7, except during periods of disassembly or repair. If the average concentration of total alpha radioactivity (the sum of natural uranium, radon-226, and thorium-230) measured from samples collected from location NR-7 exceeds 3.0×10^{-14} microcuries per milliliter (µCi/ml) over any calendar quarter, Honeywell must submit a written report to the NRC within 30 days identifying the cause for exceeding the limit and the corrective actions to reduce the radioactivity release rates. This action level was developed to ensure the dose for the maximally exposed member of the public is a small fraction of the NRC's 1.0-mSv (100-mrem) annual limit in accordance with 10 CFR 20.1301, "Dose Limits for Individual Members of the Public." The action level also provides assurance that facility operations will not have a significant impact on public health and safety and the environment. Samples collected at sampling location NR-7 are also composited at least quarterly and analyzed for uranium solubility.

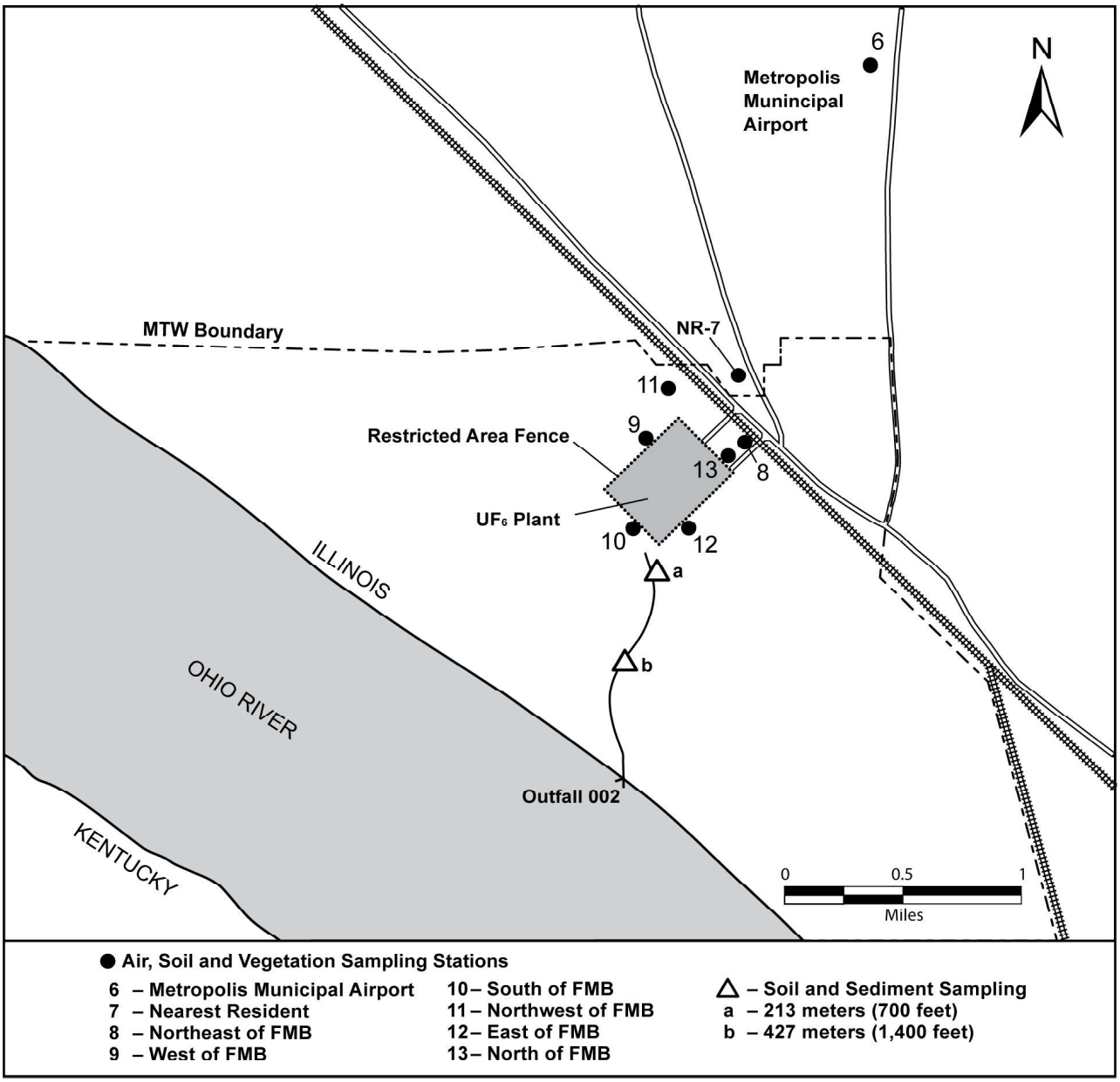

Figure 2-4 Environmental Air, Soil, Sediment, and Vegetation Sampling Locations (Source: ENERCON 2017)

Liquid Release Monitoring

All treated process and sanitary liquid wastes from the MTW flow through an unlined channel and discharge to the Ohio River at Outfall 002, an NPDES permit-controlled release point. This channel also carries stormwater runoff.

Honeywell continuously samples the Outfall 002 effluent to produce a daily composite, which is analyzed for uranium. The daily composites are combined into a monthly composite, which is analyzed for uranium, gross alpha, gross beta, and several nonradiological constituents. The detection limit for uranium is less than 0.001 part per million (ppm).

The Outfall 002 effluent is also analyzed for various parameters and numerous nonradiological constituents, including total fluorides, total suspended solids (TSS), and biological oxygen demand. Table 2-4 summarizes the NPDES permit requirements and effluent monitoring results for the years 2010 through 2014. During this period, the 30-day averages for TSS, total fluorides, and pH were all within the limits specified in the NPDES permit. The NPDES permit does not specify limits for total uranium or temperature (IEPA 2015a).

Table 2-4 Summary of Outfall 002 Monitoring

		NPDES	2010		2011		2012		2013		2014	
Parameter	Units	Limit	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.
Flow rate	MGD	N/A	6.53	3.51	6.03	3.00	3.92	1.92	7.04	2.22	4.13	2.87
Uranium	mg/L	N/A	3.63	0.59	2.06	0.51	2.06	0.33	3.91	0.35	1.94	0.34
pH	N/A	6.0–9.0	8.21	7.47	8.22	7.17	7.07	6.61	8.22	7.03	7.86	7.11
Temperature	°C	N/A	(a)	(a)	24.2	20.34	24.8	20.54	22.00	18.28	21.90	19.73
Total fluorides	mg/L	15[b] 30[c]	15.96	3.28	8.90	3.12	11.60	3.06	26.00	3.96	28.00	4.98
TSS	mg/L	15[b] 30[c]	15.00	3.49	11.00	3.55	72.00	4.63	149.00	11.17	6.0	1.65
Biological oxygen demand	mg/L	30[b,d] 60[b,d]	37.00	6.22	18.00	4.65	29.00	7.73	21.00	5.49	33.00	7.79

a This parameter in this location not monitored until 2011.
b 30-day average.
c Daily maximum.
d Biological oxygen demand limits are specific to the sanitary wastewater before combining with the Outfall 002 discharge.
MGD = millions of gallons per day, mg/L = milligrams per liter, N/A = not applicable, NPDES = National Pollution Discharge Elimination System.
Note: The NPDES permit stipulates reporting requirements for flow rate, temperature, and uranium, but not limits.
Sources: IEPA 2015a; ENERCON 2017, Table 2.1-5; Honeywell 2018c

Excursions of TSS, fluoride, fecal coliform, and high-temperature effluents occurred between 2010 and 2015. Honeywell discontinued temperature monitoring in 2010. TSS excursions in 2012 and 2013 were attributed to stormwater runoff mixing with sediment from capital development projects. Honeywell subsequently implemented controls to minimize the potential for future excursions by adding sediment filters and discharging wastewater to uranium settling Ponds 3 and 4. Fluoride excursions were attributed to leaking trenches and an associated sump; Honeywell repaired the trenches and replaced the sump. To reduce fecal coliform excursions, Honeywell increased the frequency of routine maintenance and improved its documentation of maintenance (Honeywell 2017b).

2.3.9.2 Environmental Monitoring Program

MTW conducts an environmental monitoring program that samples sediment, soil, vegetation, surface water, groundwater, and air, and measures direct gamma radiation at locations on or near the facility. Onsite air sampling locations are shown in Figure 2-4 above and offsite sampling locations are shown on Figure 2-5 below. Table 2-5 provides a summary of the site monitoring programs.

Honeywell reviews the results from the radiological environmental monitoring program and notifies plant management of trends and results that could indicate noncompliance with applicable standards. Elements of the environmental monitoring program are described in the following paragraphs. The plant ALARA committee meets quarterly to evaluate data, identify any potentially adverse trends in environmental exposures, and to develop investigation and action plans, as necessary.

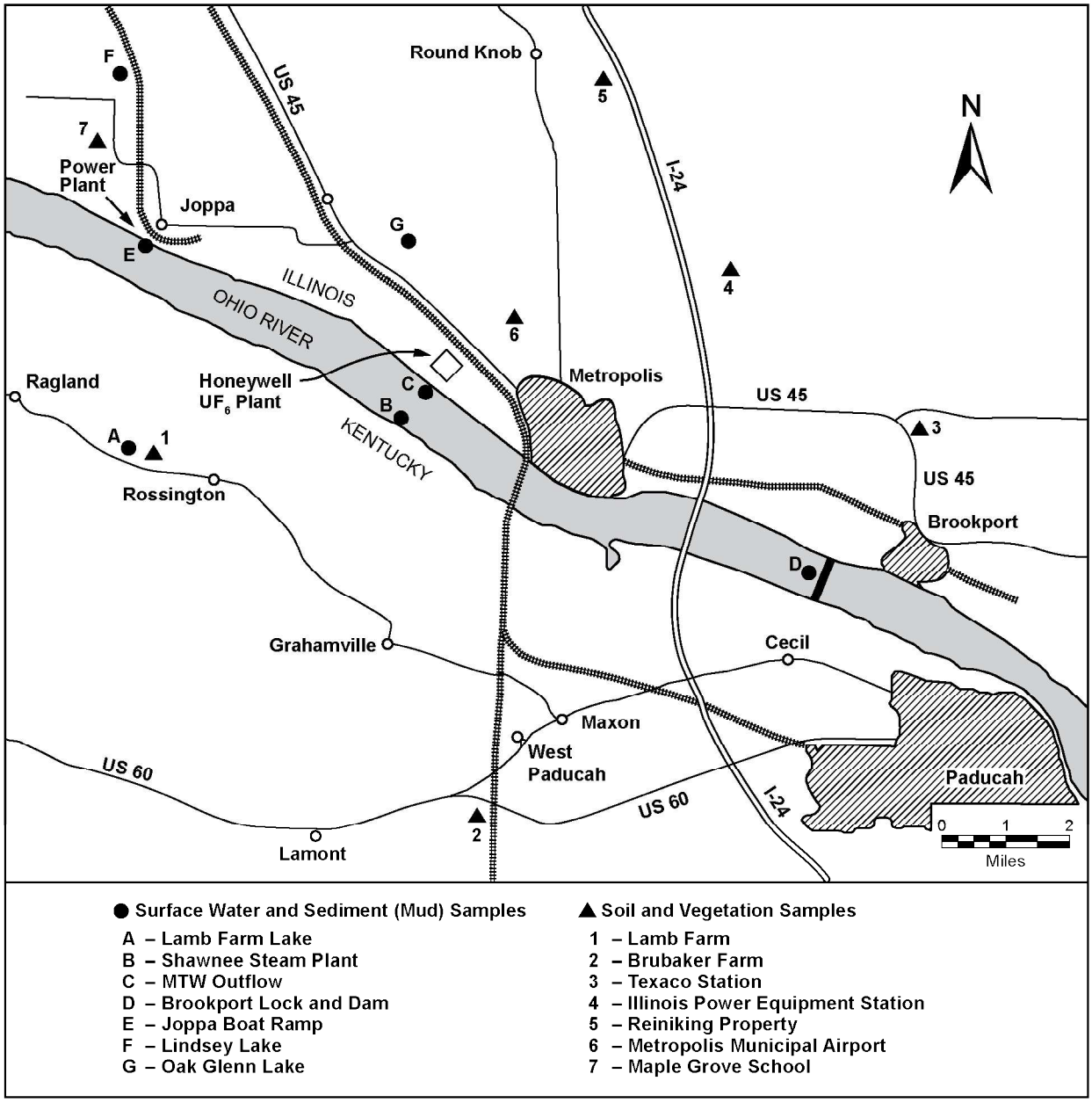

Figure 2-5 Offsite Environmental Monitoring Sampling Locations for Surface Water, Sediment, Soil, and Vegetation (Source: ENERCON 2017)

Table 2-5 Summary of Effluent and Environmental Monitoring Programs

Sample Medium	Number of Stations	Analytical Frequency	Sample Type	Type of Analysis
Onsite				
Air	6	Weekly for uranium; quarterly for radon-226 and thorium-230	Continuous	uranium, radon-226, thorium-230, fluoride
Soil	6	Semiannually	Grab	uranium, fluoride
Vegetation	6	Semiannually	Grab	uranium, fluoride
Ambient radiation	6	Quarterly	Continuous	gamma
Surface water	1	Monthly	Continuous	uranium, gross alpha, gross beta
		Monthly	Continuous	suspended solids, dissolved solids, pH, fluorides, other chemicals
Sediment	2	Semiannually	Grab	uranium, fluoride
Groundwater (sanitary well and process Well No. 3)	2 wells	As needed	Grab	inorganic constituents, volatile organic compounds, radionuclides, and general parameters, including pH, turbidity, chlorine, total coliform, and fecal coliform
Groundwater (process wells associated with monitoring the calcium fluoride ponds)	11	Quarterly	Grab	pH, specific conductance, fluoride, gross alpha and gross beta
Groundwater (inactive landfill)	8 wells	Quarterly	Grab	pH, specific conductance, other environmental constituents, gross alpha, gross beta, radon-226, and radium-228
Groundwater (Old Creosoter Area)	12 wells	Semiannually	Grab	benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, bis(2-ethylhexyl) phthalate, chromium, chrysene, dibenz(a)anthracene, indeno[1,2,3-cd]pyrene, lead, lead (dissolved), tetrachloroethene
Offsite				
Air	2	Weekly for uranium; quarterly for radon-226 and thorium-230	Continuous	uranium, radon-226, thorium-230, fluoride

Sample Medium	Number of Stations	Analytical Frequency	Sample Type	Type of Analysis
Soil	8	Semiannually	Grab	uranium, fluoride
Vegetation	8	Semiannually	Grab	uranium, fluoride
Ambient radiation	2	Quarterly	Continuous	gamma
Surface water	7	Semiannually	Grab	uranium, fluoride
Sediment	7	Semiannually	Grab	uranium, fluoride

Source: ENERCON 2017, Table 2.1-6

Air Monitoring

The environmental air monitoring program uses continuous air samples collected at four points along the restricted area fence line (Sampling Location Nos. 9, 10, 12 and 13), at two points near the MTW site boundary in the prevailing wind direction (Station Nos. 8 and 11), and at two offsite points (Station No. NR-7, at the nearest downwind residence, and Station No. 6, approximately 1.6 kilometers (1 mile) downwind of the FMB). Figures 2-4 and 2-5 show the sampling locations. MTW workers change each low volume (No. 6, 8, 9, 10, 11, 12, and 13) sample filter weekly and analyze the samples for uranium and fluoride content. Honeywell contracts with an analytical laboratory to analyze the quarterly composite of the 13 weekly samples for radon-226 and thorium-230 collected for this facility. Honeywell analyzes the weekly samples obtained at the nearest residence (NR-7) sample station for uranium. The quarterly composites of the weekly (NR-7) samples are analyzed for radon-226 and thorium-230. If the average concentration of total alpha radioactivity (the sum of natural uranium, radon-226, and thorium-230) measured in samples collected from location NR-7 exceeds 3.0×10^{-14} µCi/ml over any calendar quarter, MTW must submit a written report to the NRC within 30 days. The report must identify the cause for exceeding the limit and the corrective actions being taken to reduce the radioactivity release rates. Tabulated values in Table 2.1-8 of the ER (ENERCON 2017) indicate that one exceedance of the 3.0×10^{-14} µCi/ml action level occurred in the 2010–2014 timeframe.

The results of environmental monitoring for fluoride indicate that for the years 2010 through 2014 (Table 2.1-7 of the ER (ENERCON 2017)), the highest annual average fluoride concentration (0.346 µg/m^3) was measured on the restricted area fence line at Station No. 10, downwind of the calcium fluoride loading area. Fluoride concentrations were not measurable at most of the other sampling stations from 2011 through 2013, in part because of the temporary shutdown of the MTW to complete seismic/tornado safety upgrades from May 2012 to July 2013 (NRC 2012). The State of Illinois does not have an air quality standard for fluoride. The State of Kentucky's standard is found in Title 401 of the Kentucky Administrative Regulations (KAR) Chapter 53, "Ambient Air Quality," Section 010, "Ambient Air Quality Standards." The Kentucky primary standard for protecting public health is an annual mean of 400 µg/m^3. All fluoride emissions from 2010 through 2014 were within the Kentucky standard. For more detailed discussions of air quality conditions and potential impacts, see Sections 3.6 and 4.1.6 of this EA.

Surface Water and Sediment Monitoring

Surface water and sediment samples are collected semiannually at area lakes and ponds and on the Ohio River. Four sample locations are on the Ohio River at the following locations: (1) Outfall 002, (2) upstream of Outfall 002, (3) downstream of Outfall 002, and (4) on the Kentucky side of the river directly across from Outfall 002. Three inland locations at lakes and

ponds are also sampled. The surface water and sediment samples are analyzed for uranium and fluoride. Table 2-6 shows the results of uranium and fluoride surface-water sampling for the years 2010 through 2014.

Table 2-6 Surface Water Monitoring Annual Averages

Location	2010	2011	2012	2013	2014
Uranium (ppm)					
Shawnee Steam Plant (Ohio River, opposite MTW)	0.02	0.00	0.00	0.00	0.00
MTW Outfall 002 outflow to river	0.01	0.01	0.13	0.02	0.14
Brookport lock and dam (river upstream)	0.00	0.00	0.00	0.00	0.00
Joppa boat ramp (river downstream)	0.00	0.00	0.00	0.00	0.00
Lamb Farm Lake	0.00	0.00	0.00	0.05	0.00
Lindsay Lake	0.00	0.03	0.04	0.00	0.00
Oak Glenn Lake	0.00	0.00	0.00	0.00	0.00
Fluoride (ppm)					
Shawnee Steam Plant (Ohio River, opposite MTW)	1.52	0.16	0.13	0.09	0.14
MTW Outfall 002 outflow to river	4.49	0.42	1.64	0.40	1.56
Brookport lock and dam (river upstream)	2.51	0.19	0.15	0.15	0.17
Joppa boat ramp (river downstream)	3.40	0.20	0.17	0.16	0.17
Lamb Farm Lake	1.73	0.13	0.12	0.76	0.12
Lindsay Lake	1.98	0.16	1.12	0.20	0.19
Oak Glenn Lake	1.63	0.18	0.16	0.19	0.19

ppm = parts per million.
Note: The detection limit for uranium is <0.001 ppm.
Source: ENERCON 2017, Table 2.1-9

For the years 2010 through 2014, the uranium concentration ranged from 0.02 to 0.14 ppm for surface water in the Ohio River at the MTW Outfall 002 outflow sample station. Measurements at the other sampling locations on the Ohio River and in nearby lakes were almost entirely below the detection limit for uranium (<0.001 ppm) for this same period. Annual fluoride concentrations in surface water near the MTW outflow varied yearly with no clear increasing or decreasing trend. Both uranium and fluoride concentrations in surface water meet applicable standards.

For the years 2010 through 2014, the offsite sediment (mud) samples show comparable uranium concentrations upstream and downstream of the MTW except near the MTW outflow (sampling Station C on Figure 2-5 in this EA). Table 2-7 shows sediment sampling results for the years 2010 through 2014. The sediment sampling data generally show an increasing trend in uranium concentration over the 5-year period and a decreasing trend in fluoride.

MTW collects sediment samples from the channel to Outfall 002 at distances of 213 meters (700 feet) and 427 meters (1,400 feet) from the southeast corner of the restricted area to determine whether uranium and fluoride are present. Table 2-7 indicates that sediment concentrations for uranium in the channel consistently increase from the upstream monitoring point (213 meters downstream from restricted area) to the second monitoring point (427 meters downstream from the restricted area). The higher uranium concentration in the sediments at the

427-meter station correlates with a significant decrease in the slope of the channel. The decrease in slope results in a decrease in the downstream flow rate and, thus, an increase in the concentration of uranium-containing sediment in the channel near the 427-meter station. Fluoride concentrations are widely variable at the two monitoring points in the channel to Outfall 002. See Section 4.1.4.1 of this EA for additional information on surface water and sediment conditions and their potential impacts on the environment.

Table 2-7 Sediment Monitoring Annual Averages

Location	2010	2011	2012	2013	2014
Uranium (ppm)					
Effluent channel, 700 feet	12.54	69.02	343.50	439.50	28.30
Effluent channel, 1,400 feet	30.14	243.79	376.45	1,775.00	370.00
Shawnee Steam Plant (Ohio River, opposite MTW)	0.12	0.28	0.34	0.78	1.12
MTW Outfall 002 outflow	0.43	13.82	23.75	0.68	2.30
Brookport lock and dam (upstream)	0.07	0.19	0.71	1.00	0.57
Joppa boat ramp (downstream)	0.09	0.29	0.44	0.55	0.76
Lamb Farm Lake	0.29	0.63	1.13	2.55	0.97
Lindsay Lake	0.09	0.56	0.91	1.45	0.79
Oak Glenn Lake	0.22	0.42	0.49	1.65	1.09
Fluoride (ppm)					
Effluent channel, 700 feet	817.13	7,677.08	43.50	110.00	60.50
Effluent channel, 1,400 feet	32,782.09	5,220.50	27.40	105.50	31.00
Shawnee Steam Plant (Ohio River, opposite MTW)	9.90	5.07	0.55	0.24	2.30
MTW Outfall 002 outflow	161.65	7.21	6.10	0.54	8.15
Brookport lock and dam (upstream)	6.83	1.62	1.19	0.50	0.84
Joppa boat ramp (downstream)	12.28	1.75	1.32	0.29	1.70
Lamb Farm Lake	5.34	0.94	1.35	1.20	1.79
Lindsay Lake	0.99	1.64	0.57	1.80	2.90
Oak Glenn Lake	1.84	1.03	1.36	2.10	0.54

ppm = parts per million.
Note: Detection limits for fluoride are 0.005 mg/L; for uranium, 0.025 µg/g of soil, sediment, or vegetation.
Source: ENERCON 2017, Table 2.1-10

Soil and Vegetation Monitoring

Honeywell collects 14 soil and vegetation samples semiannually. Six sample stations are located on site at the same location as the low-volume air samplers (see Figure 2-4 in this EA). Seven stations are located off site within a 13-kilometer (8-mile) radius of MTW in Illinois and Kentucky (see Figure 2-5 in this EA), and an eighth station is located at the nearest residence (NR-7). Table 2-8a presents soil uranium measurements for the years 2010 through 2018. Table 2-8b presents soil fluoride measurements for the years 2010 through 2014. Table 2-9 presents the vegetation uranium and fluoride measurements for the years 2010 through 2018.

Table 2-8a Soil Monitoring Annual Averages of Uranium Concentration in ppm

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018
Lamb Farm[a]	0.96	1.36	1.09	1.45	1.07	1.15	1.15	1.30	1.02
Brubaker Farm[a]	1.94	0.55	1.2	1.23	1.09	1.25	0.92	1.05	0.95
Texaco Station[a]	1.90	0.72	1.1	1.3	1.09	1.25	1.15	1.05	1.10
IL Power Equipment Station[a]	1.23	0.46	0.97	1.2	1.11	1.00	1.59	1.24	0.98
Reiniking property[a]	6.65	0.70	1.17	1.35	2.15	1.15	1.50	1.16	1.00
Metropolis Municipal Airport[a]	1.10	2.50	1.75	2	2.10	2.45	2.10	1.45	1.70
Maple Grove School[a]	1.32	1.19	0.91	0.8	0.79	0.91	1.30	0.92	1.20
North of FMB	12.45	11.93	25.55	21	37.5	24.00	24.50	20.00	24.00
West of FMB	10.34	14.30	14.85	12.55	16.5	14.50	15.25	17.50	15.00
South of FMB	7.06	6.22	8.15	8.15	12.5	12.50	10.25	10.30	7.50
Northwest of FMB	13.80	15.36	19.35	4.35	26	22.50	11.25	13.50	5.70
East of FMB	49.88	89.44	71.55	36.5	162.15	117.00	235.00	109.00	105.50
North of FMB	16.89	19.52	27	23.5	27.5	31.00	19.00	40.50	19.50
Nearest residence[a]	5.21	6.84	8.5	7.3	9	17.45	9.15	8.05	7.2

a Offsite sample locations.
FMB = feed materials building; ppm = parts per million.
Note: Detection limits for uranium are 0.025 µg/g.
Sources: ENERCON 2017, Table 2.1-12; Patterson 2019b

Table 2-8b Soil Monitoring Annual Averages of Fluoride Concentration in ppm

Location	2010	2011	2012	2013	2014
Lamb Farm[a]	4.49	1.61	1.85	4.95	1.31
Brubaker Farm[a]	37.31	1.10	0.615	1.35	0.52
Texaco Station[a]	3.74	24.61	0.91	0.89	0.16
IL Power Equipment Station[a]	4.38	2.63	0.56	2.08	0.87
Reiniking property[a]	3.55	3.88	2.35	2	1.4
Metropolis Municipal Airport[a]	2.83	2.22	2.2	1.3	1.6
Maple Grove School[a]	3.62	1.22	2.9	0.89	1.575
North of FMB	1.76	4.66	8.4	15.5	8.05
West of FMB	1.23	4.27	4.85	7.3	5.85
South of FMB	1.67	4.78	11.6	16	8.9
Northwest of FMB	3.59	1.81	1.75	2.85	3.2
East of FMB	4.87	6.83	8.95	5.6	11.015
North of FMB	5.85	5.16	4.95	11.4	7.65
Nearest residence[a]	1.10	1.69	1.25	2.6	1.8

a Offsite sample locations.
FMB = feed materials building; ppm = parts per million.
Note: Detection limits for fluoride are 0.005 mg/L.
Source: ENERCON 2017, Table 2.1-12

Table 2-9 Vegetation Monitoring Annual Averages of Uranium and Fluoride Concentrations

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018
Uranium (ppm)									
Lamb Farm[a]	4.46	18.62	0.08	0.46	0.15	0.03	0.00	0.00	0.00
Brubaker Farm[a]	3.83	15.61	no result	0.25	0.36	0.02	0.00	0.00	0.00
Texaco Station[a]	3.39	11.90	0.27	0.14	0.14	0.00	0.00	0.00	0.00
IL Power Equipment Station[a]	2.26	22.04	0.18	0.28	0.19	0.03	0.00	0.00	0.00
Reiniking property[a]	2.17	9.76	0.07	0.21	1.00	0.09	0.06	0.00	0.10
Metropolis Municipal Airport[a]	4.00	4.12	0.26	0.16	0.54	1.25	0.06	0.16	0.29
Maple Grove School[a]	4.87	19.12	0.23	0.20	0.08	0.04	0.00	0.16	0.12
North of FMB	2.40	9.72	9.85	5.40	15.40	14.60	19.40	5.30	1.80
West of FMB	2.08	27.67	2.40	1.90	5.95	12.75	4.25	2.29	2.75
South of FMB	3.46	23.44	3.00	5.55	4.55	30.50	3.25	3.73	2.80
Northwest of FMB	2.23	10.64	1.72	4.60	2.25	1.85	1.50	1.32	0.75
East of FMB	11.19	35.03	6.00	6.10	14.75	36.45	20.00	10.15	17.00
North of FMB	8.93	11.97	7.50	4.60	7.15	10.30	2.50	4.40	1.60
Nearest residence[a]	1.40	16.48	2.00	7.90	0.83	0.65	1.30	0.09	1.95
Fluoride (ppm)									
Lamb Farm[a]	23.32	4.09	694.00	34.50	177.20	1822.50	11.50	31.40	60.00
Brubaker Farm[a]	12.12	7.94	1660.00	24.55	232.00	1005.00	24.50	13.05	14.00
Texaco Station[a]	12.22	8.65	1665.00	43.00	232.00	1728.50	37.00	107.50	134.00
IL Power Equipment Station[a]	13.43	7.97	1640.00	1365.00	310.00	2250.00	4.50	16.70	190.00
Reiniking property[a]	13.30	7.43	696.50	9.30	214.00	ND	6.00	9.00	90.00
Metropolis Municipal Airport[a]	11.54	35.39	1240.00	16.80	351.00	1300.00	10.00	10.55	5.50
Maple Grove School[a]	12.76	11.53	264.00	3.65	55.48	600.00	7.05	18.90	14.40
North of FMB	26.02	15.35	182.50	11.20	98.70	3.15	56.50	6.90	60.00
West of FMB	13.87	16.70	289.00	153.35	49.50	ND	ND	18.00	23.95
South of FMB	121.14	13.57	428.00	221.85	241.50	160.00	2.50	7.75	122.15
Northwest of FMB	26.16	9.52	518.50	47.50	15.15	2.10	2.55	4.30	1.15
East of FMB	37.06	15.05	85.65	6.25	8.95	3.60	2.50	3.75	21.00
North of FMB	50.88	23.92	845.00	206.65	195.00	2.00	5.45	17.35	155.95
Nearest residence[a]	28.42	47.24	1200.00	30.50	335.00	172.60	22.50	159.00	80.55

a Offsite sample locations.
FMB = feed materials building; ND = not detected; ppm = parts per million.
Note: Detection limits for fluoride are 0.005 mg/L; for uranium, 0.10 µg/g.
Sources: ENERCON 2017, Table 2.1-11; Patterson 2019b

Sampling results for the years 2010 through 2018 show uranium concentrations ranging from 5.21 to 17.45 ppm in soils at the nearest residence, with an average of 8.74 ppm. Uranium concentrations in soils at other offsite sampling locations have not fluctuated significantly during those years. The highest uranium concentration in soil at the Reiniking property was measured at 6.65 ppm in 2010. The overall offsite average concentration for the years 2010 through 2018 is 2.3 ppm, which is less than the background value of 3.0 ppm in soil. Uranium concentrations are higher in onsite soils, with the highest concentration measured in 2016 east of the FMB. The uranium concentrations in soils east of the FMB ranged from 36.5 to 235.00 ppm. All other sampling locations on the site measured soil uranium concentration levels equal to or less than 40 ppm over this same period. The average onsite uranium concentration is 32 ppm, which is 10.7 times the background value of 3.0 ppm in soil, and 2 times higher than the onsite 4-year average of 15.8 ppm reported in 1995 (NRC 1995).

Fluoride concentrations in soils at offsite locations other than the nearest residence have shown a decreasing trend, with the highest 2014 concentration measured at the Maple Grove School (1.575 ppm). Fluoride concentrations in soils at the nearest residence were at or below 2.6 ppm for the years 2010 through 2014. Fluoride concentrations in onsite soils have increased for the years 2010 through 2014, with the highest 2014 concentration (11.015 ppm) east of the FMB.

The average onsite uranium concentration in vegetation was 8.7 ppm for the years 2010 through 2018, which is twice the value (4.25 ppm) reported in the NRC's 2006 license renewal EA. Onsite uranium concentrations are higher than offsite concentrations, which averaged 2.3 ppm for the years 2010 through 2018.

Fluoride concentrations in vegetation at offsite locations were highest during 2012. In 2012, concentrations of fluoride in vegetation ranged from 264.00 to 1,665.00 ppm at offsite locations. In 2018, offsite concentrations ranged from 5.50 to 190.00 ppm. The State of Illinois does not have an applicable fluoride standard. The State of Kentucky standard at 401 KAR 53:010 allows a 40-ppm average fluoride concentration during a 6-month growing season; a 60-ppm average concentration for a 2-month average; and an 80-ppm concentration for a 1-month average.

See Sections 3.3.2 and 4.1.3 of this EA, respectively, for additional information and impacts associated with soils. See Sections 3.5.1 and 4.1.5.1 of this EA, respectively, for additional information and impacts associated with vegetation.

External Gamma Monitoring

Direct radiation is continuously monitored using environmental thermoluminescence dosimeters (TLDs) at nine locations. Four of these environmental TLDs are located on the restricted area fence line on each side of the MTW, one is at the nearest site boundary line, one is at the Metropolis Municipal Airport (1.6 kilometers (1 mile) north-northeast of the MTW site), and two are at the nearest residence (NR-7 South and NR-7A North). A ninth TLD provides a control measurement. Honeywell analyzes the results of the environmental TLDs and replaces the TLDs every quarter. Table 2-10 shows the average external gamma monitoring results.

Table 2-10 Annual Averages of External Gamma Radiation (milliSieverts)[a]

Location	2010	2011	2012	2013	2014
Control	0.28	0.31	0.29	0.27	0.27
North fence[b]	0.44	0.43	0.23	0.17	0.13
East fence[b]	0.96	1.00	0.88	0.64	0.69
South fence[b]	1.42	0.81	0.73	0.26	0.71
West fence[b]	0.31	0.33	0.13	0.04	0.05
North MTW site boundary	0.38	0.41	0.20	0.07	0.10
Airport	0.25	0.28	M	M	M
NR-7 A north	0.26	0.28	0.10	M	M
NR-7 south	0.28	0.29	0.16	M	M

a To convert mSv to mrem, multiply by 100.
b Restricted area fence.
M = below the minimal measurable quantity.
Source: ENERCON 2017, Table 2.1-13

The 2010–2014 monitoring results for the control, onsite, and offsite environmental TLDs identified the east and south restricted area fences as receiving the highest annual average of direct gamma radiation. This can be explained by the presence of the large ore concentrate storage area that is adjacent to the sampling station. The NRC's dose limit from manmade external sources in any unrestricted area is 1 mSv (100 mrem) per year and is found at 10 CFR Part 20, Subpart D, "Radiation Dose Limits for Individual Members of the Public." The shortest distance from the east restricted area fence to the site boundary is approximately 1 kilometer (0.6 mile). As shown in Table 2-10 of this EA, the annual average radiation doses at the Metropolis Municipal Airport and at the nearest residence for the years 2010 through 2014, did not exceed the background levels presented as "control" levels in Table 2-10.

Groundwater Monitoring

Honeywell employs four groundwater contaminant compliance monitoring programs at the MTW: (1) the sanitary well monitoring program, (2) the process well routine monitoring program, (3) the inactive landfill monitoring program, and (4) the Old Creosoter Area detection monitoring program. The inactive landfill and Old Creosoter Area monitoring systems are located beyond the restricted area. The following information briefly describes the four monitoring programs.

- The first program monitors both the sanitary well and process Well No. 3 (see Figure 2-6). The wells are tested for inorganic constituents, volatile organic compounds, radionuclides, and general parameters, including pH, turbidity, chlorine, total coliform, and fecal coliform. The two wells are regulated by the Illinois Department of Public Health as nontransient, noncommunity water supply wells. Appendix A, Table A-1, "Results of Monitoring Associated with Deep Water Wells (radiological)," to this EA shows that the analytical results for these wells for gross alpha and gross beta are well below the 40 CFR 141.66 primary drinking water standard maximum contaminant level of 15 picocuries per liter. Section 3.4.8.1 and the corresponding Table 3.4-11a of Honeywell's ER (ENERCON 2017) also indicate that all results are compliant with the standard.

- The second program covers routine compliance monitoring under RCRA to detect any leaks and migration from the calcium fluoride ponds and consists of two upgradient and seven downgradient wells with an additional well used only for groundwater surface elevation measurements (see Figure 2-6). Samples are taken from these wells and analyzed quarterly for pH, specific conductance, fluoride, gross alpha and gross beta. In addition to monitoring wells, each calcium fluoride pond has a clay layer overlain by an ethylene propylene diene monomer liner (IEPA 2015b). A leachate collection system for the calcium fluoride ponds leads to sumps, where samples are taken to be tested for pH and fluorides. Each of the calcium fluoride ponds is also equipped with a lysimeter that collects water from the surrounding soil. This water is sampled quarterly for pH, fluoride, and potassium levels to identify potential leaks that could impact groundwater (IEPA 2015b). The IEPA Bureau of Land regulates and oversees the monitoring program. The analytical results for these wells are reported in Appendix A, Table A-2, "Results of Groundwater Monitoring Associated with Calcium Fluoride Ponds (radiological)" and Table A-3, "Results of Groundwater Monitoring Associated with Calcium Fluoride Ponds (nonradiological)," to this EA.

- The third program monitors the groundwater constituents in the inactive landfill area. It is authorized under RCRA and overseen by the IEPA Bureau of Land. The network of eight wells (as shown in Figure 2-7) is monitored for pH, specific conductance, gross alpha, gross beta, radon-226, radium-228, and other environmental constituents. The analytical results for these wells are shown in Appendix A, Table A-4, "Results of Groundwater Monitoring at the Inactive Landfill (radiological)," and Table A-5, "Results of Groundwater Monitoring at the Inactive Landfill (nonradiological)," to this EA.

- The fourth program monitors the Old Creosoter Area, the site of a former facility operated from the early 1900s to 1956 by the Wyoming Tie and Timber Company (IEPA 2015b). This former operation predates the establishment of the MTW and is not related to uranium conversion operations. Figure 2-7 shows the locations of the associated 15 wells. The wells are monitored for the presence of certain total and dissolved metals, along with volatile and semivolatile organic compounds. The monitoring program is authorized under RCRA and overseen by the IEPA Bureau of Land. Groundwater monitoring results associated with the Old Creosoter Area are not provided in this EA because this area was not monitored for radionuclides and is not associated with Honeywell operations.

Implementation of the calcium fluoride ponds and landfill and Old Creosoter Area monitoring programs satisfies periodic monitoring requirements and corrective action requirements of the MTW's RCRA permit (IEPA 2015b).

Two RCRA groundwater corrective actions have occurred that prompted investigations at the MTW. The first is related to the chlorinated solvent/arsenic area, and the second is the ongoing inspection of underground process sewers.

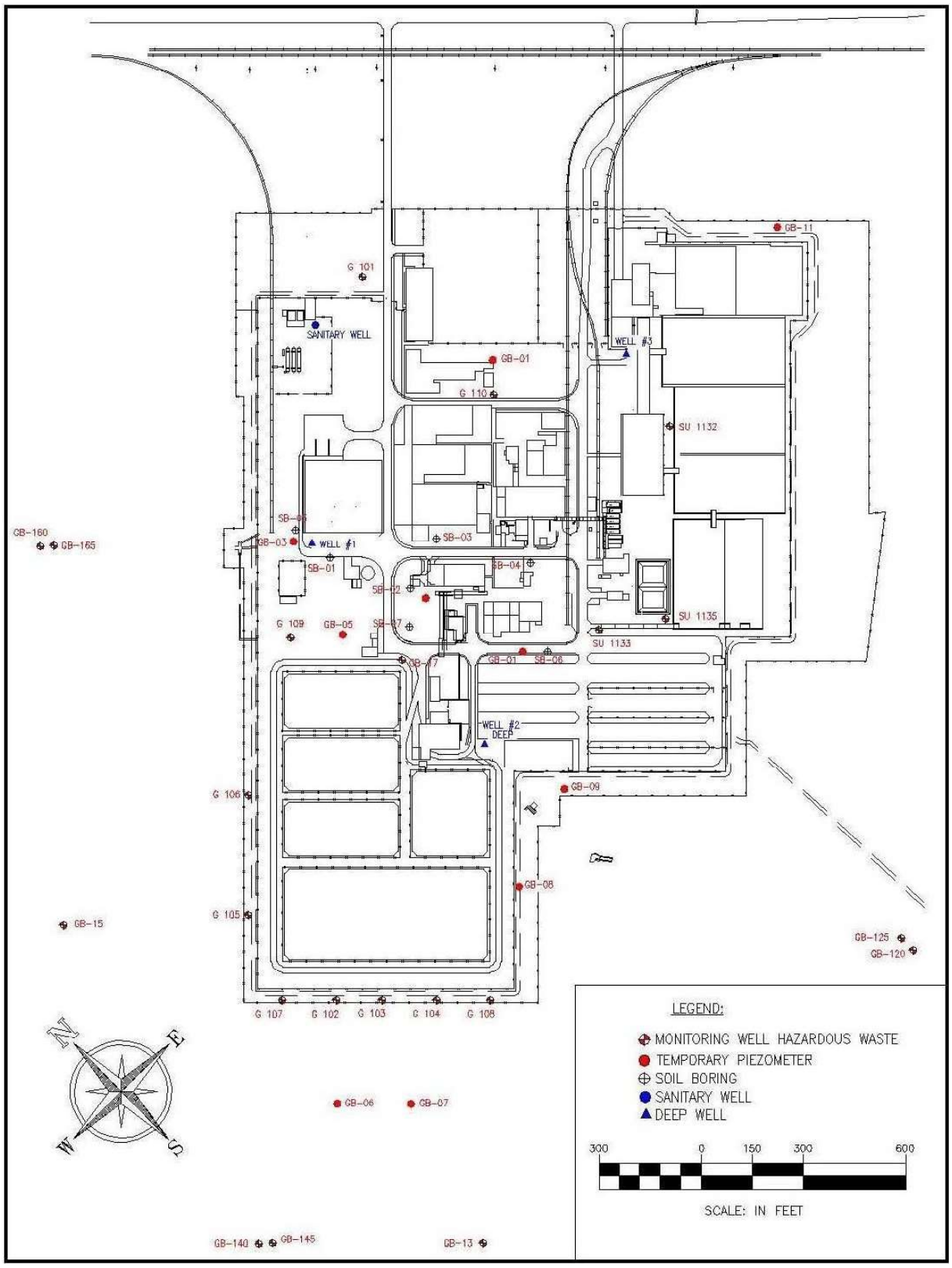

Figure 2-6 Location of Groundwater Monitoring Wells Associated with the Sanitary Well and Calcium Fluoride Ponds Monitoring Programs (Source: ENERCON 2017)

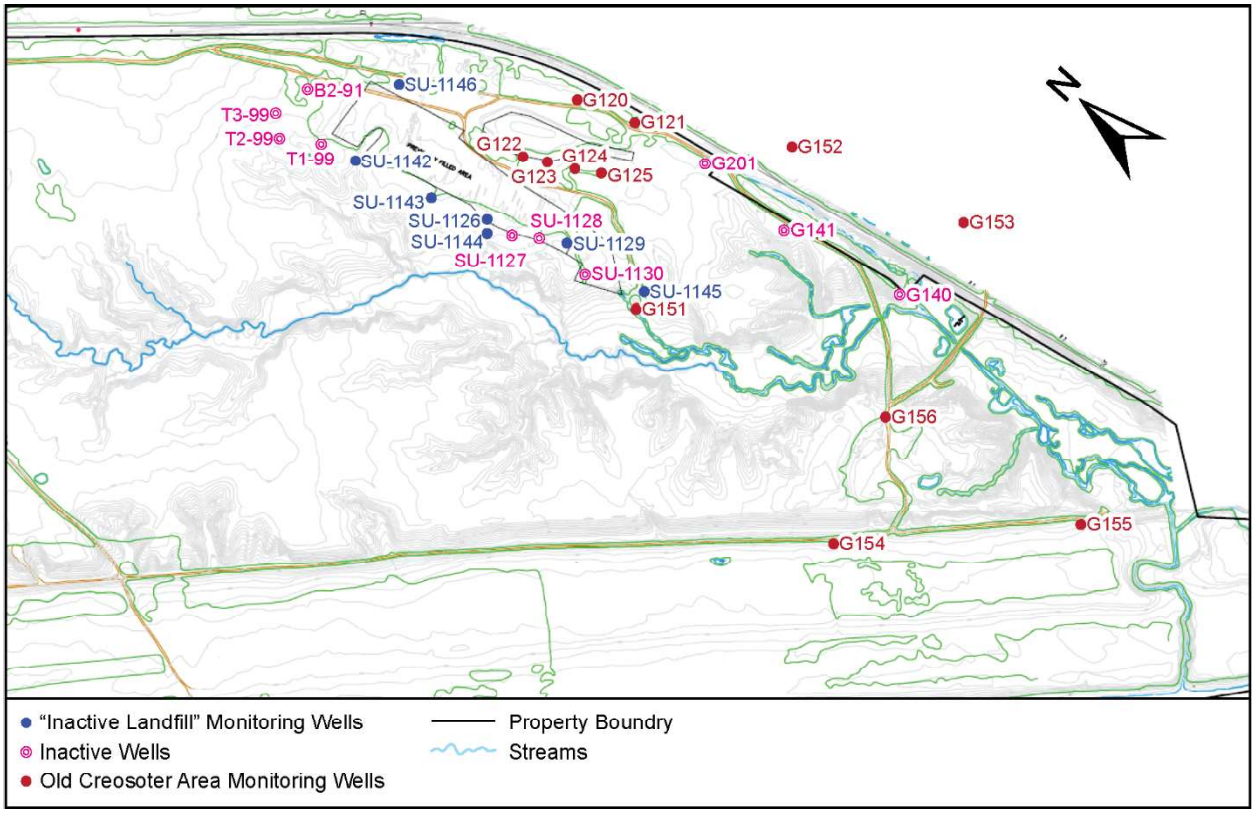

Figure 2-7 Location of Groundwater Monitoring Wells Associated with the Inactive Landfill and Old Creosoter Area Monitoring Programs (Source: ENERCON 2010)

Chlorinated Solvent/Arsenic Area

In April 2001, in response to elevated contaminant levels identified in groundwater from onsite monitoring wells, IEPA issued a violation notice to Honeywell. Honeywell undertook an investigation to identify the source of the groundwater contaminants, which include dissolved arsenic, total arsenic, chloroform, trichloroethene, tetrachloroethene, and trichlorofluoromethane. Honeywell entered an IEPA-accepted compliance commitment agreement as part of its investigation of the source of the groundwater contamination (NRC 2013a). In August 2014, the IEPA approved Honeywell's assessment, which determined the risks associated with residual groundwater impacts were below regulatory thresholds, and no additional investigation or remediation was necessary (ENERCON 2017, Section 3.4.8.3.1). In March 2016, the IEPA approved an environmental land use control (ELUC) for most of the MTW site (see Figure 3-1 in Section 3.3.1 of this EA for a graphical representation) (IEPA 2016b). Honeywell will attach the terms of the ELUC to the property deed, which places the following limitations on the property:

- Most of the site is limited to industrial and commercial uses.
- Groundwater cannot be used as a potable water supply within the ELUC area. The ELUC area does not encompass the entire MTW property. The existing potable water supply wells (i.e., sanitary well and process Well No. 3) may continue to be used as potable water supply wells.

- All existing or potential buildings must have a full concrete slab on-grade or a full concrete basement floor and walls.

No current groundwater monitoring is being performed in this area. The investigation is complete, and Honeywell is coordinating with the IEPA to obtain regulatory closure for the area.

Process Sewers

Under its RCRA permit and as part of its consultation with the IEPA, MTW is monitoring and inspecting the condition of MTW's underground process sewers and structures. As of the spring of 2016, MTW had identified two areas (referred to as areas of concern or AOCs) where process liquids could have migrated from the underground process sewers into the underlying soils. The first AOC is associated with the F_2 building and trenches and a process sewer line associated with the GF_2 building. The second AOC is sump SU-562 on the Green Salt South Pad, at the northwest side of the FMB (Honeywell 2018f).

IEPA authorized two work plans in early 2016 (IEPA 2018a) for the two AOCs, and Honeywell conducted groundwater monitoring on a quarterly basis for both areas. At the end of July 2018, MTW had completed eight quarters (i.e., two years) of monitoring (Honeywell 2018f; IEPA 2018b). Based on the groundwater monitoring results, the IEPA concurred with Honeywell that no further action was needed for either AOC pertaining to groundwater. In the first AOC, the potential source of contamination was eliminated, as the operating trenches associated with the GF_2 building were repaired. The inactive trenches associated with the GF_2 South building were filled with concrete. IEPA will require Honeywell to establish institutional controls for this AOC. Remedial actions for the second AOC (sump area) involved sampling the soil and replacing the sump SU-562. After reviewing the sampling results and replaced sump, the IEPA concluded that no further action was required for the sump area (Honeywell 2018f; IEPA 2018a, 2018c).

The MTW will continue to inspect the process sewers under the Sewer Inspection & Maintenance Plan authorized by the IEPA (IEPA 2018a). If additional contamination is identified that is associated with the process sewers, Honeywell will delineate the extent of the contamination, delineate new AOCs, and undertake corrective actions under IEPA oversight (IEPA 2018b).

Monitoring Program Status

The NRC staff reviewed the location of the environmental monitoring program sampling points, the frequency of sample collection, and the trends of the sampling program results in conjunction with environmental pathway and exposure analysis and concluded that the MTW monitoring program is protective of the environment and public health and safety. Furthermore, the NRC staff concludes that IEPA will provide effective oversight of the corrective action monitoring activities required by the facility's RCRA permit.

2.3.10 Ongoing or Anticipated Future Changes

As discussed in Section 2.2, Honeywell does not anticipate any major facility upgrades or mitigation systems will be required during the proposed license renewal term (Honeywell 2018c, Response to RAI PA-3). Honeywell recently completed treatment upgrades of the EPF to accomplish the following: (1) facilitate the removal of fluoride from the waste stream and compliance with fluoride discharge limits, and (2) enable the removal of the calcium fluoride ponds, which no longer receive effluents. The EPF upgrades comply with Honeywell's renewed

NPDES permit Special Condition 26 and provide enhanced treatment to meet the new fluoride discharge limits.

Honeywell submitted a final RCRA closure plan to the IEPA in March 2018 (Honeywell 2018d). Honeywell is currently undertaking the removal and closure of the calcium fluoride ponds in accordance with its RCRA permit requirements and Honeywell anticipates closure by the end of 2020 (Honeywell 2018d). Separately, the NRC reviewed this proposed activity to determine whether NRC approvals were needed concerning waste removal and the status of the calcium fluoride ponds. The NRC determined that no NRC approvals are needed for this activity.

2.4 Decontamination and Decommissioning

In accordance with 10 CFR 20.1406, "Minimization of Contamination," Honeywell operates the facility using ALARA practices to minimize subsurface contamination. Honeywell has a procedure for decommissioning planning that states that any work on the facility, the ground surface, or the subsurface of the site requires an evaluation to be performed of the potential impacts to the decommissioning of the site (Honeywell 2018a, Response to RAI PA-4). Honeywell documents the estimated volume and contamination levels of the material being disturbed.

The NRC requires that licensees comply with the License Termination Rule in 10 CFR Part 20, Subpart E, "Radiological Criteria for License Termination." This rule provides radiological criteria for unrestricted and restricted use, financial assurance and recordkeeping conditions, and timeliness conditions. NRC guidance for implementation of the License Termination Rule is found in NUREG-1757, "Consolidated Decommissioning Guidance" issued September 2006 (NRC 2006b).

The overall objective of decommissioning the site is to remediate the MTW to an unrestricted use condition that corresponds to a calculated dose to the public that is less than 0.25 mSv/yr (25 mrem/yr) from applicable pathways. The 25-mrem/yr dose limit is codified at 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use."

Normally, decommissioning of a facility occurs once the licensee decides to cease operations and notifies the NRC that the facility status is changing from operating to decommissioning. In addition, any separate building or area not in use for 2 years must be promptly remediated if the activities to be undertaken during remediation are allowed by the existing license. If the remediation activities are not currently allowed under an existing license, the licensee must develop a decommissioning plan and submit a request for a license amendment within 1 year. The decommissioning process is to be completed within 2 years unless an alternative schedule is approved.

In 2009, Honeywell conducted a radiological characterization of the MTW to assess the levels of radiological activity that Honeywell will need to address during decommissioning of the MTW site in the future. The radiological characterization is used to support the development of decommissioning cost estimates. The focus of the 2009 radiological site characterization was surface and subsurface soil; other media such as groundwater were not characterized. The data collected for soils show radiological contamination within the MTW restricted area and outside the restricted area at levels greater than the potential release criteria (ENERCON 2010). Honeywell used this information to update its decommissioning cost estimate (ENERCON 2016), which is discussed below.

In 10 CFR 40.36(a) and (d), the NRC requires that each applicant for a specific license authorizing the possession or use of more than 100 µCi of source material in a readily dispersible form submit a decommissioning funding plan with a cost estimate. The NRC's regulations at 10 CFR 40.46(d)(2) require that the decommissioning cost estimate be revised at intervals not to exceed 3 years. The periodic update is necessary to reflect physical and environmental changes at the facility and changes in cost-estimating assumptions, for example, cost escalation and disposal cost. In addition, Honeywell must provide an appropriate financial assurance mechanism, as described in 10 CFR 40.36(e). Honeywell revised the decommissioning cost estimate in 2016 (ENERCON 2016). The decommissioning cost estimate considers current radiological conditions at the site and the continuation of operations currently conducted under the license. The decommissioning cost estimate does not consider how much longer the facility will operate (i.e., 40 more years versus a shorter time frame). Changes at the MTW will be evaluated during the triennial updates to the cost report.

To protect the public health and safety and the environment, Honeywell will decontaminate the facilities before the NRC will terminate SUB-526. Radiological contamination will be reduced to levels that allow the release of a portion of the facility for unrestricted use, as specified in the License Termination Rule. However, a portion of the site will remain restricted due to the presence of chemical contamination. The restricted portion of the site will be subject to the ELUC, which the IEPA must approve. The ELUC will be attached to the property deed, as described in Section 2.3.9.2 of this EA.

Honeywell's 2016 decommissioning cost estimate assumes that Honeywell will remove source material and waste from processing areas and that the administrative areas will not require remediation. Items to be removed include most buildings, some pads, such as the drum storage pads, soils surrounding or underlying buildings, equipment, process drain lines and most stormwater drain lines, and the uranium settling ponds. Buildings that may remain, but that would need to be decontaminated, include the ore storage building, bed materials and filter fines building, cylinder wash building, hazardous waste storage building, drum crusher building, and drum washing building. The ore storage pads, drum storage pad, and waste storage pad would also remain. Facilities not expected to require remediation include several support buildings, the liquid fluorine facility, liquid nitrogen facility, STF, and calcium fluoride building. Areas with known soil contamination outside the restricted area will be remediated; these are the drainage channel leading to Outfall 002, the drainage swale east of the ore storage pads, an area extending 8 meters (25 feet) on either side of a 229-meter (750-foot) section along River Road, and isolated areas along the road to the inactive landfill (ENERCON 2016).

Following completion of decontamination activities, Honeywell will complete radiological surveys and generate a report documenting cleanup to the target levels. Honeywell will perform the surveys using the guidance in NUREG-1575, "The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" issued August 2000 (NRC 2000). The NRC will review the completed decontamination activities and the final survey before deciding whether to approve and terminate the license, in accordance with 10 CFR 40.42, "Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas." Financial assurance for the potential costs of decontamination and decommissioning activities associated with the license termination is provided through a corporate self-guarantee, an NRC-approved mechanism (NRC 2014b).

3 AFFECTED ENVIRONMENT

3.1 Land Use

The area of review for the land use assessment is the area within a 3.2-kilometer (2-mile) radius of the MTW site to encompass neighboring uses.

3.1.1 MTW Site

As described in more detail in Section 2.1 of this EA, the MTW site is in Massac County, at the southeastern tip of Illinois, along the northern bank of the Ohio River (see Figures 1-1 and 1-2). The northeastern corner of the outermost fence is approximately 400 meters (1,300 feet) from the city limits of Metropolis (Honeywell 2018a, Response to RAI PA-6). The perimeter of the developed portion of the site is formed by U.S. Highway 45 and the Burlington Northern Santa Fe (BNSF) railroad right-of-way to the north, although a small portion of the MTW property extends beyond U.S. Highway 45 to the northeast. The Ohio River forms the southern border. An industrial coal blending plant lies generally to the west, and privately owned developed land is to the east. Kentucky industrial sites and farmland lie generally to the south on the other side of the river.

The total MTW area covers about 405 hectares (1,000 acres) of land containing a 24-hectare (59-acre) fenced, restricted area in the north-central portion of the site (Honeywell 2018a, Response PA-7). Section 2.2 of this EA lists the existing facilities on the site.

The MTW area consists of the gently rolling hills that are typical of southern Illinois. The site is at an elevation of between 91 and 116 meters (300 and 380 feet) above mean sea level. The restricted area is on an alluvial terrace between 113 and 116 meters (370 and 380 feet) above mean sea level (ENERCON 2017, Section 3.4.2). This terrace is generally level, except for surface water drainage channels that flow south to the Ohio River. For comparison, the probable elevation of the 100-year flood is 103 meters (338 feet) above mean sea level (NRC 2006a) and the 500-year flood is 104 meters (341 feet) above mean sea level (FEMA 2018).

Honeywell used the Multi-Resolution Land Consortium National Land Cover Database to further characterize land use land cover within the property boundary. Approximately 16 percent of the site is categorized as Developed, with the remaining 84 percent Undeveloped. The largest land use cover classification is Deciduous Forest, at approximately 67 percent. Table 3-1 provides specific land use land cover details (Honeywell 2018a, Response to RAI LU-1).

Table 3-1 Land Use Land Cover on the MTW Site

Land Use Land Cover Category	Percentage
Open Water (MTW ponds)	1.63
Developed	16.12
Barren Land (rock, sand, clay)	0.14
Deciduous Forest	66.96
Pasture/Hay	2.41
Cultivated Crops	5.99
Woody Wetlands	6.75

Source: Honeywell 2018a, RAI LU-1

The onsite inactive landfill discussed in Section 2.2 and shown in Figure 2-1 of this EA is in the northeast portion of the MTW site and is approximately 4.5 hectares (11 acres). Honeywell is currently working with IEPA to certify closure of the landfill (Honeywell 2018a, Response to RAI LU-1). Honeywell is also conducting site investigation activities at the Old Creosoter Area.

The MTW site drains to the Ohio River via four creeks, or channels, that are in undeveloped areas outside the restricted area. This EA refers to the stream flowing into Outfall 002 as a channel and the other three streams as creeks (see the channel and creeks labeled "R4SBC" on Figure 3-1 in Section 3.3.1 of this EA; ENERCON 2017, Section 3.5.2.5). A 305-meter (1,000-foot)-wide portion of the site between the restricted area and the Ohio River is within the 500-year floodplain; this area was previously farmed and is now returning to more natural vegetation (ENERCON 2017, Section 3.1.1, p. 3-1, and Section 3.5.2.4). The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory maps show wetlands occur on the site, including freshwater forested/shrub wetland areas along the Ohio River and in the southeastern forested portion of the site (USFWS 2017a; Honeywell 2018a, RAI response PA-1).

An electrical transmission line crosses the MTW site from the northwest to the southeast, about halfway between the Ohio River and the southern border of the fenced, restricted area (light-green linear strip shown in Figure 2-1 in Chapter 2 of this EA). The transmission line corridor is maintained in grasses and low-growing shrubs. A buried natural gas transmission line serving both the site and the city of Metropolis crosses the property about 152 meters (500 feet) north of the administration building (Honeywell 2018a, Response to RAI PA-8).

3.1.2 Site Vicinity

Land within a 3.2-kilometer (2-mile) radius of the MTW site is mainly agricultural or undeveloped, with the exception of Metropolis and industrial areas. Within this area, about 28 percent of the land is developed, with the remainder of the area consisting of open water (about 22 percent), barren land (about 1 percent), forest (about 22 percent), wetlands (about 5 percent), and herbaceous and planted or cultivated land (about 22 percent) (ENERCON 2017, Table 3.1-1).

According to the most recent agricultural census, as of 2012 about 66 percent (41,379 hectares out of 62,678 hectares (102,249 acres out of 154,880 acres)) of the land in Massac County is used for agricultural purposes; corn and soybeans continue to be the principal cash crops and cattle and hogs are the principal livestock (USDA 2012). Between 2007 and 2012, the amount of land in farms in Massac County increased by 14 percent, with a 77-percent increase in the market value of sales (USDA 2012). The nearest pastureland is located approximately 2 kilometers (1.5 miles) northeast of the MTW and is used to graze beef cattle. The nearest dairy cattle graze approximately 13 kilometers (8 miles) east of the plant (ENERCON 2017, Section 3.1.1).

Massac Memorial Hospital is immediately northeast of the MTW, across U.S. Highway 45/West 10th Street. The Metropolis Municipal Airport is about 1.1 kilometers (0.7 mile) north-northeast of the MTW, and the Barkley Regional Airport is about 10.8 kilometers (6.7 miles) to the south (ENERCON 2017, Section 3.2). Major nearby industrial developments include the Tennessee Valley Authority (TVA) Shawnee Steam Plant and the U.S. Enrichment Corporation's Paducah Gaseous Diffusion Plant (PGDP) (a uranium enrichment facility) located across the Ohio River to the east of the MTW in Kentucky. The American Electric Power Company (AEP) Cook Coal Terminal, a coal blending plant, is located immediately northwest of the MTW site. Another nearby industrial facility is the Joppa Power Station, a coal-fired power plant operated by

Electrical Energy, Inc., about 9.5 kilometers (6 miles) to the northwest in Joppa, IL (ENERCON 2017, Section 3.1.4).

The Mermet Lake Conservation Area, which contains the Mermet Swamp Nature Preserve, is about 5.5 kilometers (3.5 miles) to the northwest. This conservation area is under the jurisdiction of the Illinois Department of Conservation. The Sielback Forest State Natural Area, owned by The Nature Conservancy, is located about 3.2 kilometers (2 miles) to the north (TVA 2017). Fort Massac State Park is east of the city of Metropolis. The Halesia Nature Preserve is located about 1.6 kilometers (1 mile) to the northwest on AEP-owned property (TVA 2017; ILDNR 2018a). The West Kentucky Wildlife Management Area, which includes the Bayou Creek Ridge Tennessee Valley Authority Habitat Protection Area, is across the Ohio River, 3.2 kilometers (2 miles) southwest of the MTW site and adjacent to PGDP (TVA 2017). The Metropolis Lake State Nature Preserve, under the jurisdiction of the Kentucky State Nature Preserves Commission, contains a 20.2-hectare (50-acre) lake, and Metropolis Lake Tennessee Valley Authority Habitat Protection Area, owned by TVA, are located directly across the river from the MTW site (TVA 2017; KSNPC 2012).

The Ohio River adjacent to the MTW is used for barge transportation, sport fishing, and mussel collection and is a source of drinking and industrial water supply (ENERCON 2017, Section 3.4.2).

Honeywell does not allow recreational hunting, fishing, or trapping on its property and has posted signs to that effect.

3.2 Transportation

The NRC's transportation assessment encompasses the area within an 8-kilometer (5-mile) radius of the MTW site. The assessment evaluates the potential impacts that MTW operations could have on the local transportation network.

3.2.1 Current Transportation Resources

As noted in Section 3.1.1 of this EA, the northeast corner of the outer fence of the MTW is 400 meters (1,300 feet) from the city limits of Metropolis. As shown in Figure 1-2 of this EA, U.S. Highway 45 and the BNSF railroad run along the northern border of the MTW site, and the Ohio River forms the southern border. The railroad and U.S. Highway 45 follow the same path southeast through Massac County, until the railroad joins with another line headed south through the county at Metropolis and crosses over the Ohio River into Kentucky. In addition, three spurs from the railroad service the site for receiving supplies and shipping product, byproducts, and waste.

U.S. Highway 45 continues southeastwardly past the site into Metropolis (where the highway becomes West 10th Street) and continues generally to the east until it turns south and then crosses the Ohio River at Brookport, IL, about 6.4 kilometers (4 miles) from Metropolis. The Illinois Department of Transportation has designated portions of U.S. Highway 45 as part of the Ohio River Scenic Byway, including the segment serving the MTW (IDOT 2017a), for its views of the Ohio River. Interstate 24 is approximately 7.2 kilometers (4.5 miles) east of the MTW site. It runs southeastwardly through Massac County, then continues south near the eastern border of the city of Metropolis, where it crosses the Ohio River to continue through Paducah, KY, the largest populated area within 32 kilometers (20 miles) of the MTW, heading east.

Table 3-2 gives the Illinois Department of Transportation average daily traffic count data for locations on U.S. Highway 45 northwest and southeast of the MTW entrance and at points north and south of U.S. Highway 45 on Interstate 24 (IDOT 2017b).

Table 3-2 Illinois Department of Transportation Average Daily Traffic Count Data

Year	Total Traffic Count	Truck Count
U.S. Highway 45, northwest of MTW, near Doug Sumner Lane, both directions		
2005	4,950	(a)
2007	4,800	(a)
2009	5,000	(a)
2011	4,300	(a)
2013	4,050	(a)
2015	3,850	300
U.S. Highway 45, southeast of MTW, near James Drive, both directions		
2005	9,800	(a)
2007	9,100	(a)
2009	9,300	(a)
2011	7,000	(a)
2013	6,650	(a)
2015	5,950	430
Interstate 24, north of U.S. Highway 45, both directions		
2005	15,700	(a)
2006	16,900	(a)
2014	16,900	(a)
2015	20,400	7,000
Interstate 24, south of U.S. Highway 45, both directions		
2005	26,100	(a)
2006	28,200	(a)
2014	29,600	(a)
2015	31,700	8,450

a Data not taken prior to 2015.
Source: IDOT 2017b

Table 3-3 gives National Highway Transportation Safety Administration traffic fatality information for Massac County. These data show that for 2015, Massac County had a per capita fatality rate in the middle third of all U.S. counties and in the upper third for truck fatalities (NHTSA 2017a). Between 2011 and 2016, there was one collision between a train and a vehicle or pedestrian at a railroad crossing in Massac County (ICC 2017). The NRC reviewed the annual Illinois Commerce Commission reports for the years 2007 through 2016 on railroad incidents involving hazardous materials releases or derailments of trains carrying such materials, or both, and did not find any such incidents that took place in Massac County.

As noted in Section 3.1.2 of this EA, the Metropolis Municipal Airport is about 1.1 kilometers (0.7 mile) north-northeast of the MTW site, and the Barkley Regional Airport is about 10.8 kilometers (6.7 miles) to the south (ENERCON 2017, Section 3.2). Ohio River ports are located in Massac County, IL, and McCracken County, KY (ENERCON 2017, Section 3.2).

Table 3-3 Traffic Fatality Data for Massac County

Year	All Traffic Fatalities	All Fatalities per 100,000 Population	Traffic Fatalities Involving a Large Truck	Truck Fatalities per 100,000 Population
2011	5	32.63	1	6.53
2012	2	13.20	0	0.00
2013	1	6.68	0	0.00
2014	1	6.72	1	6.72
2015	3	20.32	1	6.77

Source: NHTSA 2017b

3.2.2 Current MTW Use of Transportation Resources

U.S. Highway 45 is the road used to access the MTW site from all points. MTW activities account for only a small fraction of the traffic on area roads. As of February 2016, MTW employed 237 people (ENERCON 2017, Section 3.10.1). Of the 237 employees, 62 percent reside in Kentucky and 27 percent reside in Metropolis or Brookport, IL. The employees residing in Kentucky, Metropolis, and Brookport, a total of 89 percent or 211 employees, commute to MTW via U.S. Highway 45 northbound when arriving and southbound when leaving. Typical daily traffic for Highway 45 at the MTW entrance during normal MTW operations is 2,052 vehicles for northbound traffic and 2,103 vehicles for southbound traffic (Honeywell 2018a, Response to RAI TRN-1).

MTW also uses local transportation routes to ship its uranium hexafluoride product, byproduct, and waste materials and to receive process materials. Table 3-4 presents the shipments of feed materials, process chemicals, wastes and byproducts, based on current MTW operations. MTW activities do not involve any particular use of the airport resources.

The list of hazardous chemicals used in MTW operations includes hydrogen fluoride, ammonium hydroxide (aqueous ammonia), sodium hydroxide, potassium hydroxide, potassium bifluoride, sulfuric acid, and liquid hydrogen (Honeywell 2018a, Response to RAIs TRN-1 and POH-2). Table 3-5 provides hazard information for MTW process chemicals.

Table 3-4 Annual Incoming and Outgoing Shipments for MTW Operations

Material	Mode	Annual Shipments	Frequency	Origin or Destination
Incoming Shipments				
Uranium ore	Truck; international shipping plus truck	700	1–2 per day	Wyoming; Saskatchewan, Canada; international (other than Canada)
Ammonium hydroxide	Truck	9	2 per quarter	Granite City, IL
Hydrogen fluoride	Rail	88	2–4 railcars per week	Geismer, LA
Potassium hydroxide	Rail	12	1 per month	Ashtabula, OH or Charleston, TN
Sodium hydroxide	Truck	22	2 per month	St. Louis, MO
Sulfuric acid	Truck	63	1–2 per week	Clarksville, TN
Liquid hydrogen	Truck	30	1 per week	McIntosh, AL

Material	Mode	Annual Shipments	Frequency	Origin or Destination
Potassium bifluoride	International shipping plus truck	1	1 per year	Baltimore, MD
Synthetic calcium fluoride	Truck	84	1–2 per week	St. Genevieve, MO
Outgoing Shipments				
Filter fines for uranium recovery	Truck	56	1 per week	Blanding, UT
Radioactive waste	Rail	6 (railcars)	1–2 per quarter	Clive, UT
Radioactive waste	Rail	47 (railcars)	2–3 per month	Grand View, ID
Hazardous waste	Truck	4	1 per quarter	Various
Municipal solid waste	Truck	112	2 per week	Southern Illinois landfill
Universal waste	Truck	4	1 per quarter	Various
Nonhazardous waste	Truck	4	1 per quarter	Various
Uranium hexafluoride	Truck	660	12–13 per week	Various

Source: Honeywell 2018a, Response to RAI TRN-2

Table 3-5 Hazard Information for MTW Process Chemicals

Material	U.S. Department of Transportation Hazard Class	NFPA Health Rating	Human Health Hazard, Acute Exposure
Ammonium hydroxide	8/ Corrosive	3	• Irritant and corrosive to the skin, eyes, respiratory tract, and mucous membranes. • May cause severe chemical burns to the eyes, lungs, and skin. • Skin and respiratory-related diseases could be aggravated by exposure. • The extent of injury dependent on the duration of the exposure, the concentration of the liquid or vapor, and the depth of inhalation.
Anhydrous hydrogen fluoride	8/ Corrosive	4	• Inhalation and contact hazard. • Consequences are dependent on release quantity, population density, and meteorological conditions. • Acute health effects include irritation of the skin, eyes, mucous membranes, and respiratory tract; accumulation of fluid in the lungs (pulmonary edema); nausea and vomiting; gastric pain; irregular heart rate (cardiac arrhythmia); tissue destruction and burns; low blood calcium (hypocalcimia); and possibly death.

Material	U.S. Department of Transportation Hazard Class	NFPA Health Rating	Human Health Hazard, Acute Exposure
Potassium hydroxide, solution	8/ Corrosive	3	• Primarily a contact exposure and exposure of respiratory system via mist. • Health effects include severe lesions and burns. • Dust or mist exposures may cause eye or respiratory irritation.
Potassium bifluoride	8/ Corrosive	3	• Primarily a contact hazard. • Corrosive to tissues; can cause severe burns and systemic effects. • In case of a fire, decomposition product can include hydrogen fluoride.
Sodium hydroxide solution	8/ Corrosive	3	• Primarily a contact hazard. • Can cause severe burns in tissues that come in contact with it. • Inhalation of low levels of sodium hydroxide as aerosols may cause irritation of the nose, throat, and respiratory airways.
Sulfuric acid	8/ Corrosive	3	• Inhalation and contact hazard. • Highly reactive and produces toxic fumes. • Consequences are dependent on release quantity, population density, and meteorological conditions. • Corrosive to all body tissues. • Inhalation of vapor may cause serious lung damage. • Contact with the eyes may result in total loss of vision. • Skin contact may produce severe necrosis. • Fatal in small doses.
Liquid hydrogen	2.1/ Flammable gas 2.1/ T75, TP5 318	3	• Forms explosive mixtures in air. • Produces vapor cloud. • Inhalation and contact hazard. • Consequences are dependent on release quantity, population density, and meteorological conditions. • Contact with liquid may cause cold burns/frostbite. • Asphyxiant in high concentrations.

NFPA = National Fire Protection Association.
Sources: Honeywell 2018a, Response to RAI TRN-1; ATSDR 2002, 2004; CDC 2011, 2017a, 2017b;ScienceLab.com 2013a, 2013b; Cameo 2017a, 2017b; Praxair 2016

3.3 Geology and Soils

The geology and soils assessment was limited to the MTW site because potential impacts would be localized. The NRC analyzed potential impacts of seismic activity on the MTW within

a 32-kilometer (20-mile) radius of the MTW site, which includes the New Madrid Seismic Zone (NMSZ).

3.3.1 Geology

The MTW site has a relatively flat topography, lying between 91 and 116 meters (300 and 380 feet) above mean sea level. The restricted area is on a bluff overlooking the Ohio River and is between 113 and 116 meters (370 and 380 feet) above mean sea level (ENERCON 2017, Section 3.3.1). Four creeks with an average dissection depth of 9 to 12 meters (30 to 40 feet) branch away from the bluff from due south to due west. The creeks and this bluff grade into a terrace located between 6 and 12 meters (20 and 40 feet) above the river elevation (ENERCON 2017, Section 3.3.1). These creeks are also mapped, as shown by blue lines in Figure 3-1 (Honeywell 2018a, Figure 3.4-3).

The MTW site is located at the northern end of the Mississippi Embayment, a depositional basin filled in with sediments 40 to 100 million years old that overlie older (300- to 600-million-year-old) bedrock (Nelson and Masters 2008). Surface soils at the MTW site consist of silty loam and silty clay loam, which have low permeability and poor drainage. The underlying unconsolidated surface deposits are approximately 24 to 27 meters (80 to 90 feet) thick and consist of sediments from high-energy and low-energy fluvial and reported aeolian depositional environments.

Alluvial deposits consisting of sand, silt, or clay and localized sandy gravel deposits are found along the Ohio River. Locally, the MTW site and much of the surrounding region are covered by a few meters of Quaternary loess. Surface geology maps developed by the Illinois State Geological Survey (Nelson and Masters 2008) show the site to overlie a 7.6-meter-thick (25-foot-thick) section of the Cahokia Formation. The Quaternary-aged formation contains lenses of silt, clay, sand, and gravel.

Figure 3-2 presents a partial geologic cross section (AA') of the MTW site. The Metropolis Formation, which underlies the Cahokia Formation, consists of clay-rich silty sand and sandy silt, ranging in thickness from 6 to 17 meters (20 to 50 feet). The deeply weathered, poorly sorted, and burrowed alluvial sediments of the Metropolis Formation are fluvial sediments that occupied an underfit valley ancestral to the modern Ohio River (Nelson and Masters 2008). This formation is known as a low-yield aquifer in regions to the east and north of the MTW site (Nelson et al. 2002). However, at the MTW site, the Metropolis Formation is not identified as an aquifer, but rather is described as a partially saturated formation. It overlies the uppermost aquifer, the Mounds Gravel, which is composed of gravel and sand from 11 to 20 meters (35 to 65 feet) thick. The Mounds Gravel is made up of the deposits of large, braided rivers that were, in part, ancestral to the modern Tennessee River (Nelson and Masters 2008). Groundwater monitoring wells at the MTW site are located within the Mounds Gravel (ENERCON 2017). Section 4.1.4.2 describes these monitoring wells in more detail.

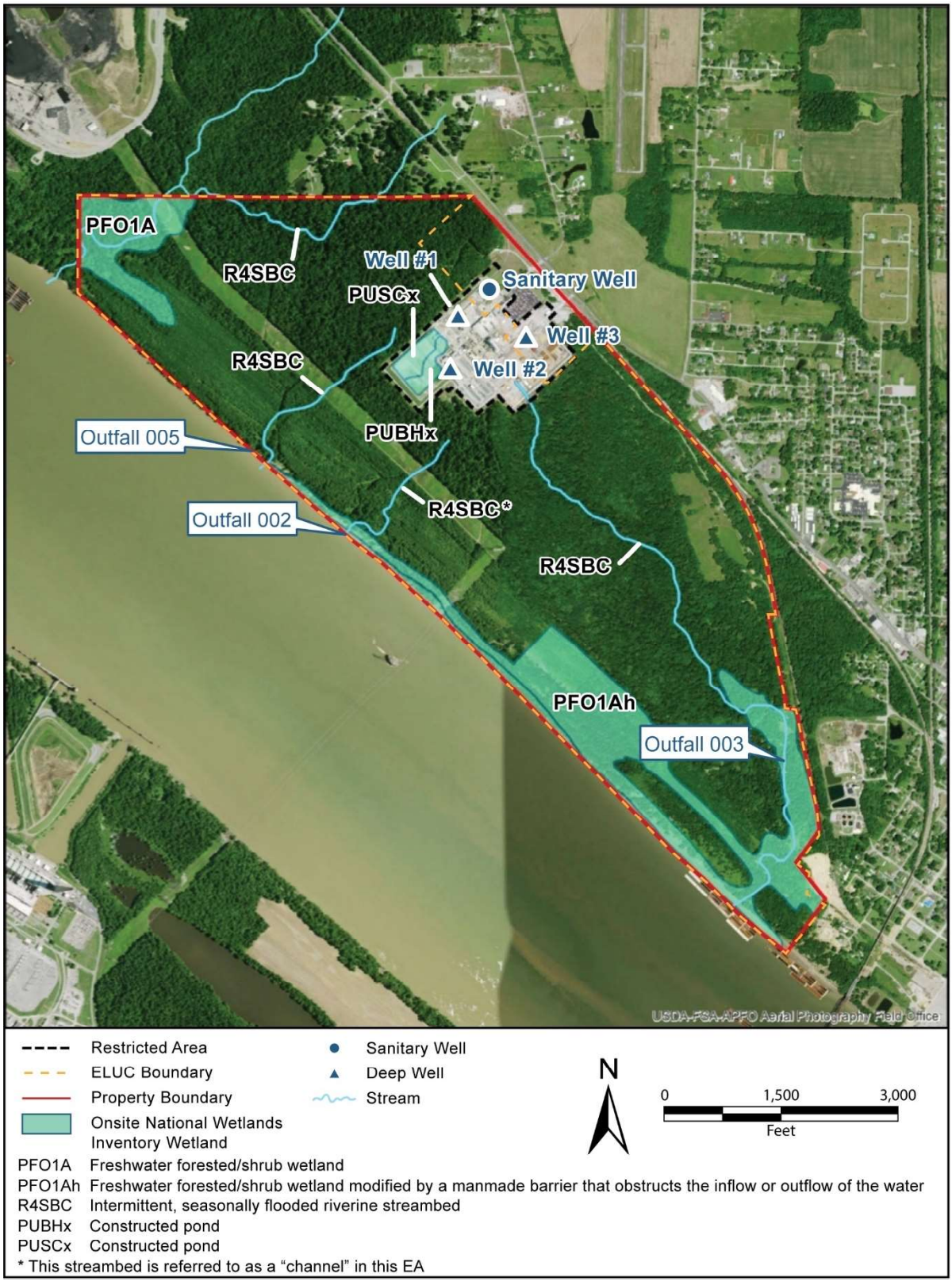

Figure 3-1 Environmental Land Use Control Boundary and Surface Water Features (Source: Honeywell 2018a, RAI Responses Figure 3.4-3)

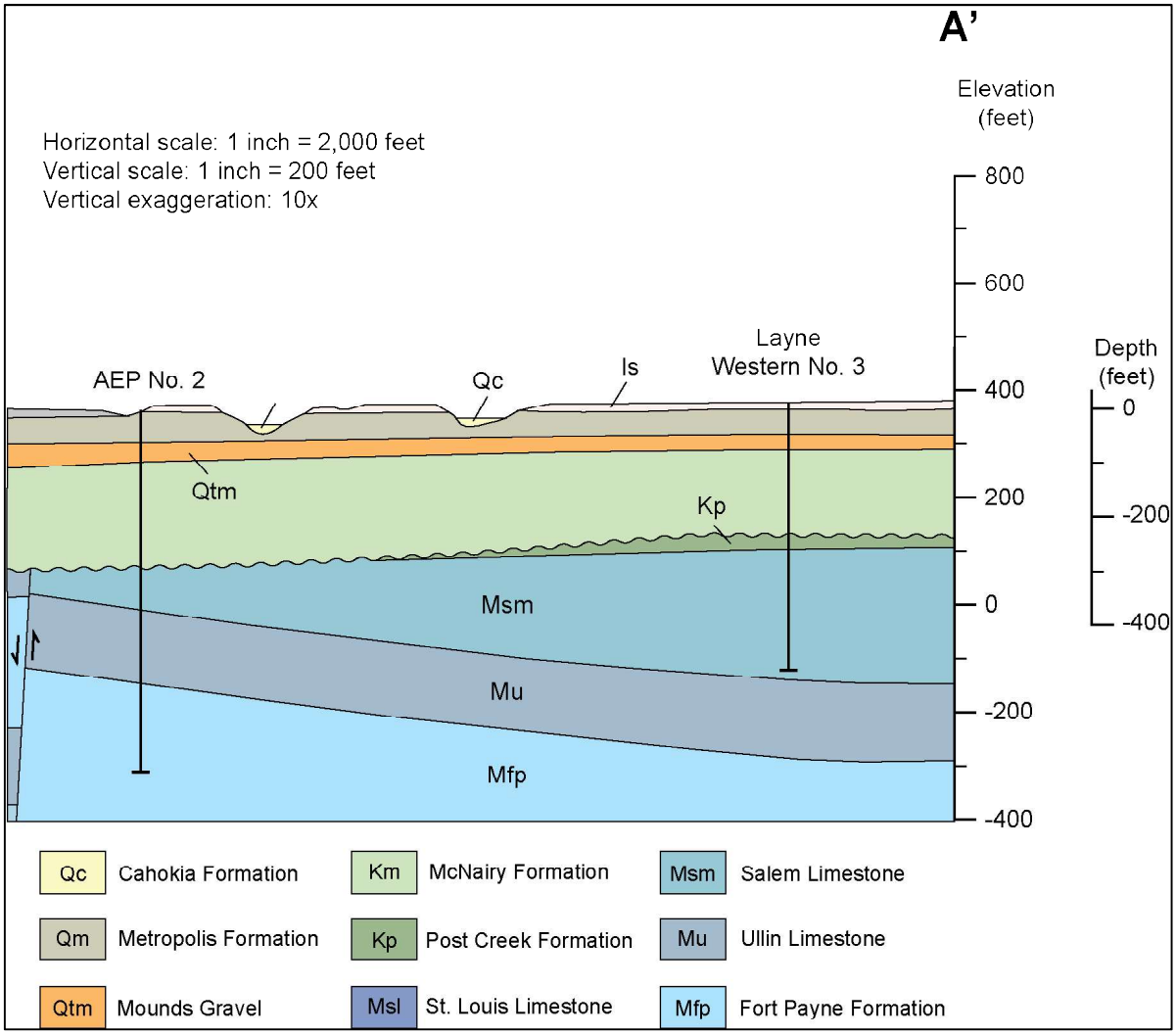

Figure 3-2 Geologic Cross Section, Northwest to Southeast Across the Footprint of the MTW Site (adapted after the AA′ Cross Section in Nelson and Masters 2008)

Bedrock underlying the unconsolidated Mounds Gravel surface deposits consists of Cretaceous McNairy Formation sandstones and shales; Cretaceous Post Creek gravels, sands, and clays; and Mississippian limestones and sandstones. The McNairy Formation sands, silt, and clay are approximately 40 to 49 meters (130 to 160 feet) thick. The Post Creek Formation is approximately 6 to 11 meters (20 to 35 feet) thick underlying the site. The Mississippian Salem Limestone is approximately 67 meters (220 feet) thick and occurs at depths of 85 to 150 meters (280 to 500 feet) (Nelson and Masters 2008).

The AA' cross section in Figure 3-2 identifies the Layne Western No. 3 well, which is labeled "Well #3" on Figure 3-1 of this EA. Well No. 3, Well Nos. 1 and 2, and the sanitary well are each screened within the Mississippian Salem Limestone. Only the sanitary well and Well No. 3 supply potable water.

The nearest active mineral extraction operations are sand and gravel extractions along the Ohio River (dredging). There appear to be three active gravel quarries in the Mounds Formation about 3 to 8 miles (4.8 to 12.9 kilometers) to the west-northwest of the site (Nelson and Masters

2008). Many additional inactive quarries of the same type are found within the same region. Commodities mined within 80 kilometers (50 miles) of the MTW site are bail clay, crushed stone, Fuller's earth, silica, and silicon (ENERCON 2017, Section 3.3.4).

3.3.2 Soils

The dominant soil types on the MTW site include Stoy silt loam, 0 to 2 percent slopes (primarily northwest of the restricted area); Stoy silt loam, 2 to 5 percent slopes (southeast of the restricted area); and Weir silt loam, 0 to 2 percent slopes (southeast, near the restricted area). Stoy silt loam is prime farmland, and the Weir silt loam is considered a hydric soil prone to ponding. They are not generally suited for building (ENERCON 2017, Section 3.3.3.2).

The soils within the restricted area of the MTW site (i.e., the developed part of the site) and the northern portion of the site below U.S. Highway 45 are primarily orthents; that is, erodible material has been removed so that typical soil horizon indicators are absent. Belknap silt loam, Armiesburg silty clay loam, Peoria silty clay loam, and Armiesburg-Sarpy complex lie along the lower part of the site, along the river, and are typical of floodplains.

3.3.3 Seismicity

The MTW site is located near several major fault zones as shown in Figure 3-3, which includes annotations and identifies the NMSZ and St. Genevieve fault system. The fault zones are approximately 24 kilometers south and 50 kilometers northwest (15 and 31 miles) of the site, respectively. As shown in Nelson and Masters (2008), the Raum fault zone trends southwest to northeast and lies approximately 6 kilometers (4 miles) to the west-northwest of the site. The Lusk Creek fault zone (Figure 3-3) parallels the Raum zone and lies approximately 6 kilometers (4 miles) farther to the west.

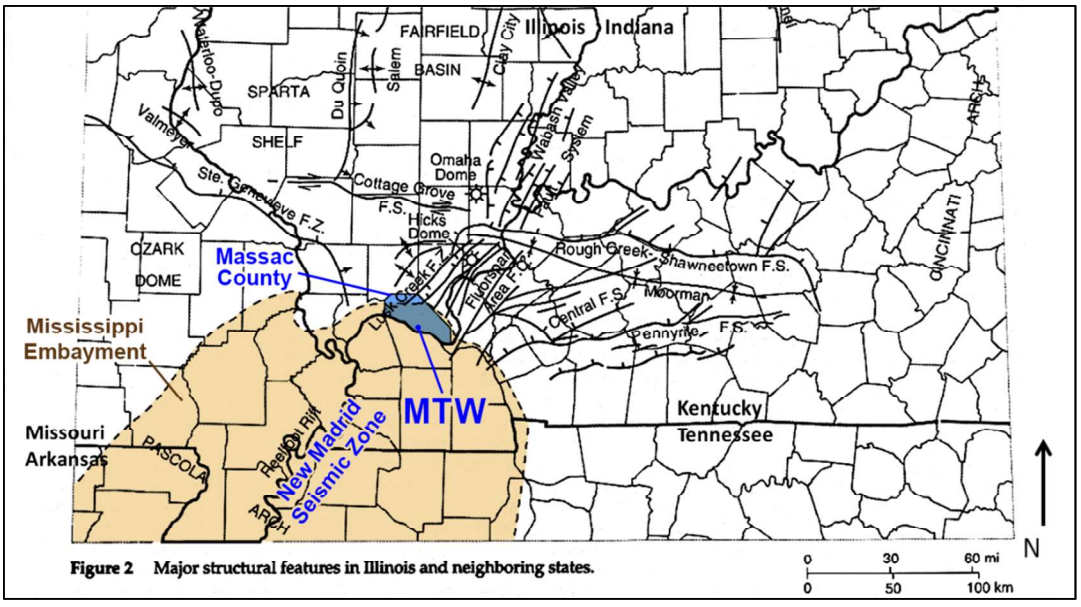

Figure 3-3 Regional Geologic Setting (Source: ISGS 2018, modified)

Many earthquakes associated with the NMSZ have occurred in northeastern Arkansas and southeastern Missouri, as well as a few in northwestern Kentucky into southwestern Illinois. The U.S. Geological Survey has recorded 28 earthquakes of magnitude greater than 2.5 within 80 kilometers (50 miles) of the MTW site since the end of 2007; the largest occurred in 2012, registering a magnitude of 3.9 about 8 kilometers (5 miles) southwest of Charleston, MO—about 80 kilometers west of the MTW site (USGS 2017a). The associated Modified Mercalli Intensity for these earthquakes ranges from II to III and could be felt by persons indoors, with vibrations similar to those of a passing truck (USGS 2017b). The major historic earthquakes felt in this area were the 1811–1812 New Madrid earthquakes, with epicenters approximately 97 kilometers (60 miles) southwest of the MTW site. The strongest of these earthquakes is estimated to have produced a Modified Mercalli Intensity IX earthquake, which, if experienced at MTW, would be capable of causing considerable damage to well-constructed buildings, breaking some underground pipes, and causing serious damage to reservoirs.

The U.S. Geological Survey National Seismic Hazard Maps display probability levels for selected earthquake magnitudes and intensities across the United States, including the NMSZ, in which the MTW site is located (USGS 2017c). A sampling of two maps provides some ranges of seismic assessment relevant to the MTW site in the southeastern tip of Illinois. The first map (USGS 2018a), shown in Figure 3-4, identifies that the MTW site lies within an area with an annual risk of approximately 1 to 2 percent chance in 2018 for potentially minor-damage ground shaking. The second map (USGS 2018b), shown in Figure 3-5, shows that the MTW site also lies within a zone that has a 2-percent probability of exceeding relatively significant peak ground acceleration in a 50-year period (approximately 0.7605 *g* (USGS 2017a). This probability is equivalent to a frequency of 1 occurrence every 2,475 years. The two maps are complementary. The first map relates directly to the potential for damage, and the second map focuses on the peak ground acceleration, regardless of the damage.

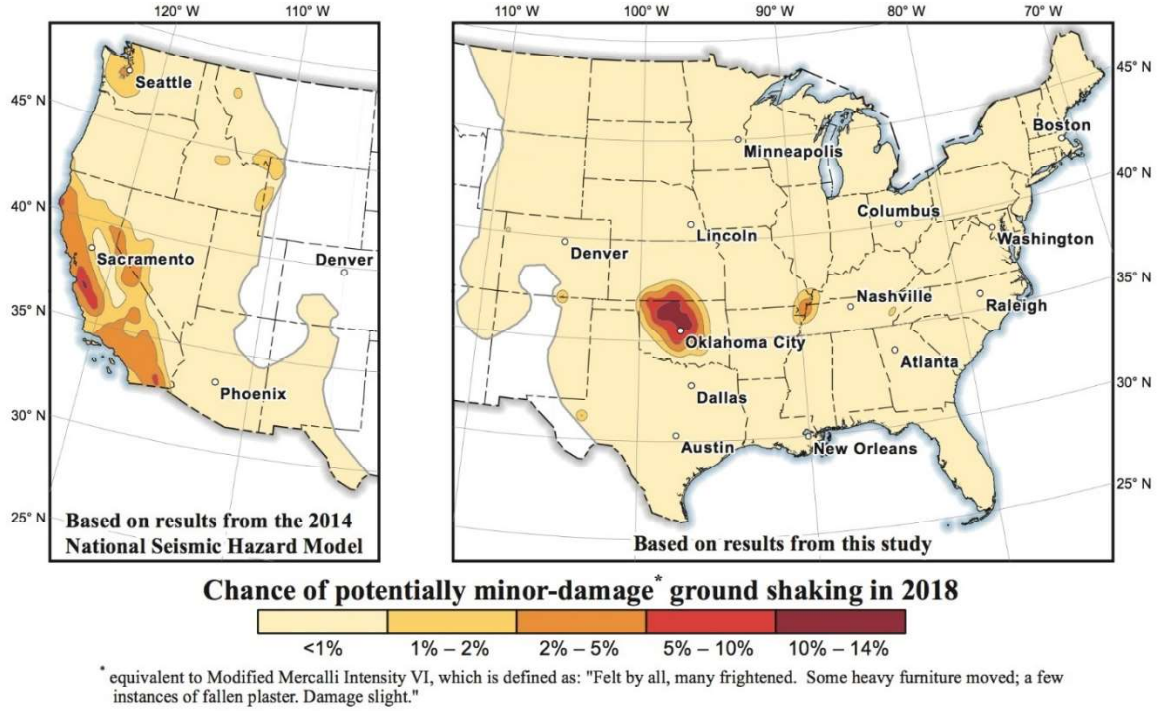

Figure 3-4 Chance of Potentially Minor-Damage Ground Shaking in 2018 (USGS 2018a)

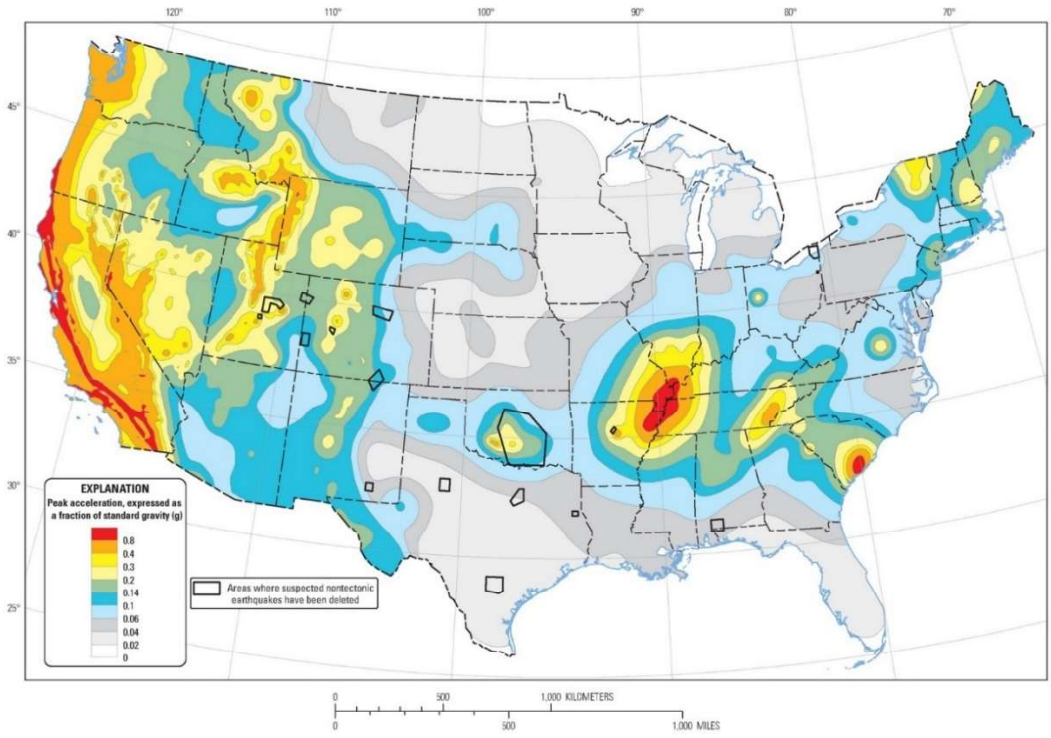

Figure 3-5 Two Percent Probability of Exceedance in 50 Years for Peak Ground Acceleration (USGS 2018b)

3.4 Water Resources

The area of review for the surface water assessment includes the MTW site, the discharge points from the MTW site to the Ohio River, and the water sampling points in the river identified in Section 2.3.9.2 of this EA. The area of review for groundwater is the subsurface below the MTW site.

3.4.1 Surface Water

3.4.1.1 Features and Flow Characteristics

The MTW site borders the Ohio River on the south, approximately 56 kilometers (35 miles) upstream from where the Ohio joins the Mississippi River. At the site, the Ohio River is about 910 meters (3,000 feet) wide with a normal pool elevation of 88 meters (290 feet) above mean sea level (ENERCON 2017, Section 3.4.1). As noted in Section 3.1.1 of this EA, wetlands are present on the site. As Figure 3-1 shows, a 46.3-hectare (114.3-acre) forested, broad-leafed deciduous, temporary flooded wetland area (PFO1Ah) occurs along the bank of the Ohio River, and a similar 56.2-hectare (138.8-acre) wetland (PFO1A) is in the southeastern forested portion of the site (USFWS 2017a; Honeywell 2018a, RAI Response PA-1). Other than the settling ponds themselves, no wetlands have been mapped in the restricted area. Three creeks are located outside of the restricted area, as indicated in Figure 3-1. These creeks have intermittent flow from stormwater runoff. A fourth creek or channel receives the following: (1) treated discharges from processes located in the restricted area, (2) stormwater from within the restricted area, and (3) liquors from activities associated with the calcium fluoride ponds. The

channel carries these discharges to Outfall 002. Because of the additional discharges from the MTW operations, the channel is seldom, if ever, dry.

The southern portion of the MTW site is located within the 100-year floodplain, although no MTW structures are in this area (ENERCON 2017, Section 3.4.5). Since recordkeeping began in 1928, the maximum recorded peak flow on the Ohio River at Metropolis, IL, was 52,386 cubic meters per second (m^3/s) (1,850,000 cubic feet per second (ft^3/s)) and occurred on February 1, 1937 (USGS 2017b). Although river flooding occurs annually, flood waters reportedly have never reached the MTW site (ENERCON 2017, Section 3.4.2). The elevation of the restricted area (between 113 and 116 meters (370 and 380 feet)) is considerably above the probable elevation of the 100-year flood, which is 103 meters (338 feet) above mean sea level (ENERCON 2017, Section 3.4.2), and the 500-year flood, which is 104 meters (341 feet) above mean sea level (FEMA 2018). The restricted area is also about 198 meters (650 feet) in distance from the 100-year floodplain. For comparison, the historic 1937 flood reached an elevation of 104 meters (341 feet) (NRC 2013a). The maximum peak stage of the 2011 flood event of 35,679 m^3/s (1,260,000 ft^3/s) recorded an elevation of 103 meters (338 feet) (ENERCON 2017, Section 3.4.2).

The eastern portion of the MTW site includes the inactive landfill and the Old Creosoter Area. The topographic map reproduced in Figure 1-2 of this EA confirms that both features lie within the footprint of a terrace that is 113 meters (370 feet) above mean sea level and above the 500-year floodplain. This is the same elevation as the terrace for the restricted area. The eastern area of the site drains through a creek that flows to Outfall 003 (see Figure 3-1). The creek's elevation is 104 meters (340 feet) above mean sea level as it passes below the eastern terrace. Thus, the creek bed could be reached by a 100-year flood (103 meters (337 feet) above mean sea level) and a 500-year flood (104 meters (340 feet) above mean sea level), but the advancement of flood waters up the creek would not likely reach the terrace where the inactive landfill and the Old Creosoter Area are located.

The nearest flow control structure is lock and dam 52 at Brookport, IL, about 11 kilometers (7 miles) upstream from the site (ENERCON 2017, Section 3.4.2). However, this structure does not impact flooding downstream because it is for navigational purposes only.

3.4.1.2 Quality and Use

A channel (shown in Figure 3-1), carries treated effluent from the EPF, liquors resulting from calcium fluoride pond closure activities, and MTW facility stormwater to Outfall 002 located on the Ohio River (Patterson 2019a). The MTW's liquid effluent discharge rate averaged about 0.12 m^3/s (4.18 ft^3/s) between 2010 and 2014, with the monthly average ranging from 0.05 m^3/s to 0.19 m^3/s (6.65 ft^3/s to 1.84 ft^3/s) (ENERCON 2017, Table 3.4-1). These discharge rates are well below the annual average flow rate of 7,915 m^3/s (279,501 ft^3/s) for the Ohio River (USGS 2017c).

Honeywell also monitors biological oxygen demand, pH, TSSs, total fluoride, and total uranium at Outfall 002; the results are discussed in Section 2.3.9.1 of this EA. The channel leading to Outfall 002 is not used for potable water, fishing, recreation, or irrigation before it discharges directly into the Ohio River (ENERCON 2017, Section 3.4.1). Stormwater runoff from the restricted area discharges from Outfalls 003 and 005 (ENERCON 2017, Section 2.1.2.2.6).

The MTW does not use surface water as potable water or process water, and the onsite intermittent creeks are not accessible for fishing, recreational, irrigation, or other agricultural

uses (ENERCON 2017, Section 3.4.3). The nearest public drinking water intake is from the Ohio River at Paducah, KY, about 17.7 kilometers (11 miles) upstream from the MTW. The nearest downstream public drinking water intake is from the Mississippi River at Cairo, IL, about 51 kilometers (32 miles) away (ENERCON 2017, Section 3.4.3).

As discussed in Section 2.3.9.1 of this EA, NPDES permit number IL0004421 stipulates the effluent limits for Outfall 002 (IEPA 2015a). Effluent at the outfall is sampled daily for uranium and weekly for numerous nonradiological constituents. Concentrations of NPDES-monitored contaminants in the MTW effluent have not shown adverse trends within the past 5 years (ENERCON 2017, Section 3.4.4). Excursions involving TSS, fluoride, fecal coliform, and temperature (temperature limits were discontinued in 2010) occurred between 2010 and 2015, as presented in Section 2.3.9.1.

The Ohio River Valley Water Sanitation Commission's most recent biennial assessment of Ohio River designated uses, considering conditions in 2010–2014, found that the 88.8-kilometer (55.2-mile) segment of the Ohio River that includes the MTW site (river miles 925.8 to 981.0) supports the river's uses for warm-water aquatic life, public water supply, and contact recreation. Certain species found in the Ohio River near the MTW site, such as carp, catfish, and bass, are under a fish consumption advisory because of nonradiological contaminants, including mercury and polychlorinated biphenyls (ORSANCO 2016, 2017).

Section 2.3.9 of this EA provides further detail on surface-water quality and monitoring results.

3.4.2 Groundwater

3.4.2.1 Hydrogeologic Setting

The unsaturated profiles across the site illustrated by ER Figures 3.3-2a–3.3-2c (ENERCON 2017) indicate broad patterns of clay-rich to sand-rich horizons at multiple depths through and below the water table approximately 15 meters (50 feet) below the elevation of the MTW restricted area.

The uppermost units are fluvial and windblown sediments of Quaternary ages. Lenses of clay, sand, and silt are identified within those profiles. These sediments most likely are the Cahokia Formation, the clay rich Equality Formation, and the Peoria, Roxana, and Loveland silts (Nelson and Masters 2008). The fluvial sources range from low- to high-energy streams. Because the clay zones appear discontinuous, they are not relied upon as a barrier to any potential migration of contaminants from the overlying MTW footprint.

The upper surface of the Metropolis Formation lies approximately 8 meters (25 feet) below the surface at the restricted area of the MTW. This formation is a permeable zone consisting of clay-rich silty sand and sandy silt, ranging in thickness from 6 to 17 meters (20 to 50 feet). The deeply weathered, poorly sorted, and burrowed alluvial sediments of the Metropolis Formation are interpreted as fluvial sediments that occupied an underfit valley ancestral to the modern Ohio River (Nelson and Masters 2008). This zone appears to be discontinuous and the water table is found directly below the Metropolis Formation in the transmissive Mounds Gravel Formation, which has an upper surface elevation 15 meters (50 feet) below the land surface (ENERCON 2017, Nelson and Masters 2008). The Mounds Gravel is made of gravel and sand 11 to 20 meters (35 to 65 feet) thick.

Within the Mounds Gravel, the water table slopes from northeast to south by southwest and flows at an average rate of 0.0094 to 0.19 meters per day (0.031 to 0.62 feet per day) towards the Ohio River. Temporary slope reversals occur within the water table aquifer on a periodic basis in association with flooding on the Ohio River. The duration of reversal events is approximately 10 to 34 days; however, a series of multiple events may extend the flow reversal for up to 58 days (NRC 2006a).

The Mounds Gravel hydrogeologic unit is used as a drinking water source upgradient of the plant, but the productivity is not high enough to support large industrial or municipal withdrawals. Three deeper, confined aquifers underlie the MTW site. Two aquifers are in the Cretaceous sediments, and the third is within the Mississippian Salem Limestone described in Section 3.3 of this EA. The Cretaceous McNairy Formation may yield enough water for domestic use, but the high iron content and fine-grained matrix make the groundwater quality unattractive for human consumption or industrial use (NRC 2006a). The principal source of groundwater for industrial, utility, and municipal water use is the highly fractured and cavernous Mississippian Salem Limestone that underlies the MTW site at depths from 85 to 150 meters (280 to 500 feet) below the surface.

3.4.2.2 Quality and Use

Nelson and Masters (2008) present a map and geological cross section of the region surrounding the MTW site that shows the Mississippian Salem Limestone is the groundwater source for the three industrial water supply wells and the sanitary water well located on the MTW site. The total withdrawal capacity of these wells is 18.43 million liters per day (4.87 million gallons per day), or 12,800 liters per minute (3,380 gallons per minute) (Honeywell 2018a). The depths of these wells range from 126 to 159 meters (412 to 520 feet). The total capacity of these wells is more than sufficient to meet the normal plant operating requirements of 7,800 to 9,960 liters per minute (2,060 to 2,630 gallons per minute). The site's potable water needs are met by the sanitary water well, in accordance with EPA drinking water regulations administered by the Illinois Department of Public Health (ENERCON 2017, Section 3.4.7). A pump test performed in 1971 established connections between all the wells, except process Well No. 3, which appears to be isolated. Drawdowns were minor after 72 hours and did not exceed 0.6 meters (2 feet) in any well (ENERCON 2017, Section 3.4.7). This suggests high well capacities or high aquifer storage capacity, or both.

As described in Section 2.3.9.2 of this EA, Honeywell has implemented two shallow groundwater corrective actions at the MTW site (ENERCON 2017, Sections 3.4.8.3.1 and 3.4.8.3.2). One corrective action, now complete, was to remedy the effects of historic activities. An ongoing corrective action is monitoring underground process sewers and structures for possible contamination.

3.5 Ecology

The MTW was cleared of natural vegetation before the construction of facility buildings, the settling ponds, and other MTW-related facilities (see Figure 1-2 in Chapter 1). The remaining 95 percent of the property remains mostly undeveloped (ENERCON 2017, Section 3.5). The ecological resources that have the potential to be affected by the license renewal are predominately those in the undeveloped portion of the site. Therefore, the area of review for ecological assessment is the entire MTW site.

3.5.1 Terrestrial

The MTW site is in EPA Level IV Ecoregion 72a, the Wabash-Ohio bottomlands, which is a subregion of Ecoregion 72, interior river valleys and hills (ENERCON 2017, Section 3.5.1; Woods et al. 2006). Ecoregion 72a is a small region along the Ohio River and around Ecoregion 72k, Cretaceous Hill. It is composed of poorly drained floodplains and low terraces. Once covered by bottomland forests and wetlands, Ecoregion 72a has mostly been cleared and drained for agriculture, although seasonally high water tables and localized flooding affect land use (Woods et al. 2006).

The natural vegetation around the MTW site is characteristic of oak-hickory and southern mixed hardwood forests. Associated tree species include oak (*Quercus* spp.), hickory (*Carya* spp.), persimmon (*Doispyros virginiana*), sassafras (*Sassafras albidum*), and black locust (*Robinia pseudoacacia*). Tree species such as cottonwood (*Populus deltoides*) and a variety of willows (*Salix* spp.) occur along the river in areas that are periodically flooded. Dryer areas along the river support tree species such as box elder (*Acer negundo*), American beech (*Fagus grandifolia*), sweet gum (*Liquidambar styraciflua*), and sycamore (*Plantanus occidentalus*). Vegetation along the electrical transmission line corridor (see Section 3.1.1 of this EA) crossing the MTW site is maintained and includes only grasses and low-growing shrubs such as brome grass (*Bromus tectorum*), broom sedge (*Andropogon virginicus*), bluegrass (*Poa pratensis*), goldenrod (*Solidago* spp.), sumac (*Rhus* spp.), and blackberry (*Rubus allegheniensis*). The MTW site also includes freshwater forested and shrub wetland areas along the Ohio River and in the southeastern forested portion of the site (see Section 3.1.1 of this EA). The floodplain portion of the site had been farmed in the past and is in the process of returning to more natural vegetation (ENERCON 2017, Section 3.5.2.4).

The MTW site is home to animal species that are typical of old field and second-growth forests in the region. Birds and mammals that could occur on forested land include the cardinal *(Richmondena cardinalis*), titmice and chickadees (*Parus* spp.), woodpeckers, eastern gray squirrel (*Sciurus carolinensis*), white-footed mouse (*Peromyscus leucopus*), and opossum (*Didelphis marsupialis*). Animals associated with the banks of the Ohio River include muskrats (*Ondatra zibethica*), raccoon (*Procyon lotor*), and a variety of species of turtles, water snakes, salamanders, and frogs. Other important species in the area of the MTW site include recreational game animals (e.g., white-tailed deer (*Odocoileus virginianus*), furbearers, small game, and resident and migratory game birds) and sport fish.

3.5.2 Aquatic

The aquatic biota of the Ohio River include algal plankton communities comprising yellow-green (diatoms), green, and blue-green algae. Zooplankton communities consist primarily of rotifers.

Benthic communities in the Ohio River are characterized by species adapted to both flowing and restricted circulation conditions. Crustaceans are found in greater abundance in pooled areas behind dams than in the open river. Benthic invertebrate communities are not well developed in the Ohio River, possibly because of the lack of suitable substrates, high turbidity, or unfavorable chemical environment. Chironomid larvae and turbificids often dominate the community in terms of numbers, and the Asiatic clam (*Corbicula manilensis*) occurs in large quantities. Other common organisms include snails and leeches. Freshwater mussels could occur in the Ohio River adjacent to the MTW site, but no significant mussel beds are known to be present in the stretch of river adjacent to the MTW site (KDFWR 2018; USFWS 2018a, 2018b; see also Section 3.5.3 below).

Forage fish that feed largely on detritus, plant material, and bottom-dwelling invertebrates are abundant. These include the emerald shiner, the gizzard shad, and carp. Although commercial fishing has largely been abandoned on the Ohio River, sport fishing is still popular. Commonly caught species include channel catfish, white bass, and bluegill. Certain species found in the Ohio River near the MTW site, such as carp, catfish, and bass, are covered under a fish consumption advisory (ORSANCO 2016).

3.5.3 Threatened, Endangered, Proposed, and Candidate Species

3.5.3.1 Federally Listed Species

Congress enacted the Endangered Species Act of 1973, as amended (ESA), to prevent further decline of endangered and threatened species and restore those species and their critical habitat. Section 7 of the ESA requires Federal agencies to consult with the USFWS regarding actions that may affect listed species or designated critical habitats. The ESA and its implementing regulations at 50 CFR Part 402, "Interagency Cooperation—Endangered Species Act of 1973, as Amended," describe the consultation process that Federal agencies must follow in support of agency actions.

This section lists the federally listed species and critical habitats that could potentially occur in the MTW action area (site) or adjacent Ohio River, which borders both Massac County, IL, and McCracken County, KY. The ESA regulations define "action area" as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the Federal action (50 CFR 402.02, "Definitions"). The ESA analysis in this EA considers the action area to include the entire MTW site, as well as the Ohio River directly adjacent to the MTW site, including discharge areas. The NRC expects all direct and indirect effects of the proposed action on ecological resources to be contained within these areas, except for downstream effects of discharges into the river.

The USFWS's Environmental Conservation Online System's Information for Planning and Conservation system (IPaC) was used in this EA to identify the species and habitats with the potential to be present in Massac County and McCracken County. This larger area was evaluated to ensure the EA analyzed all potentially threatened, endangered, proposed, and candidate species in the Ohio River habitat. Based on IPaC results, 16 federally listed species have the potential to occur in the MTW action area, nine in Massac County, and an additional seven were reported in McCracken County (USFWS 2018a). Table 3-6 lists all these species, followed by brief descriptions. Proposed species or candidate species have not been identified in the action area; however, designated critical habitat for one threatened species of mussel, the rabbitsfoot, *Quadrula cylindrica,* is found within the Ohio River in McCracken County (USFWS 2018a). Two additional federally listed species have been found in McCracken County (wood stork, *Mycteria americana*, a single record in 2010, and shovelnose sturgeon, *Scaphirhynchus platorynchus*, a single record in 2006) (KDFWR 2018). These sightings are isolated records and do not appear in IPaC searches conducted for Massac County and McCracken County. The shovelnose sturgeon is listed as a threatened species under the ESA's "similarity of appearance" provision because of its similarity to the pallid sturgeon and the overlapping ranges of these two fish in the Missouri and Mississippi River basins. This EPA designation, however, does not apply to the Ohio River near the MTW site (USFWS 2018c).

None of these federally listed species has been observed in the restricted area of the site. USFWS did not identify any listed plant species occurring in Massac County.

Federally listed threatened or endangered terrestrial animals whose ranges include Massac County, McCracken County, or both, are the least tern (*Sternula antillarum*), the Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septentrionalis*), and gray bat (*Myotis grisescens*).

In the interior of the United States, least terns nest on exposed riverine sandbars and forage nearby for small fish. They breed in the summer and fly south to winter along the Gulf of Mexico and on Caribbean Islands (NatureServe 2017a). Least terns are likely summer residents on the Ohio River in proximity (within 0.6 to 1.2 kilometers (1 to 2 miles)) to the MTW site, with adults present, likely foraging, "across from Metropolis Lake" on the Ohio River, as observed during a 2005 breeding survey (Ciuzio et al. 2005). A sandbar that appears to be suitable habitat based on aerial photos (see Figure 3-1 in this EA) is directly adjacent to the river discharge point of Outfall 002, but no terns have been known to nest there. The nearest known nesting sites are two islands about 2.7 kilometers (1.6 miles) downstream, across from the AEP Cook Coal Terminal. The last record of terns nesting there was in 2012, with eight known nests. River flooding and nest inundation is a problem throughout the Ohio River. The only other known least tern nesting site farther downstream on the Ohio River is near Monkey's Eyebrow, KY (approximately 23 kilometers, 14.3 miles downstream of the MTW site); 24 nests were reported there in 2012 (Harper 2018).

Table 3-6 Massac County, IL, and McCracken County, KY, Federally Threatened, Endangered, or Candidate Species

Name	Federal Status	State Status	Present on MTW Site?
least tern (*Sternula antillarum*)	endangered	IL and KY endangered	Likely as a migrant or summer resident, breeding on sandbars in the river (INHS 2018; KDFWR 2018); last observed in Massac County in 1996 (ILDNR 2016); last observed in McCracken County in 2012 (KDFWR 2018); adults observed on the Ohio River "opposite Metropolis Lake" during breeding season in 2005 (Ciuzio et al. 2005).
Indiana bat (*Myotis sodalis*)	endangered	IL and KY endangered	Potential habitat statewide, but no known occurrence in Massac County (USFWS 2017b). Fifteen records for McCracken County, last observed there in 1999 (KDFWR 2018).
northern long-eared bat (*Myotis septentrionalis*)	threatened (4,d rule)	IL and KY endangered	Last observed in Massac County in 2005 (ILDNR 2016). Last observed in McCracken County in 2008 (KDFWR 2018).
gray bat (*Myotis grisescens*)	endangered	IL and KY endangered	No Massac County or McCracken County records (ILDNR 2016; KDFWR 2018), but present in McCracken County according to IPaC (USFWS 2018a).
orangefoot pimpleback (pearlymussel) (*Plethobasus cooperianus*)	endangered	IL and KY endangered	Potentially in the river; last observed in McCracken County in 2015 (KDFWR 2018).
pink mucket (pearlymussel) (*Lampsilis abrupta*)	endangered	IL and KY endangered	Potentially in the river; last observed in McCracken County in 2004 (KDFWR 2018).

Name	Federal Status	State Status	Present on MTW Site?
purple cat's paw (pearlymussel) (*Epioblasma obliquata*)	endangered	KY endangered	Potentially in the river; no Massac County or McCracken County records (ILDNR 2016; KDFWR 2018), but present in McCracken County according to IPaC (USFWS 2018a).
fat pocketbook (mussel) (*Potamilus capax*)	endangered	IL and KY endangered	Potentially in the river; last observed in McCracken County in 2015 (KDFWR 2018).
rabbitsfoot (mussel) (*Quadrula cylindrica cylindrica*)	threatened	IL endangered and KY threatened	Potentially in the river, which is critical habitat (USFWS 2016); last observed in McCracken County in 2015 (KDFWR 2018).
sheepnose (mussel) (*Plethobasus cyphyus*)	endangered	IL and KY endangered	Potentially in the river; last observed in McCracken County in 2015 (KDFWR 2018).
spectaclecase (mussel) (*Cumberlandia monodonta*)	endangered	IL and KY endangered	Potentially in the river; last observed in Massac County in 1994 (ILDNR 2016).
rough pigtoe (mussel) (*Pleurobema plenum*)	endangered	IL delisted and KY endangered	Potentially in the river; no Massac County or McCracken County records (ILDNR 2016; KDFWR 2018), but present in McCracken County according to IPaC (USFWS 2018a).
northern riffleshell (mussel) (*Epioblasma torulosa rangiana*)	endangered	IL and KY endangered	Potentially in the river; no Massac County or McCracken County records (ILDNR 2016; KDFWR 2018), but present in McCracken County according to IPaC (USFWS 2018a).
ring pink (mussel) (*Obovaria retusa*)	endangered	IL delisted and KY endangered	Potentially in the river; no Massac County or McCracken County records (ILDNR 2016; KDFWR 2018), but present in McCracken County according to IPaC (USFWS 2018a).
clubsell (mussel) (*Pleurobema clava*)	endangered	IL and KY endangered	Potentially in the river; no Massac County or McCracken County records (ILDNR 2016; KDFWR 2018), but present in McCracken County according to IPaC (USFWS 2018a).
fanshell (mussel) (*Cyprogenia stegaria*)	endangered	IL and KY endangered	Potentially in the river; no Massac County or McCracken County records (ILDNR 2016; KDFWR 2018), but present in McCracken County according to IPaC (USFWS 2018a).

Sources: USFWS 2018a; ILDNR 2012, 2016; KDFWR 2018

The Indiana bat was identified in several Illinois counties, although not Massac County. The entire State of Illinois is within its range (NatureServe 2017b). Bats have been reported to the Kentucky Department of Fish and Wildlife Resources as present in McCracken County at least 15 times, the most recent record of which dates to 1999 (KDFWR 2018). Indiana bats migrate seasonally between winter hibernacula, such as caves and abandoned mines, and summer roosting habitats. In the spring, females emerge from hibernation to summer roosts, where they form nursery colonies in cavities and under the loose bark of living or dead trees. During the summer, the Indiana bats frequent wooded or semi-wooded areas, often, but not always, along

streams. They forage for flying insects in riparian areas, upland forests, ponds, and fields, preferring forested landscapes (NatureServe 2017b).

The northern long-eared bat is one of the species of bats most impacted by the disease known as "white-nose syndrome." Because of declines caused by this disease and its continued spread, the northern long-eared bat was listed as threatened under the ESA in 2015. Like the Indiana bat, the northern long-eared bat spends the winter hibernating in caves and mines. In the summer, the bat roosts singly or in colonies underneath bark, in cavities, or in crevices of living and dead trees. They forage for insects in the understory of forested hillsides and ridges (USFWS 2017c). The bat's range includes Massac County and McCracken County, including the forested areas that provide its summer habitat, with records of sightings as recent as 2005 (ILDNR 2016) and 2008 (KDFWR 2018).

The gray bat is federally listed as endangered and is present in McCracken County according to IPaC (USFWS 2018a), although neither Illinois nor Kentucky has recorded an occurrence of the bat in its database of rare species (ILDNR 2016; KDFWR 2018).

Twelve mollusk species that are federally listed, threatened, or endangered aquatic animals have ranges in the Ohio River in the vicinity of the MTW site: fat pocketbook, orangefoot pimpleback, pink mucket, rabbitsfoot, sheepnose, spectaclecase (USFWS 2018a), rough pigtoe, purple cat's paw, northern riffleshell, ring pink, clubsell, fanshell (USFWS 2018a) (see Table 3-6 in this EA for details of county records). A mussel survey (including dive surveys) would be required to determine the presence of these species in this portion of the Ohio River, although the stretch of river adjacent to the MTW site is not known to host significant mussel resources or beds (USFWS 2018b). The portion of the Ohio River in Massac County and McCracken County is considered critical habitat for the rabbitsfoot mussel (USFWS 2018a).

3.5.3.2 State-Listed Species

The Illinois Department of Natural Resources designates species as endangered or threatened through the Illinois Endangered Species Protection Board; the Kentucky Department of Fish and Wildlife Resources does the same through the Kentucky State Nature Preserves Commission. The Illinois Endangered Species Protection Act (Chapter 520 of the Illinois Compiled Statutes, Section 10 (520 ILCS 10)) requires Illinois State agencies to ensure that their actions do not jeopardize the continued existence of endangered and threatened species or result in the destruction or modification of critical habitat. Projects that require State-issued permits, use State funds, or are conducted by State agencies require the Illinois Department of Natural Resources to conduct an environmental review for impacts on State-designated endangered and threatened species.

As a Federal agency, the NRC is not required to analyze impacts on resources that are subject to the Illinois Endangered Species Protection Act. However, this EA evaluates the State-listed species that have the potential to be present in the MTW action area, and assesses the likely impacts on those species, in order to provide a complete assessment of the potential impacts of the proposed action for the purposes of NEPA. The NRC staff used the Illinois Natural Heritage Database (updated in 2016) to identify State-listed species with the potential to occur in the MTW action area within Massac County (ILDNR 2016) and the Kentucky Species Information portal to search for State-listed species in McCracken County with the potential to occur near, on, or in the Ohio River (KDFWR 2018). Table 3-6 in this EA denotes the State status of federally listed species for Illinois and Kentucky.

The Illinois Department of Natural Resources lists 57 threatened or endangered plant and animal species that are present in Massac County (ILDNR 2016). Fifty of these species are not federally listed. Of the 50 species, 25 are plant or lichen species, 1 is a bat species (southeastern myotis, *Myotis austroriparius*), 5 are additional mussel species (not already federally listed), 8 are bird species, 4 are reptiles (three snakes and one turtle), 4 are fish, 1 is a crayfish, 1 is a frog (bird-voiced treefrog, *Hyla avivoca*), and 1 is an amphibian, the hellbender salamander (*Cryptobranchus alleganiensis*).

The NRC staff is not aware of any biological surveys that confirm the presence of State-listed species in the vicinity of the MTW site. Seven additional State-listed species are also federally listed (discussed above). Of the State-listed bird species, five are likely to be found in the Ohio River habitat adjacent to or within the project site, either as raptors fishing in the river (e.g., Mississippi kite (*Ictinia mississippiensis*), osprey (*Pandion haliaetus*)) or as waterfowl using the river itself (e.g., common gallinule (*Gallinula galeata*)).

The Kentucky Department of Fish and Wildlife Resources lists 73 threatened or endangered animal species that are present in McCracken County; however, no plant species are listed (KDFWR 2018). Three State-listed species are bats, including the southeastern myotis and two additional species not listed federally or in Illinois, the evening bat (*Nycticeius humeralis)* a species of special concern, with a record from 2016, and Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) also a species of special concern, with a record from 2009. Only one species is also State-listed in Illinois, the eastern ribbon snake (*Thamnophis sauritus sauritus*). The Kentucky State-listed species recorded in McCracken County are not co-listed in Illinois or at the Federal level. These species include 1 frog, 1 snake, and 2 turtle species, 16 fish species, 1 mollusk, 1 crustacean, and 5 aquatic gastropods (snails). In addition, 23 bird species are State-listed with records in McCracken County, 14 of which are likely to be found in or around the Ohio River (e.g., waterfowl or raptors that feed on aquatic species). The aquatic species, fish-eating species, and aerial insect-eating species (bats), could be found in and around the Ohio River in proximity to the MTW site.

The bald eagle (*Haliaeetus leucocephalus*) is one of the fish-eating species reported in McCracken County and likely forages for fish in the Ohio River in the vicinity of the MTW site (KDFWR 2018). Bald eagles are protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.). Bald eagles use mature, forested riparian areas near rivers, streams, lakes, and wetlands and are present along all the major river systems in Ohio and Illinois, with some of the largest wintering roosts in the continental United States occurring in Illinois (Steenhof et al. 2008). Suitable habitat exists in the action area, but there is no documentation of regularly inhabited roosts.

3.6 Meteorology, Climatology, and Air Quality

3.6.1 Meteorology and Climatology

The climate of the area is characteristic of the humid continental zone, where the primary source of heat and moisture for western Kentucky and southern Illinois is the Gulf of Mexico. The general climate of the area of the MTW site remains as that described in the NRC's EA for the previous license renewal (NRC 2006a). Because of the MTW site's proximity to the Ohio River, its climate is more typical of western Kentucky than southern Illinois. Winters are characterized by evenly distributed precipitation events and moderate diurnal changes in temperature. In the summer, frontal and pressure systems generally pass north of the region, resulting in a more tranquil weather pattern over the area.

Previous analyses have relied on meteorological data from the National Weather Service's station at Paducah, KY, on the far bank of the Ohio River, approximately 11.3 kilometers (7 miles) south of the site. Instead, this EA examines data from the Paducah Barkley Regional Airport from January 1, 2005, through December 31, 2016 (NOAA 2017a).

3.6.1.1 Temperature

The average annual temperature in the area is 14.4 °C (57.9 °F), with monthly average temperatures ranging from 26.3 °C (79.3 °F) during July to 1.3 °C (34.5 °F) during January (NRC 2006a). The maximum temperature at the Paducah airport station was 41.1 °C (106.0 °F), recorded in 1952; the minimum temperature of -24.4 °C (-12.0 °F) was recorded in 1951. National Weather Service data for the years 1997 through 2004 indicate that the Paducah area had approximately 42 days annually where the high temperature exceeded 32.2 °C (90.0 °F) and about 12 days where the daily high temperature did not exceed the freezing level (NRC 2006a).

Based on an analysis of the new data for Paducah for the years 2005 through 2016 (NOAA 2017a), the average annual temperature remains about 14.7 °C (58.5 °F), with monthly average temperatures ranging from 26.1 °C (78.9 °F) during July to 1.9 °C (35.5 °F) during January. A new record maximum was recorded in June 2012 at 42.2 °C (108 °F); the minimum temperature was -23.3 °C (-10 °F), in February 2015. The high temperature exceeded 32.2 °C (90.0 °F) on an average of 44.5 days per year and was 0 °C (32 °F) or below on an average of 24 days per year.

3.6.1.2 Precipitation

Precipitation in the region occurs throughout the year, with seasonal variation (NRC 2006a). The mean annual precipitation for the Paducah, KY, station is 117.8 centimeters (46.38 inches), with more rainfall typically occurring between March and July than for the remainder of the year. Additionally, the region experiences approximately 70 thunderstorm days annually (NRC 2006a). The maximum monthly rainfall (45.0 centimeters (17.73 inches)) occurred during March 1966, and the greatest daily rainfall (20.3 centimeters (8.00 inches)) occurred on March 4, 1964. Annual snowfall is generally light (22.1 centimeters (8.7 inches)) and usually occurs during January, February, and March. However, measurable snowfall has occurred as early as November and as late as April. The maximum monthly snowfall (57.4 centimeters (22.6 inches)) occurred during January 1978 (NRC 2006a).

The NRC's analysis of the new data for Paducah for the years 2005 through 2016 (NOAA 2017a) shows that these parameters remained consistent. Mean annual precipitation increased to about 128.3 centimeters (50.5 inches), with annual snowfall averaging 26.7 centimeters (10.5 inches). The maximum monthly rainfall at Paducah for the years 2005 through 2016 was 29.6 centimeters (11.64 inches) in September 2006.

3.6.1.3 Winds, Tornados, and Storms

Based on data for the years 1997 through 2004, the predominant wind direction at the MTW site is from the southwest quadrant with a secondary maxima from the north-northwest. The average wind speed over this period was 10.1 kilometers per hour (kph) (6.3 miles per hour (mph)), with individual year averages ranging from 9.8 to 10.8 kph (6.1 to 6.7 mph). The maximum hourly average wind speed observed during this period was 55.5 kph (34.5 mph), and the maximum gust was 113 kph (70.2 mph) in 2001. Based on an analysis of the new data for

Paducah for the years 2005 through 2016 (NOAA 2017a), the average wind speed remained consistent at 10.3 kph (6.4 mph), with individual year averages ranging from 9.3 to 11.1 kph (5.8 to 6.9 mph). The maximum daily average wind speed was 33.5 kph (20.8 mph), and the maximum gust was 127.1 kph (79 mph) in 2011 (NRC 2006a).

In general, this region is not directly influenced by tropical cyclone activity. However, because of the region's proximity to the Gulf of Mexico, it occasionally experiences increased rainfall from northward-moving tropical systems from the central and western Gulf Coast (NRC 2006a).

Tornados are measured on the Enhanced Fujita (EF) scale, where EF0 is the weakest, with winds of 105 to 137 kph (65 to 85 mph), and EF5 is the strongest, with winds over 322 kph (200 mph) (NOAA 2017b). Between 1950 and 2015, there were no EF5 tornados and one EF4 tornado (May 6, 2003) (winds 26 to 322 kph (166 to 200 mph)) in the seven counties around the MTW site. The EF4 tornado began approximately 32.2 kilometers (20 miles) west-northwest of Metropolis and traveled 9.7 kilometers (6 miles) into Massac County (NRC 2006a). EF3 tornados (winds 219 to 266 kph (136 to 165 mph)) occurred in 2006, about 6.4 kilometers (4 miles) west of the MTW site, and in 2013, south of Paducah, KY (MRCC 2017). Smaller tornados in the immediate vicinity of the site include an EF2 tornado (winds 179 to 266 kph (111 to 165 mph)) in 2012, an EF1 tornado (winds 138 to 177 kph (86 to 110 mph)) in 2011, and an EF0 tornado in 2005—all just northwest of the MTW site (MRCC 2017).

3.6.2 Air Quality

The area of review for the air quality assessment is Massac County, IL, and McCracken County, KY.

Section 2.3.9.1 of this EA presents the results of air emission monitoring for radionuclides and fluoride implemented at MTW. Air quality is measured against the EPA-established National Ambient Air Quality Standards, which were established to protect human health and welfare (primary standards) and to protect against damage to the environment and property (secondary standards). The National Standards regulate total suspended particulates (inhalable particulate matter with aerodynamic diameters less than 10 micrometers (PM_{10}) and less than 2.5 micrometers ($PM_{2.5}$)), ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, and lead. Illinois Administrative Code (IAC) Title 35, “Procedural and Environmental Rules,” Subtitle B, “Air Pollution,” Chapter I, “Pollution Control Board,” Section 243, “Air Quality Standards,” adopted the national ambient air quality standards for pollutants. Table 3-7 summarizes the ambient air quality standards for the regulated pollutants.

Compliance with these standards is determined individually for each pollutant. An area is classified as “in attainment” when concentration levels are below the National Standards. As of February 2017, Massac County, IL, and McCracken County, KY, continue to be in attainment with regard to these six criteria pollutants (EPA 2017a, 2017b).

Table 3-8 shows the IEPA annual air quality report for 2016 estimated stationary point source emissions in Massac County, IL.

Table 3-7 Summary of National and Illinois Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead		Primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and secondary	Annual	52 ppb	Annual mean
Ozone		Primary and secondary	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$[a]	Primary	Annual	12.0 µg/m^3	Annual mean, averaged over 3 years
		Secondary	Annual	15.0 µg/m^3	Annual mean, averaged over 3 years
		Primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

a $PM_{2.5}$ standards are referenced to local conditions of temperature and pressure rather than standard conditions (760 millimeters of mercury and 25 °C).
ppb = parts per billion, ppm = parts per million, µg/m^3 = micrograms per cubic meter.
Source: IEPA 2016c

Table 3-8 Massac County, IL, Estimated Stationary Point Source Emissions, 2015 (metric tons per year)

Carbon Monoxide	Nitrogen Oxides	PM_{10}	Sulfur Dioxide	Volatile Organic Material
1,296.0	5,523.8	845.9	14,990.6	254.4

Note: To convert metric tons to tons, multiply by 0.907.
Source: IEPA 2015b

The EPA established prevention of significant deterioration (PSD) requirements in 40 CFR 52.21, "Prevention of Significant Deterioration of Air Quality," to identify maximum allowable increases in concentration for particulate matter, sulfur dioxide, and nitrogen dioxide for areas designated as in attainment. Different increment levels are identified for different PSD classes. Class I areas are high-value locations and have the most stringent standards. The Mammoth Cave National Park is the closest PSD Class I area, located about 240 kilometers

(150 miles) east of the MTW site. Since EPA promulgated the PSD regulations in 1977, PSD permits have not been required for any emission source at MTW.

Burning fossil fuels and other agricultural and industrial processes produce greenhouse gases (GHGs). These gases can trap heat in the atmosphere. Examples of GHGs include carbon dioxide, methane, nitrous oxide, and certain fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These gases vary in their ability to trap heat.

In Illinois, the level of carbon dioxide emissions (including the MTW) was 233.9 million metric tons (257.8 million tons) in 2014, which represents about 4 percent of the total GHG emissions in the United States (EPA 2017c). MTW released 18,489 metric tons (20,381 short tons) of carbon dioxide in 2014 (ENERCON 2017, Table 2.1-4), which is about 0.008 percent of the State total emissions.

Recent improvements in the emissions and the science of climate change have enabled the U.S. Global Change Research Program (GCRP) to estimate regional climate changes in the United States. The GCRP's Third National Climate Assessment (GCRP 2014) delineates the MTW site as located in the Midwest region of the United States. GCRP forecasts an increase in heat wave frequency and intensity, increased humidity, decreased air quality, and an increase in the number of extreme rainfall events in the Midwest region.

3.7 Noise

The area of review for the noise assessment is the area within a 3.2-kilometer (2-mile) radius of the MTW site.

3.7.1 Noise Guidelines

EPA has identified an equivalent continuous noise level (24-hour) of 70 decibels or less as adequate to protect against hearing loss over a lifetime and a day-night average sound level outdoors of 55 decibels or less to be adequate to protect against activity interference and annoyance (EPA 1974, Table 1). EPA identifies noise at or greater than 55 A-weighted decibels (a weighted measure used to approximate the noise response of the human ear), with a margin of safety determined to protect hearing, as causing outdoor-activity interference and annoyance. As points of comparison, heavy highway traffic at 91 meters (300 feet) has a noise level of 60 A-weighted decibels and a gas-powered lawn mower at 30 meters (100 feet) has a noise level of 70 A-weighted decibels. Noise levels lessen with increasing distance from the respective source.

The Federal Highway Administration has codified noise abatement criteria levels (Categories A to E) for noise-sensitive receptors based on types of land use and human activity. Table 3-9 gives some of the categories and their associated noise abatement criteria.

Illinois promulgated its own sound emission standards in 35 IAC 901, "Sound Emission Standards and Limitations for Property Line Noise Sources," which contains sound emission standards and limitations for property line-noise sources. Section 901.101, "Classification of Land According to Use," classifies land according to its use, based on the Land-Based Classification Standards (LBCS) of the American Planning Association (APA 2001). The MTW site is Class C land, LBCS code 3110, for primarily plant or factory-type activities. Residential land, within LBCS code 1000, is considered a Class A land use. In accordance with 35 IAC 901.102, "Sound Emitted to Class A Land," daytime noise from Class C land to Class A

land cannot exceed 75 decibels at low frequencies (31.5 hertz) to 40 decibels at high frequencies (8,000 hertz). Nighttime limits are 69 decibels at low frequencies and 32 decibels at high frequencies. These limits apply at any point within the receiving land.

Table 3-9 Federal Highway Administration Noise Abatement Criteria Levels

Category	Location	Description	Level (dBA[a])
A	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.	57
B	Exterior	Residential	67
C	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, park lands, wildlife and waterfowl refuges, historic sites, schools, television studios, trails, and trail crossings.	67
D	Interior	Auditoriums, daycare centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.	52
E	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A through D or F.	72
F	(b)	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.	(b)
G	(b)	Undeveloped lands that are not permitted.	(b)

a Hourly A-weighted sound level decibels.
b Not identified in the regulation.
Source: 23 CFR Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise," Table 1

The Occupational Safety and Health Administration promulgated noise exposure limits in 29 CFR 1910.95, "Occupational Noise Exposure," for the protection of workers that are based on an equivalent A-weighted sound level. The regulation requires that an employer administer a continuing, effective hearing conservation program if certain conditions are met, as described in paragraphs (c) through (o) of the regulation.

3.7.2 Existing Levels at the MTW Site

Honeywell conducted noise monitoring in October 2011 and December 2014 within the MTW. The highest noise levels measured were within the FMB, ranging from 78.8 to 109.3 decibels. Noise readings in other MTW buildings consistently measured about 70 decibels (Sanders 2016).

In addition to the MTW, other sources of noise near the site include U.S. Highway 45, the BNSF railroad, and the Metropolis Municipal Airport. Honeywell has not performed any noise surveys at the boundary of the restricted area, and no ambient noise survey data are available for the area around the MTW site.

The distance from the restricted area to potential receptors helps mitigate any offsite noise impacts from facility operations. The nearest residence is more than 538 meters (1,765 feet) north-northeast of the FMB in the restricted area (ENERCON 2017, Section 3.7). There are no other noise-sensitive receptors (e.g., residences, schools, hospitals) in close proximity.

3.8 Historic and Cultural Resources

As required by Section 106 of the National Historic Preservation Act (NHPA), the NRC is considering the impact of this license renewal on historic, archaeological, and traditional cultural resources. In accordance with 36 CFR 800.8 (the implementing regulations for NHPA), "Coordination with the National Environmental Policy Act," the NRC is using the NEPA process to coordinate its obligations under NHPA Section 106. The staff conveyed this information to the Illinois State Historic Preservation Office (SHPO) in a letter dated July 11, 2018 (NRC 2018a).

For this proposed action, the area of potential effect (APE) is the entire MTW site, comprising approximately 405 hectares (1,000 acres), which is owned by Honeywell. Most of the APE is densely forested land, with actual plant operations taking place on about 5 percent of the site, within a 24-hectare (59-acre) fenced, restricted area in the north central portion of the APE (see Figure 2-1).

The NRC staff selected an 8-kilometer (5-mile) radius from the approximate center point of the previously disturbed, restricted area to identify historic properties listed or eligible for listing on the National Register of Historic Places (NRHP) (Honeywell 2017b). The NRC evaluated potential adverse effects of the proposed license renewal on the viewsheds associated with those properties (Honeywell 2017b). The extended 8-kilometer radius includes land in southern Massac County, IL, and northern McCracken County, KY.

3.8.1 Identified Historic and Cultural Resources

Information evaluated for this review derives from the license renewal ER (ENERCON 2017), as updated and supplemented in this analysis. Data for known or previously recorded historic and cultural properties within the APE and the extended radius were assembled from several sources. Historic properties listed on the NRHP were identified on the U.S. National Park Service NRHP Web site (NPS 2018a, 2018b). Information for historic architectural resources was obtained from the State of Illinois' Historic and Architectural Resources Geographic Information System (HARGIS). HARGIS is maintained by the Illinois Historic Preservation Agency and includes all architectural resources listed in the NRHP, determined eligible for listing in the NRHP, or surveyed without an NRHP determination. Data for archaeological resources was obtained from the Inventory of Illinois Archaeological Sites geographic information system database. This database is maintained by the Illinois Department of Natural Resources and the Illinois State Museum.

3.8.1.1 National Register of Historic Places Listed or Eligible Properties Outside the Area of Potential Effect

Several historic properties listed on the NRHP or determined eligible for listing are situated near the MTW site but lie outside the APE. Two NRHP-listed properties are in Massac County, IL, and one is in McCracken County, KY. These properties are within 8 kilometers (5 miles) of the MTW site (Table 3-10). Two other NRHP-eligible historic buildings located in downtown Metropolis, IL, and one NRHP-eligible historic district located in McCracken County also lie within 8 kilometers of

the site. The closest of these properties is the TVA Shawnee Steam Plant (also known as the Shawnee Fossil Plant), which was listed on the NRHP in August 2016 (NPS 2016). This operating facility is located on the southern bank of the Ohio River, directly opposite the MTW site 1.8 kilometers (1.1 miles) from the southern boundary of the MTW site (also the APE boundary). Also located within 8 kilometers of the MTW site are the Elijah P. Curtis House in Downtown Metropolis (NPS 1978) and the site of historic Fort Massac, just southeast of Metropolis (NPS 1971). Three NRHP-eligible historic properties lie within 8 kilometers of the MTW site, including Washington Park Band Shell and U.S. Post Office Building in Metropolis (HARGIS 2017), and the PGDP Historic District (CDM 2006).

Table 3-10 NRHP-Listed or -Eligible Properties in Proximity to the MTW Site

Properties Listed or Eligible for Listing in the NRHP	Location, Date Listed/Determined Eligible	Approximate Distance/Direction from the Honeywell MTW
Elijah P. Curtis House	Metropolis, Massac County, IL: Listed 1978	3.2 kilometers (2 miles)/ southeast
Washington Park Band Shell	Metropolis, Massac County, IL; Determined Eligible	3.2 kilometers (2 miles)/ southeast
U.S. Post Office Building	Metropolis, Massac County, IL: Determined Eligible	3.2 kilometers (2 miles)/ southeast
Fort Massac Site	Southeast of Metropolis, Massac County, IL: Listed 1971	4.9 kilometers (3 miles)/ southeast
Kincaid Mounds Site	Southeast of Brookport, Massac County, IL: Listed 1966	25.5 kilometers (15.8 miles)/ southeast
Shawnee Steam Plant	Northwest of West Paducah, McCracken County, KY: Listed 2016	1.8 kilometers (1.1 miles)/ southwest
Paducah Gaseous Diffusion Plant Historic District	West of West Paducah McCracken County, KY: Determined Eligible: 2003	7.1 kilometers (4.5 miles)/ southwest

Sources: Hargis 2017; CDE 2006

3.8.1.2 Previous Cultural Resources Surveys in the MTW Area of Potential Effect

Built in 1958, the land acquisition and initial construction of the MTW preceded historic preservation laws and implementing regulations (e.g., NEPA and NHPA). For this reason, very few cultural resources investigations have been conducted on the 405-hectare (1,000-acre) APE. Existing information reveals that less than 25 percent of the APE has been surveyed for potential archaeological and historical sites, and all previous fieldwork occurred on land west of the restricted area.

An early literature review and site file search for the Illinois portion of the Ohio River shoreline and the adjacent floodplain did not reveal any known archaeological or historic sites between Metropolis (River Mile 943) and Joppa (River Mile 951) (Muller and Davy 1977).

A 2001 cultural resource field investigation of 110 hectares (275 acres) encompassed the heavily wooded area extending from the west boundary of the restricted area to the western boundary of the site (the APE), recording five cultural resource sites in the process (Neal and Latham 2001):

(1) 11Mx283—a lithic artifact scatter of unknown prehistoric temporal association

(2) 11Mx284—a prehistoric limited activity artifact scatter of undetermined age

(3) 11Mx285—a lithic artifact scatter of unknown prehistoric temporal association

(4) 11Mx286—the remains of an early to mid-20th century farmstead and associated surface artifact scatter

(5) 11Mx287—an abandoned road grade and associated concrete bridge that appears to have been first used about 1825 and into the middle of the 20th century

Site 11Mx286 lies about 525 meters (0.33 mile) northwest of the southwest corner of the fenced restricted area, and it is the nearest to the MTW. None of the cultural resource sites documented in the 2001 survey was evaluated by the field investigators as potentially eligible for the NRHP, although SHPO concurrence with these recommendations is not finalized.

In 2010, a 20.2-hectare (50-acre) cultural resources field survey on the west side of the restricted area did not reveal prehistoric or historic archaeological or historical sites (Mayo et al. 2010, as cited in Favret 2018). Approximately the west half of this survey area overlapped with the previous 2001 field investigation. A recent archaeological literature review for the area west of the restricted area confirmed the results of the 2001 and 2010 field efforts, but it did not provide new information (Favret 2018).

3.8.2 Tribal Associations for the Metropolis Works Site

The NRC completed a cultural affiliation evaluation of the Honeywell MTW vicinity to identify present-day Tribes with specific historic association to the APE (Nickens 2018). Review of treaty/land cession information, including judicially established Indian Lands, revealed that lands in southern Illinois, north of the Ohio River, were ceded to the U.S. Government by the 1803 Treaty with the Kaskaskia Tribe, which also included the Mitchigamia, Cahokia, and Tamaroi Tribes, all members of the larger, former Illiniwek or Illinois Confederacy. Today, the descendants of these Tribes comprise the Peoria Tribe of Oklahoma. The “Jackson Purchase” of western Kentucky, containing lands south of the Ohio River, was ceded to the U.S. Government in 1818 by the Chickasaw Tribe, which today is known as the Chickasaw Nation of Oklahoma. Several other modern-day Tribes can be documented as having a less-certain traditional cultural affiliation within the Honeywell MTW APE. The cultural associations are traced through historical documentation of temporary visits or short-term occupations, to the early Fort Massac, which was controlled variously by the French, British, and American forces (1757–1814). In addition, the oral stories and traditions of many present-day Tribes memorialize their ancestors’ experiences on the earlier westward migration routes through the Lower Ohio River Valley.

Based on this evaluation of the historical information, the NRC extended consultation for the Honeywell MTW to the following Tribes (NRC 2018b, 2018e):

- Peoria Tribe of Oklahoma
- Chickasaw Nation of Oklahoma
- Absentee-Shawnee Tribe of Indians of Oklahoma
- Shawnee Tribe of Oklahoma
- Miami Tribe of Oklahoma
- Delaware Tribe of Oklahoma
- Kaw Nation of Oklahoma

- Omaha Tribe of Nebraska
- Osage Nation
- Ponca Tribe of Oklahoma
- Quapaw Tribe of Oklahoma

The NRC invited each Tribe to participate in the consultation process. Chapter 6 of this EA provides information regarding the staff's consultation with the Tribes, including responses received from the Tribes.

3.9 Scenic and Visual Resources

The area of review for the scenic and visual resources assessment is the area within an 8-kilometer (5-mile) radius of the MTW site.

Generally, the area of southern Illinois is an area of swampy, forested bottomlands and low clay and gravel hills. Away from well-traveled roadways and industrial areas such as the MTW site, the area affords pastoral viewsheds where rural residences and undeveloped agricultural land and deciduous forests are the dominant visual features.

U.S. Highway 45 and the BNSF railroad right-of-way run along the north side of the MTW site, with cropland on a small portion of site property that extends beyond the highway. The Illinois Department of Transportation has designated portions of U.S. Highway 45 as part of the Ohio River Scenic Byway, including the segment bordering the MTW site (IDOT 2017a) for its views of the Ohio River. Throughout the MTW vicinity, high-value scenic views are present along the banks of the Ohio River. For example, Fort Massac State Park, east of the city of Metropolis, offers views of the river from numerous picnic areas and pavilions.

As shown in Figure 3-6, the developed portion of the MTW site (the restricted area and surrounding cleared land) has the typical appearance of an industrial complex, with industrial/warehouse-type buildings, open-air material storage, exhaust stacks with pollution-control equipment, parking lots, railroad spurs, settling ponds, and other operational support areas. Two 2.7-meter (9-foot)-high chain-link and barbed-wire security fences, approximately 15.2 meters (50 feet) apart, surround the MTW buildings, ponds, and operational areas. The portion of the site outside of the restricted area is undeveloped and mostly forested. The site buildings are mostly low, and the tallest is the 6-story FMB. The restricted area is visible from U.S. Highway 45.

While Massac County is mainly rural, the area in the immediate vicinity of the MTW site contains substantial industrial and urban development on both sides of the Ohio River. In addition to MTW buildings, travelers on U.S. Highway 45 are likely to see the coal-fired Joppa Power Station about 9.7 kilometers (6 miles) northwest, the AEP Cook Coal Terminal immediately northwest of the MTW site, and smoke stacks from the TVA Shawnee Steam Plant across the Ohio River. The industrial area transitions into the Metropolis urban area approximately 3.2 kilometers (2 miles) southeast of the MTW site.

Figure 3-6 Aerial View of the MTW Looking to the Southwest, Across U.S. Highway 45 (Source: ENERCON 2017, Figure 3.9-1)

3.10 Socioeconomics and Environmental Justice

The area of review for the socioeconomics assessment is Massac County. The area of review for the environmental justice assessment is a 6.4-kilometer (4-mile) radius around the MTW, as described in Section 3.10.2 of this EA.

3.10.1 Socioeconomics

3.10.1.1 Demographics

The MTW site is in a predominantly undeveloped, rural region with low average population density in Massac County, IL. It is immediately across the Ohio River from McCracken County, KY. The area includes widely scattered villages and small cities. In 2010, 528,404 people lived within an 80-kilometer (50-mile) radius of the site (ENERCON 2017, Section 3.10.6). Table 3-11 depicts population trends in the area. Since the 2010 U.S. Census, the population of Massac County has decreased by an estimated 4.3 percent, with the population of the city of Metropolis decreasing by about 3.6 percent. The population of McCracken County has decreased by 0.8 percent, with the population of the city of Paducah decreasing by about 0.7 percent.

Given the request for a 40-year license period, the NRC considered population projections out to 2057. Taking into consideration projections the States of Illinois and Kentucky made, Honeywell determined that the population in Massac County, IL, would increase from 14,766 in 2015 to 15,487 people in 2057, while the population in McCracken County, KY, would increase

from 65,018 to 66,781 people over the same period (ENERCON 2017, Section 3.10.6.1). The NRC reviewed the source data and determined that Honeywell's projections are reasonable.

Table 3-12 depicts the minority populations of the area. The percentages of minority populations in Metropolis are on par with those of Massac County and lower than those of the State of Illinois. The percentages in Paducah are comparable to those in McCracken County and the State of Kentucky, except that the population of African Americans in Paducah exceeds that in McCracken County by about 13 percent and that in the State of Kentucky by about 16 percent.

Almost 73 percent of the population of 41,504 persons who live within 16 kilometers (10 miles) of the plant resides in the southeast quadrant (ENERCON 2017, Figure 3.10-1). Another 11 percent live to the southwest. These quadrants include Metropolis, IL, and Paducah, KY, and the adjacent communities. Except for these communities, the remainder of the two-county area is predominantly rural. In the 2010 U.S. Census, the census block that includes the MTW Site (Block Group 3, Census Tract 9701, Massac County, IL) reported a population of 1,204 people (MCDC 2017).

Table 3-11 Population Trends in the Area of the MTW Site

Location	Population (US Census Bureau) 2000	Population (US Census Bureau) April 1, 2010	Population Estimate (US Census Bureau) July 1, 2015	Population in 2025 (State Estimate)	Population in 2057 (Estimate)
Massac County, IL	15,161	15,429	14,766	15,438	15,487
Metropolis, IL	6,482	6,537	6,334	(a)	(a)
McCracken County, KY	65,514	65,565	65,018	65,487	66,781
Paducah, KY	26,307	25,024	24,864	(a)	(a)

a No data.
Source: USCB 2000, 2017a; IDPH 2015; KSDC 2016; ENERCON 2017, Section 3.10.6.1

Table 3-12 Minority Populations in the Area of the MTW Site

Location	White	African American	Hispanic	American Indian	Other
Illinois[a]	63%	14%	16%	0.11%	7%
Massac County, IL[a]	89%	6%	2%	0.6%	3%
Metropolis, IL[b]	86%	8%	2%	0.6%	3%
Kentucky[a]	86%	8%	3%	0.17%	3%
McCracken County, KY[a]	84%	11%	2%	0.3%	3%
Paducah, KY[b]	70%	24%	3%	0.2%	4%

a Based on Five-Year American Community Survey 2010–2014 (USCB 2014).
b As of April 1, 2010 (USCB 2017a).

There are two permanent residences and three mobile homes within 610 meters (2,000 feet) of the feed materials building. The two permanent residences are nearest to the site and are located about 538 meters (1,765 feet) north-northeast from the feed materials building (ENERCON 2017, Section 3.7).

3.10.1.2 Economics

As of February 2017, 193 employees and 105 contractor personnel were employed at the site. As stated in Chapter 1 of this EA, Honeywell is now temporarily in a "ready-idle" state, and 26 Honeywell employees will remain on site during this state (Honeywell 2018b). During full operational mode, the MTW employs 269 employees and 157 contactor personnel (Honeywell 2018a, Response to RAI SOC-1). Approximately 34 percent live in Illinois, with 27 percent in Brookport and Metropolis in Massac County. Another 62 percent live in Kentucky, with 37 percent in Paducah and West Paducah in McCracken County. The remaining 4 percent of the employees live in other states (ENERCON 2017, Section 3.10.1). The MTW's annual shutdown for routine maintenance activities typically results in an increase in contractor personnel depending on the amount of work required during the shutdown.

Table 3-13 compares employment statistics between 2010 and 2016 for Massac County and McCracken County as compared to their respective States. The labor forces and unemployment rates both decreased. The MTW accounts for less than 4 percent of employment in Massac County, and less than 0.7 percent of employment among the two counties.

Table 3-13 Employment Structure by State and County

Area	2010 Labor Force Population	2010 Number Unemployed	2010 Percent Unemployed	2016 Labor Force Population	2016 Number Unemployed	2016 Percent Unemployed
Illinois	6,645,000	675,000	10.2%	6,578,000	386,000	5.9%
Massac County	7,075	674	9.5%	6,059	427	7.0%
Kentucky	2,056,000	212,000	10.3%	2,004,000	99,000	4.9%
McCracken County	30,650	2,774	9.1%	28,851	1,632	5.7%

Sources: BLS 2010, 2016, 2017

Table 3-14 depicts the trend in median household income, and Table 3-15 shows personal income and average wages.

Table 3-14 Median Household Income in the Area of the MTW Site

Location	Median Household Income in 2010[a]	Median Household Income, 2011–2015[b]
Illinois	$55,735	$57,574
Massac County, IL	$41,077	$40,977
Metropolis, IL	$32,715	$31,875
Kentucky	$41,576	$43,740
McCracken County, KY	$41,630	$44,067
Paducah, KY	$29,275	$33,608

a In 2000 dollars. Source: USCB 2010
b In 2015 dollars. Source: USCB 2017a

Table 3-15 Personal Income in the Area of the MTW Site

Location	Per Capita Personal Income		Average Wages and Salaries	
	2010	2015	2010	2015
Illinois	$41,698	$50,377	$50,214	$57,037
Massac County, IL	$30,800	$34,828	$41,499	$50,566
Kentucky	$33,026	$38,592	$38,549	$43,108
McCracken County, KY	$37,523	$44,428	$37,708	$41,496

Sources: BEA 2016, 2017a, 2017b

Table 3-16 depicts poverty rates in the area. The percentage of low-income populations in Metropolis and Paducah exceed the corresponding percentages in their respective counties and States, but by less than 10 percent.

Table 3-16 Poverty Rates in the Area of the MTW Site

Location	% Persons in Poverty, 2015
Illinois	13.6%
Massac County, IL	16.8%
Metropolis, IL	23.0%
Kentucky	18.5%
McCracken County, KY	15.2%
Paducah, KY	23.9%

Source: USCB 2017a

3.10.1.3 Health and Social Services

The nearest school is 3 kilometers (1.87 miles) southeast; the nearest hospital is 1.5 kilometers (0.95 mile) southeast; and the nearest nursing home is 1.2 kilometers (0.73 mile) southeast to the MTW site (ENERCON 2017, Section 6.1.2.2).

In accordance with SUB-562, the MTW participates in mutual assistance agreements with State and local emergency agencies to ensure proper response in the event of an emergency at the MTW. The MTW currently has agreements with the Massac County Emergency Services and Disaster Agency, City of Metropolis Office of Emergency Management, Massac County and City of Metropolis Fire Departments, Massac County Sheriff, City of Metropolis Police Department, Massac Memorial Hospital, and Lourdes Hospital and Baptist Health Hospital in Paducah, KY (ENERCON 2017, Section 3.10.2). All parties review and renew the respective agreements annually unless specified otherwise. Under the agreements with Massac County and the City of Metropolis, Honeywell provides training to local emergency responders in general awareness and MTW-specific hazards. In return, the local emergency responders provide law enforcement, fire and emergency services, and coordination to protect public health and safety during any MTW plant emergency. Under the agreements with the hospitals, Honeywell offers training specific to the types of injuries that might occur at the MTW and assistance with chemical/radiological decontamination in the event of exposure during the treatment of an injured employee.

3.10.2 Environmental Justice

On August 24, 2004, the NRC published a final policy statement on the treatment of environmental justice matters in NRC regulatory and licensing actions (Volume 69 of the *Federal Register*, page 52040 (69 FR 52040)) (NRC 2004). The policy statement provides that one of the first steps in the environmental justice analysis is to identify the geographic area for which to obtain demographic information. Current staff guidance in NUREG-1748 (NRC 2003), which the 2004 policy statement affirms, provides that the potentially affected area is normally determined to be within a 1.0-kilometer (0.6-mile) radius of the center of the proposed site in urban areas and 6.4 kilometers (4 miles) if the facility is in a rural area. Once the potentially affected area is identified, demographic data for the area are collected from the U.S. Census Bureau at the census block group level. The goal is to evaluate the communities, neighborhoods, or areas that may be disproportionately impacted (NRC 2003).

Census data are obtained to identify both minority and low-income populations, if present, by determining the percentages of these populations within each of the census block groups. The census block percentages are compared to percentages at the county and State levels. When the minority or low-income populations in a block group exceed the State or county percentages for these groups by 20 percent, a more detailed environmental justice analysis must be conducted (NRC 2003). When the minority or low-income populations in a block group exceed 50 percent, this is also a significant difference and requires a detailed analysis (NRC 2003). When elevated percentages are not present, a detailed environmental justice review is not required.

For the purposes of this review, the NRC staff identified 12 block groups within a 6.4-kilometer (4-mile) radius of the centerpoint of the MTW site. The staff compared the relevant population, demographic, and economic data from the U.S. Census' Five-Year American Community Survey for 2011–2015 (USCB 2017b) to that for Massac County, IL; McCracken County, KY; and the States of Illinois and Kentucky, in addition to using EPA's EJSCREEN, an environmental justice mapping and screening tool (EPA 2017d). As shown in Table 3-17, none of the census block groups within 6.4 kilometers of the MTW site contains minority populations or households below the poverty level that exceed the criteria noted above. Figure 3-7 shows the location of the block groups.

Table 3-17 Comparison of Minority and Poverty Status in the Area of the MTW Site

				Difference from State Values		Difference from County Values	
Block Group ID	State	Minority (percent)	Low Income (percent)	Minority (percent)	Low Income (percent)	Minority (percent)	Low Income (percent)
171279701003	IL	13.75	12.26	-23.78	-1.19	2.89	-3.86
171279701004	IL	1.09	3.38	-36.44	-10.07	-9.77	-12.74
171279702001	IL	6.72	9.06	-30.81	-4.39	-4.14	-7.06
171279702002	IL	11.86	26.52	-25.67	13.08	1.00	10.40
171279702003	IL	4.38	13.81	-33.15	0.37	-6.48	-2.31
171279702004	IL	19.52	29.83	-18.02	16.39	8.66	13.72
171279704001	IL	19.18	33.18	-18.36	19.74	8.31	17.06
171279704002	IL	12.61	27.78	-24.93	14.33	1.74	11.66

Block Group ID	State	Minority (percent)	Low Income (percent)	Difference from State Values		Difference from County Values	
				Minority (percent)	Low Income (percent)	Minority (percent)	Low Income (percent)
171279704003	IL	9.10	7.69	-28.43	-5.75	-1.76	-8.43
Massac County	IL	10.86	16.12	(a)	(a)	(a)	(a)
State of Illinois	IL	37.53	13.44	(a)	(a)	(a)	(a)
211450314002	KY	11.17	19.24	-3.28	0.72	-4.83	2.29
211450315001	KY	7.87	10.36	-6.58	-8.16	-8.13	-6.59
211450315002	KY	15.40	19.75	0.95	1.24	-0.60	2.81
McCracken County	KY	16.00	16.94	(a)	(a)	(a)	(a)
State of Kentucky	KY	14.45	18.52	(a)	(a)	(a)	(a)

a Not applicable.
Sources: USCB 2017b; EPA 2017d

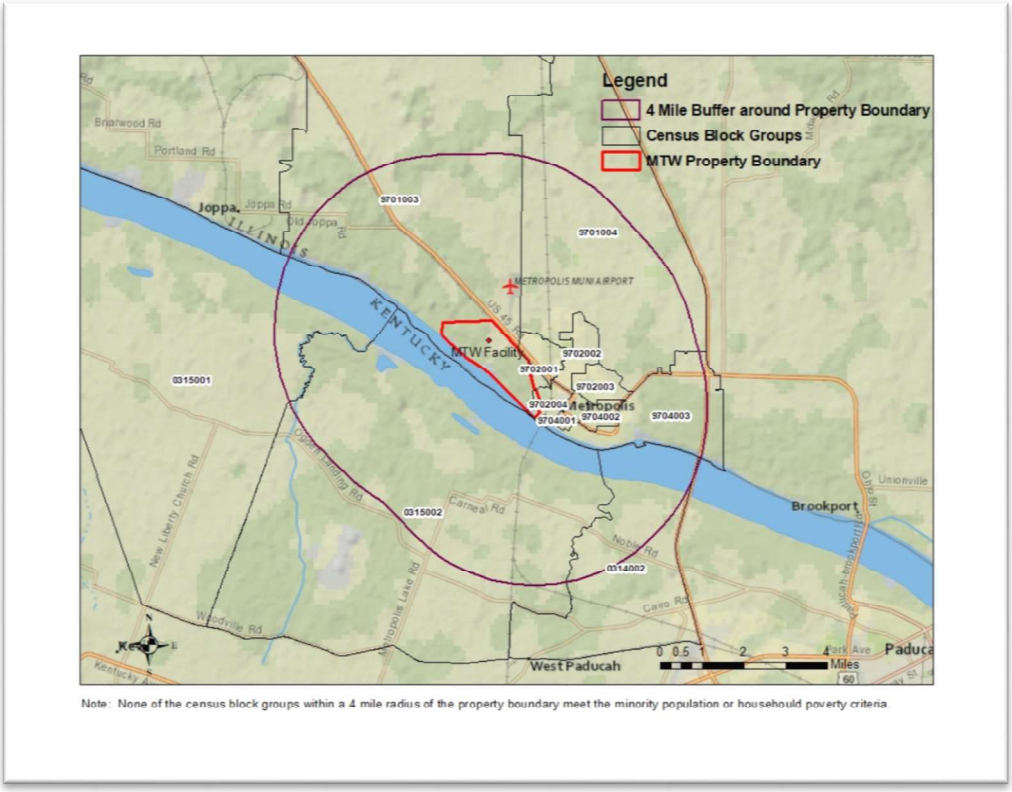

Figure 3-7 Map of Block Groups Used in the Environmental Justice Analysis (Source: EPA 2018)

3.11 Public and Occupational Health

3.11.1 Background Radiological Characteristics

The average annual radiation dose per person in the United States is 6.20 mSv (620 mrem), about half from background sources (e.g., cosmic rays and terrestrial sources) and half from manmade sources (EPA 2017e). Medical procedures account for nearly all (96 percent) of human exposure to manmade radiation (NRC 2017f). Assuming no medical exposures, a resident of Metropolis, IL, would have an estimated total yearly dose from external background radiation of 1.15 mSv (115 mrem) (EPA 2017f). Approximately 0.28 mSv (28 mrem) is attributable to cosmic rays, while terrestrial sources contribute about 0.46 mSv (46 mrem) per year. Radionuclides within the body, such as potassium, contribute about 0.4 mSv (40 mrem) per year. Massac County is in EPA Radon Zone 3, which means that predicted average indoor radon screening levels are less than 2 picocuries per liter, the lowest of the three zones (EPA 2017g). If a home had this level, this would contribute another 2.88 mSv (288 mrem) to the dose (EPA 2017f).

Activities and effluents from industrial facilities using radioactive materials would also contribute to an individual's dose. As noted in Section 3.1.2 of this EA, the area around the MTW site includes the Paducah Gaseous Diffusion Plant. Although the plant is no longer in production, it is undergoing remediation activities that involve radiological releases. For 2013, the DOE estimated a combined (internal and external) dose to the maximally exposed individual member of the public of 0.054 mSv (5.4 mrem) per year, and estimated an annual cumulative dose of 1.02 person-rem to members of the public residing within 80 kilometers (50 miles) of the plant (DOE 2016).

The background uranium concentration is 3 ppm in the soil and 0.28 ppm in vegetation (Marschke and Gorden 2019; NRC 2013a). The uranium concentrations in the Ohio River are near or below the detection limit of 0.001 ppm (Marschke and Gorden 2019).

3.11.2 Public Health and Safety

3.11.2.1 Sources of Exposure

The area within 80 kilometers (50 miles) of the MTW site is assessed for radiological impacts (dose). The regional area surrounding the MTW site that includes major population centers is assessed for nonradiological impacts.

In addition to the background radiation exposures described in Section 3.11.1, MTW employees and members of the public in the immediate vicinity of the MTW site may be exposed to low levels of radiation and radioactive materials and chemical contaminants. These contaminants are emitted because of liquid and airborne plant effluents and external gamma radiation from routine controlled releases and nonroutine releases from unplanned events over the course of plant operations and during the transportation of process materials, products, and waste materials.

Radioactive materials released from the MTW may migrate into the environment through a variety of transport pathways that could result in both internal and external exposures. Internal exposures due to atmospheric releases may occur through inhaling radioactive material dispersed in the air or by ingesting crops and animal products that encounter radioactive material deposited from the air. External exposures may occur through direct radiation from an airborne plume or from particulates deposited on the ground from the plume. For liquid releases, internal exposures may come from ingesting water or irrigated crops, while external exposures may result from recreational activities such as swimming and boating.

Fluoride releases and exposure mechanisms may occur through air and liquid emissions. For atmospheric releases, internal exposures may occur through inhalation or ingestion. For liquid releases, internal exposures may come from ingesting water or irrigated crops.

Gaseous effluent streams containing radioactive and nonradioactive pollutants are discharged in accordance with operating permits issued by IEPA (IEPA 2016a). MTW operations release small amounts of radioactive material to the atmosphere from 53 monitored release points (ENERCON 2017, Section 2.1.2.2.1). These releases are primarily uranium, although the facility also releases relatively small amounts of thorium-230 and radium-226. Fluoride is the primary nonradiological gaseous contaminant released through stacks on the FMB. Section 2.3.8 of this EA summarizes MTW emissions.

The MTW is subject to its NPDES permit (IEPA 2015a) for liquid releases. Treated wastewaters discharge to the Ohio River via one monitored release point, NPDES Outfall 002. Two other NPDES outfalls discharge stormwater to the Ohio River. Liquid waste streams generated at the MTW are categorized as low-level radioactive and nonradioactive waste streams. Before discharge into the Ohio River, both radioactive and nonradioactive waste from MTW operations are processed through the EPF. Table 2-4 in Chapter 2 of this EA summarizes data for flow rate, uranium, pH, temperature, total fluorides, total suspended solids, and biological oxygen demand for the years 2010 through 2014.

In addition to the air permit and NPDES permit requirements, radiological emissions must meet the NRC radiological dose limits in 10 CFR Part 20 for occupational and public exposures. Exposure limits include a limit of 0.05 Sv (5 rem) per year for an occupational worker and 1 mSv (100 mrem) per year to a member of the public. Honeywell must also meet EPA exposure limits in 40 CFR Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations,” Subpart B, “Environmental Standards for the Uranium Fuel Cycle,” which specifies an annual whole-body dose equivalent limit of 0.25 mSv (25 mrem).

3.11.2.2 Current Exposure Levels

Honeywell implements an environmental monitoring program that involves the periodic collection of air, surface water, bottom sediments, vegetation, soil, and external gamma radiation samples at onsite and offsite sampling points. Section 2.3.9.2 of this EA presents sampling results representative of the years 2010 through 2014 for each of these areas.

3.11.3 Occupational Health and Safety

MTW workers have occupational health and safety risks from exposure to industrial hazards, hazardous materials, and radioactive materials. Industrial hazards at the MTW are similar to other industrial facilities of the same size; that is, chemical exposures, heavy-machinery accidents, crush injuries, and cuts and abrasions. These hazards apply to workers conducting material processing operations as well as monitoring, research, general office, and industrial site activities. The chemical manufacturing sector had an injury and illness rate of 2.0 per 100 full-time workers in 2016 (BLS 2018). Honeywell seeks to limit these risks by implementing safety programs that meet Occupational Safety and Health Administration requirements, such as those promulgated in the Occupational Safety and Health Act of 1970, Section 5(a)(1) and Section 5(a)(2), and corporate standards (ENERCON 2017, Section 4.12). The MTW programs use the Occupational Safety and Health Administration recordable incident rate to measure and compare work injuries, illnesses, and accidents within and between industries. The MTW has

had no work-related fatalities, and it had an average recordable injury rate of 2.5 per year for the years 2010 through 2014 (ENERCON 2017, Section 3.11.5).

Operations at the MTW use nonradiological materials that could pose a risk to worker health and safety through chronic exposure or improper handling. Table 3-5 in Section 3.2.2 of this EA provides the list of hazardous chemicals used in operations and the hazard information associated with these chemicals. Plant employees could experience chemical exposures through routine exposures from controlled system drainage, venting, and leakage points and nonroutine exposures resulting from unplanned excursions. Honeywell implements a process safety management program, consistent with 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals," to provide a comprehensive assessment of chemical safety hazards and specific processes and programs to mitigate them (ENERCON 2017, Section 4.12).

MTW workers may be exposed under the following conditions: (1) external radiation exposure from working close to natural uranium, its daughter products, and other licensed materials in storage and in the plant process and (2) internal exposures resulting from inhalation or ingestion of radioactive process materials. Radiation exposure from normal operations is primarily a result of inhaled radioactive material during the uranium conversion process. Honeywell maintains a radiation protection program in accordance with 10 CFR Part 20 to ensure that radiation doses are below NRC limits and meet ALARA principles. Historical data and plant operating experience indicate that employees are unlikely to receive an annual total effective dose equivalent (TEDE) of more than 50 mSv (5,000 mrem). MTW employees working in the ore concentrate sampling plant, or other jobs where close contact with uranium or its daughter products occur, such as in the FMB, are most likely to receive higher than average exposures (NRC 2006a; Honeywell 2018a, Response to RAI POH-1).

Table 3-18 provides the average and the maximum occupational doses (i.e., TEDE) for the years 2010 through 2014 for monitored workers at the site (Honeywell 2018a, Response to RAI POH-1). For the 5-year period from 2010 through 2014, the average TEDE for MTW workers was less than 1.27 mSv (127 mrem). The maximum individual TEDE for the workers averaged 0.01477 Sv (1.477 rem), peaking at 0.02459 Sv (2.459 rem) in 2011.

Table 3-18 Monitored Occupational Exposure Doses

Year	Average Individual Occupational Dose in TEDE Sv (rem)	Maximum Individual Occupational Dose in TEDE Sv (rem)
2010	0.00155 (0.155)	0.01642 (1.642)
2011	0.00228 (0.228)	0.02459 (2.459)
2012	0.00131 (0.131)	0.01827 (1.827)
2013	0.00057 (0.057)	0.00866 (0.866)
2014	0.00062 (0.062)	0.00591 (0.591)
10 CFR 20.1201(a)(1)(i)	0.05 (5)	0.05 (5)

Source: ENERCON 2017, Table 3.11-1

3.12 Waste Management

The area of review for the waste management assessment is the MTW site. Current MTW operations produce low-level radioactive, nonradioactive hazardous, mixed, and nonradioactive liquid and solid wastes. The facility manages these wastes by using a combination of recycling

and offsite disposal. Two byproduct streams, synthetic fluorspar (calcium fluoride) and filter fines, are sent off site for reclamation and reuse and are not considered waste streams (ENERCON 2017, Section 3.12).

3.12.1 Low-Level Radioactive Waste

Low-level radioactive solid waste consists of items contaminated with uranium residuals. Such items include environmental control filters, maintenance and housekeeping wastes, personal protective equipment, and equipment removed from service. MTW personnel collect this dry active waste and debris waste in marked containers; segregate the containers by radioactivity, drum, or bag; and finally ship the waste containers to a permitted disposal facility. Drums that held uranium feedstock and process intermediates are crushed and shipped off site for disposal. Approximately 1,529 cubic meters (2,000 cubic yards) of crushed drums were shipped off site for disposal for the years 2010 through 2014 (ENERCON 2017, Section 3.12.1).

Table 3-19 shows the volume of low-level radioactive waste generated at the MTW for the years 2010 to 2016. The plant was shut down to complete seismic upgrades from 2012 to 2013, which explains the low generation rates of low-level radioactive waste and other wastes during this period (Honeywell 2018a, Response to RAI WM-1).

Table 3-19 Low-Level Radioactive Waste Annual Generation Rate

Year	Cubic meters (cubic yards)
2010	3,644.37 (4,766.66)
2011	3,256.44 (4,259.26)
2012	991.09 (1,296.30)
2013	184.37 (241.15)
2014	1,070.1 (1,399.7)
2015	3,610.4 (4722.1)
2016	4,001 (5,233)

Sources: ENERCON 2017; Honeywell 2018a

Honeywell currently ships its unimportant source quantity waste to the U.S. Ecology facility in Grandview, ID, for disposal. The U.S. Ecology facility holds a RCRA Part B permit and is permitted to accept waste that includes residuals of source material in permitted levels. Two other NRC-licensed facilities are available to receive this waste: Waste Control Specialists, LLC, near Andrews, TX, and Energy*Solutions* near Clive, UT (ENERCON 2017, Section 3.12.1).

3.12.2 Mixed Waste

The MTW manufacturing process does not generate mixed waste (waste that contains both RCRA hazardous waste and radioactive constituents) but does produce some incidental mixed waste streams as part of laboratory and maintenance activities. The MTW stores mixed waste is in two RCRA-permitted storage facilities. Typical mixed wastes include items such as radiologically contaminated xylene paint thinner; used lubricating oils and waste naphtha from maintenance or cleaning activities; and waste acetone, tributyl phosphate, and Freon. About 6,350 kilograms (14,000 pounds) of mixed waste was shipped off site in 2013, with 18 containers remaining in storage in 2014. There were no mixed wastes shipped off site during 2015 and 2016. MTW does not expect any projects that might cause a large increase in mixed waste generation (Honeywell 2018a, Response to RAI WM-2).

Mixed waste is currently disposed of at the Waste Control Specialists facility in Andrews County, TX, or the Energy*Solutions* disposal facility near Clive, UT (ENERCON 2017, Section 3.12.4).

3.12.3 Hazardous Waste

MTW is a large-quantity generator (RCRA ID ILD006278170) of RCRA hazardous waste. Management of RCRA waste at MTW is regulated by IEPA through a RCRA permit (Permit #B-65R2-M-17). Facilities under the RCRA permit include two storage areas. One of these areas is for the storage of containerized hazardous waste in two storage buildings. The other area consists of surface impoundments (known as calcium fluoride Ponds B, C, D, and E) that were used for the storage of calcium fluoride-contaminated liquid waste. Sources of hazardous waste include production activities, EPF residuals, and laboratory and maintenance activities.

About 5,900 to 12,000 kilograms (13,000 to 27,000 pounds) of RCRA hazardous waste was generated annually between 2010 and 2014. These quantities are not indicative of normal operations because they were the result of housecleaning efforts during plant shutdown from 2010 to 2012. Approximately 5,580 kilograms (12,275 pounds) of hazardous waste were shipped during calendar year 2015 and 4,500 kilograms (9,900 pounds) were shipped during calendar year 2016. These quantities are representative of the annual hazardous waste generation in the future. MTW does not have plans for projects that generate a large increase in hazardous waste (Honeywell 2018a, Response to RAI WM-3).

3.12.4 Nonradioactive, Nonhazardous Waste

Nonradioactive, nonhazardous waste generated at the MTW includes cleaning compounds, antifreeze, floorsweep, compressed gases, and miscellaneous trash. Personnel collect these items in roll-off containers and frontload dumpsters and send them off site for disposal or recycling. In 2014, the MTW generated about 3,901 kilograms (8,600 pounds) of universal waste (hazardous but common waste such as batteries or light bulbs), 54,431 kilograms (120,000 pounds) of nonhazardous waste, and 171 metric tons (188 tons) of debris or trash (ENERCON 2017, Section 3.12.2). The site collects office waste in four dumpsters with 2-cubic-yard capacity and two dumpsters with 8-cubic-yard capacity; these are removed off site once to twice weekly. In 2014, the MTW also generated about 526 metric tons (580 U.S. tons) of soil from nonroutine remediation activities.

Two byproduct streams that are not waste include synthetic calcium fluoride and filter fines. These two waste streams are transported off site for reclamation and reuse. Synthetic calcium fluoride is shipped to industrial users who use it as a substitute for natural calcium fluoride (fluorspar). Filter fines are shipped off site for recovery of uranium, which is returned to the MTW for re-introduction into the manufacturing process.

In 2014, the MTW used Clean Harbors (various locations), Safety-Kleen (various locations), and Spring Grove Resource Recovery in Ohio for recycling and disposal, and the Southern Illinois Regional Landfill for the soil disposal. As of 2015, the Southern Illinois Regional Landfill had a remaining disposal capacity of 30 million cubic meters (39 million cubic yards) (ENERCON 2017, Section 3.12.2).

4 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter evaluates the potential environmental impacts from the proposed action to continue MTW site activities for 40 years (Section 4.1) and from the reasonable alternatives to the proposed action; that is, the reduced duration alternative (Section 4.2) and no-action alternative (Section 4.3). In performing this evaluation, the NRC staff reviewed Honeywell's license renewal application and ER (ENERCON 2017); collected information from local, State, and Federal agencies; and then independently evaluated the environmental impacts to the various resources of the affected environment (as described in Chapter 3 of this EA), in accordance with NUREG-1748 (NRC 2003). The analysis of potential environmental impacts is based on the following: (1) Honeywell's forecast of activities over the proposed 40 years and (2) data that reflect current site conditions, activities, and effluent levels.

Most of the impacts associated with the proposed action are expressed as annual impacts. The annual impacts are not expected to change if MTW operates for fewer years, as proposed in the reduced duration alternative. Because the impacts from the proposed action would be similar to or greater than the impacts from the reduced duration alternative, this EA does not separately address each resource area evaluated in the EA for the reduced duration alternative.

Regardless of which alternative the NRC adopts, 10 CFR 70.38, "Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas," requires that Honeywell submit a detailed site decommissioning plan when operational activities at the MTW are terminated, unless Honeywell applies for an additional licensing term. Facility decommissioning of the MTW would begin upon the NRC's approval of that plan. The NRC's review of the proposed site decommissioning plan will address public health and safety and the environmental impacts. The decommissioning process is described in Section 2.4 of this EA. Section 4.4 evaluates potential impacts from site decommissioning for the proposed action and the alternatives to the proposed action.

The NRC also evaluated the cumulative environmental impacts; that is, potential impacts that result when the incremental impacts of the proposed action and alternatives are considered together with the impacts of other past, present, and reasonably foreseeable future actions. This analysis of cumulative impacts is discussed in Chapter 5 of this EA.

4.1 Proposed Action

4.1.1 Land Use

As discussed in Section 3.1.2 of this EA, land uses in Massac County are predominantly pasture, cropland, and forestland. Undeveloped land uses within a 3.2-kilometer (2-mile) radius of the MTW site are generally forest, planted and cultivated areas, and open water, which combined cover 72 percent of the area.

Continued MTW operations for the proposed duration of 40 years would not involve major construction or expansion of the facility such that additional acreage would be needed. Land use impacts from the continued operation of the MTW would be consistent with its current land use. The NRC concludes that the proposed action would have no significant impacts on the environment of the MTW site and the areas surrounding the site.

4.1.2 Transportation

The transportation impacts analysis in the proposed license renewal (ENERCON 2017) considers the impacts to local traffic and the nonradiological and radiological public and occupational safety impacts from incident-free transportation and from potential transportation accidents. Under the proposed action, Honeywell would continue converting uranium ore concentrates to gaseous fluorine and uranium hexafluoride at the authorized capacity of 15,000 metric tons (16,535 tons). The uranium hexafluoride would continue to be shipped to enrichment facilities for further processing into enriched uranium. Therefore, the transportation activities associated with the proposed action are expected to be similar to typical transportation activities occurring during the current license period.

4.1.2.1 Traffic Volume

To evaluate the impacts of the proposed transportation on local traffic, the NRC staff compared the magnitude of proposed transportation activities with the existing traffic volumes near the site shown in Tables 3-2 and 3-3. In February 2016, MTW employed 237 people (ENERCON 2017, Section 3.10.1). The employees residing in Kentucky, Metropolis, and Brookport, a total of 89 percent, or 211 employees, commuted to MTW via U.S. Highway 45 northbound when arriving and southbound when leaving. The number of employee trips are small compared to the traffic counts on these highways, as shown in Table 3-2 in Chapter 3 of this EA, consisting of less than 10 percent of the daily directional traffic. The proposed action would not increase traffic volumes; therefore, continued MTW operations would have no significant impact to local roadways in the area of review.

4.1.2.2 Nonradiological Impacts from Traffic Accidents

Honeywell estimated commuting mileage based on employee resident zip code groupings and used information from Table 3-3 in Chapter 3 of this EA to estimate annual commuting mileage for truck and rail transportation. Table 4-1 presents the estimated mileage and potential fatalities based on 2015 national fatality rates of 1.1 fatalities per 100 million vehicle miles in 2015 (car and truck) (BTS 2017) and 1.01 fatalities per million train miles (FRA 2018).

Table 4-1 Estimated Highway and Rail Fatalities

Parameter	Annual Mileage (km (mi))[b]	Annual Risk of Fatalities
Commuting plus truck shipment for MTW[a]	6,300,000 (3,900,000)	0.043
Rail shipment for MTW	497,000 (309,000)	0.003[c]

a Commuting: 3,170,000 kilometers (1,970,000 miles); truck shipment: 3,106,000 kilometers (1,930,000 miles).
b Mileage is from Honeywell 2018a, Table 4.2-2.
c Statistics for the total fatalities and mileage from FRA 2018 are for trains and were used to determine fatalities per train-mile. This value was multiplied by the number of miles specific to MTW shipments (see footnote b). To assign a probability of a fatality to a single railcar-mile, the analysis assumed 105 railcars per train, so the risk associated with a train was divided by 105 railcars. This approach assumes that shipments to and from the MTW are normally made by one or two railcars at a time, and a whole train dedicated to these shipments is not used.
km = kilometer; mi = mile

Because the magnitude of transportation activities associated with the proposed action is a small fraction of existing traffic for local roads, the current impacts are not projected to change, and the estimated number of annual fatalities would continue to be much less than 1, the NRC staff concludes the MTW impact to local traffic would not be significant. Furthermore, because Honeywell is not proposing major changes to the current operating license, the local transportation impacts in the area of review would represent a continuation of existing levels of traffic.

4.1.2.3 Radiological and Chemical Hazards from Traffic Accidents

Radiological Transportation Hazards from Traffic Accidents

The NRC evaluated the potential impacts of transporting radioactive materials and documented its findings in NUREG-0170 "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes" issued December 1977 (NRC 1977). That analysis concluded that "the average radiation dose to the population at risk from normal transportation is a small fraction of the limits recommended for members of the public from all sources of radiation other than natural and medical sources and is a small fraction of natural background dose" (NRC 1977). This earlier environmental analysis considered the types of activities conducted at the MTW, including the receipt of yellowcake and shipment of uranium hexafluoride. In addition, there have been no significant changes in MTW transportation types, rates, or routes since that evaluation. Thus, the conclusion remains valid for the proposed action.

More recently, the NRC evaluated the radiological impacts of an accident related to transporting yellowcake to the MTW from uranium recovery facilities (NRC 2009a, Section 4.2.2.2). That analysis showed an accident dose risk of up to 0.01 latent cancer fatality per year for transporting yellowcake to the MTW from a generic in situ recovery facility.

Two incidents have occurred since 2010 related to the transport of radiological materials to and from the MTW. On September 20, 2015, the engine of a uranium ore truck caught fire outside the MTW restricted area fence, but the payload of uranium ore drums was not compromised. Massac County and Metropolis City fire departments responded and extinguished the fire (Honeywell 2018a, RAI Response TRN-1). In a second incident, on January 12, 2017, Energy Fuels, Inc. notified Honeywell that a drum of calcined-recovered ore leaked about 0.9 kilogram (2 pounds) of material while in transit to its receiving facility, contaminating the floor of the trailer. Energy Fuels, Inc., the receiving operator, performed the cleanup and decontamination. The NRC issued a notice of violation and Honeywell implemented corrective actions to prevent reoccurrence (NRC 2017c). The NRC concluded that there was reasonable assurance that the leak did not result in significant safety consequences to the public.

Safety controls and compliance with existing transportation regulations in 10 CFR Part 71, "Packaging and Transportation of Radioactive Material," add confidence that radiological materials and wastes can be shipped safely with a low potential of affecting the environment and human health. For example, transport drums must meet specifications of 49 CFR Part 173, "Shippers—General Requirements for Shipments and Packagings," which is incorporated in NRC regulations at 10 CFR Part 71.

Based on the two aforementioned reports and regulatory controls in place for transporting radiological materials, the NRC concludes that transportation of these materials to and from the MTW under the proposed action would not cause significant environmental impacts.

Chemical Transportation Hazards from Traffic Accidents

The process chemicals used for MTW operations involve inhalation and contact hazards for persons exposed during a transportation accident that involves a release of the material. The consequences are dependent on the release quantity, meteorological conditions that could spread contamination or promote reactivity, and the location of the accident in relation to human population. Table 2-1 in Chapter 2 of this EA lists the industrial chemicals used at the MTW, and Table 3-5 in Chapter 3 of this EA shows the hazard information for these chemicals. Based on the table of reportable quantities (49 CFR 172.101, "Purpose and Use of Hazardous Materials Table," Appendix A), the transport of hydrogen fluoride would present the greatest hazard in the event of a release. In a DOE analysis (DOE 2004a, Section 5.2.3.3), DOE determined that releases of hydrogen fluoride in quantities typically transported by truck or rail could result in upwards of 3,000 permanent health effects (in an urban setting). The transport of anhydrous hydrogen fluoride, with its greater concentration, would involve greater consequences; however, the probability of such accidents is very low for both truck and rail shipments (MTW would receive shipments of anhydrous hydrogen fluoride by rail (Honeywell 2018a, Response to RAI TRN-1)). According to Honeywell, the estimated mileage for transport of hydrogen fluoride over the proposed 40-year license renewal term is approximately 3,376,000 kilometers (2,110,000 miles), which is less than what DOE analyzed—4,800,000 kilometers (3,000,000 miles).

In addition, compliance with NRC and U.S. Department of Transportation packaging and transportation regulations (10 CFR Part 71 and 49 CFR Parts 100–199) provides protection for workers and the public from exposure to unsafe levels of radiation during transport and limits the potential for releases of hazardous and radioactive materials during transportation accidents. These regulations address a variety of factors related to safety, including packaging design and content limitations, labeling, signage (placarding), driver qualifications, routing, incident reporting, and emergency preparedness. Roles and responsibilities of shippers, carriers, emergency responders, and applicable State and Federal agencies are established in these regulations or by other coordination actions to ensure prompt response and support is provided for incidents involving releases of hazardous (including radioactive) materials during transport. MTW has procedures in place that govern the packaging, loading, and inspection of shipping containers and loads prior to shipment. MTW also uses dedicated railcars and trailers for much of the shipping (Honeywell 2018a, Response to RAI TRN-1).

Based on the low probability of an accident and the regulatory framework and shipping practices related to the transport of hazardous materials, the NRC staff concludes that the potential impacts from the transport of hazardous materials under the proposed action would not cause significant environmental impacts.

4.1.3 Geology and Soils

The proposed action involves continuing operations with minor modifications to existing onsite systems, as described in Section 2.2 of this EA. Such system modification would not have a significant impact to geological features, including soil compaction, soil erosion, subsidence, landslides, or disruption of natural drainage patterns. Honeywell has addressed or is addressing limited contamination associated with the calcium fluoride ponds, process sewers, chlorinated solvent and arsenic area, landfill, and Old Creosoter areas with regulatory oversight from the IEPA, as described in Section 2.3.9 of this EA. Section 4.1.4.2 of this EA discusses the potential impacts in these contaminated areas.

The NRC staff reviewed soil sampling results for uranium taken at the nearest residence for the years 2006 through 2018 (Marschke and Gorden 2019). The peak values of uranium in soil at the nearest residence during those years are about 6 times greater than naturally occurring soil uranium concentrations, and the mean value during the same period is about 3 times greater than naturally occurring soil uranium concentrations. Because of the variability in the data, the NRC staff could not identify statistically significant increasing or decreasing trends at the nearest residence. In addition, the NRC staff could not correlate the variation in measured soil concentrations to air emissions from the MTW site. The increase in uranium soil concentration in 2015 at the nearest residence could be the result of an unplanned release of uranium hexafluoride that occurred on October 26, 2014. The NRC staff concluded as a result of an NRC inspection that this release posed no safety hazard requiring response to protect the public (NRC 2015c).

The NRC staff also reviewed soil sample results for uranium taken at the offsite locations shown in Figure 2-5 of this EA for the years 1999 through 2018 (Marschke and Gorden 2019). The NRC staff could not identify statistically significant increasing or decreasing trends at the offsite locations because of the variability in the data at each of the offsite locations. In addition, the NRC staff could not correlate the variation in measured soil concentrations to air emissions from the MTW site or to meteorological patterns. Section 4.1.11.1 of this EA describes the estimated radiation dose to the population surrounding the MTW site (collective dose). The NRC concludes that the proposed action would not have a significant impact on geology and soils in the area of review. This conclusion is based on the absence of new construction, the implementation of spill prevention and cleanup procedures, in conjunction with the use of monitoring wells, and active IEPA oversight. Honeywell complies with RCRA requirements in treating contamination from past operations and implements the protective measures stipulated in the ELUC. The NRC expects that Honeywell would promptly investigate and, if necessary, remediate any future releases of contaminants.

Seismicity

As discussed in Section 3.3.3 of this EA, the MTW site is in a region of recognized seismic activity caused by the NMSZ. Major historic earthquakes felt in this area were from the 1811–1812 New Madrid earthquakes, whose epicenter was approximately 97 kilometers (60 miles) southwest of the MTW site. The strongest of these earthquakes is estimated to have produced a Modified Mercalli Intensity IX earthquake (i.e., a seismic event capable of causing considerable damage to well-built buildings, breaking some underground pipes, and causing serious damage to reservoirs) at Metropolis. The effect of another seismic event similar to the 1811–1812 earthquakes could potentially result in damage to MTW buildings, containments, and piping with possible releases of uranium hexafluoride. The return period for an earthquake on the NMSZ could be as low as 475 years (Pezeshk 2004).

Honeywell has implemented several upgrades and modifications to the process facilities and site infrastructure since 2006, when the last license renewal EA was published, as described in Section 2.2 of this EA. These upgrades and modifications include seismic and tornado protection upgrades that were completed in 2013 (ENERCON 2017, Section 1.1). In its safety evaluation of these upgrades, the NRC concluded with reasonable assurance that the FMB structure that houses equipment and piping that contain uranium hexafluoride would not sustain damage leading to significant releases of uranium hexafluoride from facilities, equipment, or piping for up to a 1,700-year return period earthquake (NRC 2013b, 2014a).

The NRC concludes that the risk of significant environmental impacts from a seismic or tornado event is minimized because of the upgrades made at the MTW, as described above.

4.1.4 Water Resources

4.1.4.1 Surface Water and Sediments

Liquid waste streams generated at MTW are categorized as low-level radioactive and nonradioactive waste streams. Section 2.3.8 of this EA discusses these waste streams. Each of the waste streams is recycled or treated separately. IEPA has permitted three NPDES outfalls (Outfalls 002, 003, and 005) for Honeywell's use. Stormwater from the site is discharged to the Ohio River from Outfalls 003 and 005. Stormwater from the restricted area, wastewater generated during the closure of the calcium fluoride ponds, and uranium hexafluoride process-related treated liquid effluents are discharged through Outfall 002 into the Ohio River. The liquid effluent discharge rate from Outfall 002 averaged 0.12 m^3/s (4.18 ft^3/s) for the years 2010 through 2014 (see Table 2-4 in Chapter 2 of this EA). This discharge rate is significantly below the annual average flow rate of the Ohio River of 7,915 m^3/s (279,501 ft^3/s) (USGS 2017c). The NRC does not anticipate that the liquid effluent discharge would have a significant impact on the flow rate for the Ohio River.

As discussed in Section 3.4.1 of this EA, the MTW does not use surface water as a source of potable water or process water, and the onsite intermittent creeks are not used for fishing, recreation, irrigation, or other agricultural uses. The nearest public drinking water intake is located at Paducah, KY, about 17.7 kilometers (11 miles) upstream. The nearest downstream public drinking water intake is in Cairo, IL, about 51 kilometers (32 miles) from the MTW site. The groundwater wells will continue to provide process and potable water for the facility under the proposed action.

Nearby industrial facilities use the Ohio River primarily for effluent discharge, cooling water makeup discharge, or both. The nearest downstream city, Joppa, IL, located approximately 12.9 kilometers (8 miles) to the northwest, does not use the Ohio River for drinking water supply (ENERCON 2017, Section 4.4.2). The volumetric water discharges from the MTW represent only 0.0015 percent of the average river flows. Accounting for this small quantity, the distance (51 kilometers (32 miles)) to the nearest public water supply intake, and plant's compliance with the NPDES permit, the NRC staff concludes that potential impacts to water ingestion receptors from activities associated with the MTW under the proposed action would not be significant.

Based on the data in Table 2-6 in Chapter 2 of this EA, the uranium and fluoride concentrations in surface waters are higher for the MTW outflow location than for the upstream and downstream sample locations in all years. Dissolved uranium concentrations in the Ohio River above and below the MTW outflow were below the detection limit for the years 2010 through 2014. Fluoride concentrations were variable at each river sampling location, based on data in Table 2-6.

The sediment sampling data in Table 2-7 in Chapter 2 of this EA indicate an apparent increasing trend in the uranium concentrations in sediments in the Ohio River, at Outfall 002, and offsite lakes. These concentrations, however, consistently measure less than 3 ppm (the soil background concentration for uranium) except at Outfall 002. At Outfall 002, measured uranium concentrations sediment peaked at 23.75 ppm and then dropped to 2.3 ppm by 2014. Data on fluoride concentrations taken from the same locations show an overall decreasing trend in fluoride concentrations. Regarding the channel leading to Outfall 002, Table 2-7 documents

the increase in uranium and fluoride concentrations in suspended solids identified in 2013 for both the 213- and 427-meter (700- and 1,400-foot) sample locations. A related study of soils in and along the channel (ENERCON 2010) assumed that the entire length of the channel to the Ohio River is impacted by overflows of the site ponds during high precipitation storm events. The recent improvements in the wastewater treatment system at MTW have led to decreased runoff from the pond areas into Outfall 002 and the Ohio River. Therefore, the NRC concludes that discharges from Outfall 002 during the renewal period would not significantly impact the surface water quality of the Ohio River.

Surface-water quality is protected by Honeywell's adherence to release limits and monitoring programs required under the NPDES permit. Current effluent quality characteristics are within permit limitations. Recent facility upgrades at the EPF have further reduced fluoride discharge amounts into the Ohio River and reduced associated impacts to the river. Therefore, the NRC staff does not expect that the infrequent and limited exceedances of NPDES permit limits would have a significant impact on the surface-water quality of the Ohio River.

The NRC concludes that the proposed continued operations at MTW would not have a significant impact on surface-water resources in the area under review. Specifically, no significant impacts are anticipated due to the following: (1) the small volume of discharge relative to the volume of water in the Ohio River, (2) the minimal downstream water intakes, (3) Honeywell's compliance with the NPDES permit, and (4) the oversight and enforcement authority of the IEPA under the NPDES permit. In addition, Honeywell is required to address uranium contamination as part of decommissioning. While uranium deposition in sediments in the Outfall 002 channel likely would continue, the impact of uranium deposition in sediments would not be significant or permanent because they would be removed during decommissioning.

4.1.4.2 Groundwater

The groundwater quality at the site is monitored by means of four groundwater contaminant monitoring programs. The monitoring programs require mitigative actions when elevated contaminant levels are identified. The programs are described in Section 2.3.9.2 of this EA. A summary of ongoing activities under the monitoring programs and actions to inspect the process sewers follows:

- The sanitary well monitoring program, described in Section 2.3.9.2, samples groundwater from the deep Mississippian limestone aquifer. Results from the monitoring program show compliance with Illinois Department of Health drinking water standards (35 IAC 611 Subtitle F; ENERCON 2017, Section 3.4.8.1).

- The RCRA surface impoundment liner leakage monitoring program for the calcium fluoride ponds identifies leakage through the pond impoundment liners (see Section 2.3.9.2 of this EA). The program also specifies corrective actions to be taken before leakage impacts groundwater. The early leakage notification system that is part of the groundwater monitoring network limits potential groundwater impacts from the calcium fluoride ponds. Remediation of leaks in response to the monitoring would localize and limit contamination.

- Section 2.3.9.2 of this EA states that Honeywell is investigating the condition of its underground process sewers and structures under its RCRA permit. Honeywell identified two areas where contaminants appear to have migrated out of the

underground process sewers. Honeywell worked with IEPA to identify the extent and significance of potential releases. The IEPA reviewed Honeywell's remedial actions, the results of the well monitoring, and the results of the soil investigation and closed its investigations of the two AOCs (IEPA 2018b). Honeywell continues to inspect the remaining process sewers at the plant and reports to the IEPA annually on the progress of the investigations (see Section 2.3.9.2 of this EA) (NRC 2018c). IEPA will require institutional controls for this area. The NRC concludes that no significant impacts on groundwater from past process sewer leaks are anticipated in the area under review. The NRC bases its finding on the following: (1) the low contamination levels, (2) the localized nature of contamination, and (3) the remediation measures already implemented by Honeywell.

- Honeywell monitors groundwater around the inactive historic landfill. Honeywell is working with IEPA to assess the status of the landfill. The IEPA will determine whether additional investigations and remediation actions are required.

- Honeywell monitors groundwater in the Old Creosoter Area. Remedial actions in that area (excavation and capping) have been completed, with only administrative controls left to finalize, such as the delineation of an ELUC (NRC 2018c).

The upper surface elevation of the Metropolis Formation lies 15 meters (50 feet) below the land surface (see Section 3.4.2 of this EA). The Metropolis Formation does not provide drinking water within or downgradient of the MTW. This formation provides water to a very limited number of domestic wells, which are upgradient and east of the site (see Nelson et al. 2002). The Mississippian Salem Limestone is the principal source of groundwater for industrial, utility, and municipal water use, and it underlies the MTW site at depths from 85 to 150 meters (280 to 500 feet). The great depth of the aquifer and the low permeability clays in the overlying McNairy and Post Creek Formations are expected to prevent contamination from migrating from MTW and contaminating groundwater. The monitoring of the limestone wells and IEPA's regulatory oversight provide additional protection of the aquifer.

The NRC staff concludes that groundwater impacts in the area of review would not be significant due to the localized effects of subsurface contamination from past events and the depth to groundwater resources.

4.1.5 Ecology

As noted in Section 3.5 of this EA, MTW operations all take place within a single restricted area, which covers about 5 percent of the license area. Site workers cleared the restricted area of all vegetation to construct buildings, settling ponds, and other MTW-related facilities. The remaining 95 percent of the property remains mostly undeveloped. Therefore, the descriptions of ecological resources in this section refer to just those in the unrestricted portion of the site, except for the approximately 40.5 hectares (100 acres) of cropland north of U.S. Highway 45.

4.1.5.1 Terrestrial

Minimal terrestrial resources impacts are expected from continued plant operation because no major expansion of existing facilities will take place.

The primary potential impact on the terrestrial resources as part of continued operations would be from the nonradiological constituents released to the environment. The NRC previously

examined the effects of these releases (NRC 1995, 2006a) in reviewing previous Honeywell license renewal applications and concluded that continued operation of the facility would not result in significant adverse impacts on terrestrial biota or people near the facility. Fluoride concentrations in the air, soil, and vegetation off site would be below levels that would result in adverse effects. As discussed in Sections 4.1.3, and 4.1.6 of this EA, degradation in offsite soil, air, or vegetation from fluoride has not occurred since the previous assessments were completed. Furthermore, the expected releases during the next 40 years would be the same as under current operations. Therefore, the proposed action is expected to result in minimal adverse impacts to the offsite environment. The USFWS concurred that the proposed license renewal is not likely to adversely affect wildlife resources (USFWS 2018d).

The NRC staff reviewed soil and vegetation sampling results for uranium and fluoride taken at offsite locations, shown in Figure 2-5 of this EA, for the years 2000 through 2018 (Marschke and Gorden 2019). Uranium concentrations in soils do not appear to correlate with either MTW effluents or meteorological conditions. In addition, the NRC staff observed that the time of occurrence of spikes in soil uranium concentration data at the offsite locations is typically 2 to 3 years before the occurrence of spikes in vegetation uranium samples. Based on this observation, the staff concludes that it could take 2 to 3 years for vegetation to absorb uranium from soil. Section 4.1.11.1 of this EA describes the estimated radiation dose at the nearest residence from all pathways.

Measured fluoride concentrations in vegetation at offsite locations demonstrate that the MTW is a small contributor to air emissions of fluoride in the area when compared to fluoride emissions from two nearby power plants. Therefore, the NRC staff finds that fluoride concentrations in vegetation cannot be clearly associated with MTW operations (see Section 5.2 of this EA for more discussion). However, because the MTW is a contributor of fluoride emissions and fluoride may adversely affect vegetation at relatively low concentrations and be hazardous to livestock when it accumulates in forage crops, monitoring of fluoride in local vegetation will continue (see Section 2.3.9 of this EA).

4.1.5.2 Aquatic

As discussed in Sections 3.4.1 and 4.1.4.1 of this EA, the volume of water discharged from Outfall 002 is negligible (0.0015 percent) when compared to the average flow in the Ohio River. The surface-water sampling results in Table 2-6 indicate that nonradiological (i.e., fluoride) and radiological constituents in surface water are rapidly diluted in the Ohio River. The data in Table 2-7 indicate a decreasing trend in fluoride concentrations in river sediment, while uranium concentrations in river sediment appear to be increasing both upstream and downstream of the MTW over the 5-year period from 2010 through 2014. However, over the years 1979 through 2014, the uranium concentrations in river sediment consistently remain below about 3 ppm (Marschke and Gorden 2019). There are no established standards for uranium or fluoride in stream sediments. River sediments in the MTW outflow have high fluoride concentrations relative to upstream and downstream concentrations. Therefore, there may be a localized impact on benthic (bottom-dwelling) organisms in the effluent mixing zone in the river. Phytoplankton and zooplankton production in the effluent mixing zone could also be reduced from decreased light penetration from the suspended solids in the effluent. These effects would be highly localized. Facility upgrades to the EPF to meet more stringent NPDES requirements for fluoride should decrease impacts of fluoride in river sediment, thus lessening the potential impacts on benthic organisms.

Section 3.4.1 of this EA describes the wetlands located at the MTW site. No significant impacts to wetlands are expected from the proposed action because the natural wetlands along the bank of the Ohio River and in the southeastern portion of the site are located outside of the restricted and immediately adjacent area. The two wetland features identified in the National Wetlands Inventory within the restricted area are the calcium fluoride ponds.

As described in Chapter 3 of this EA, three creeks and a drainage channel drain surface water from undeveloped portions of the MTW site into the Ohio River, which forms the southern boundary of the MTW site, approximately 549 meters (1,800 feet) southwest of the restricted area. The Ohio River is classified as a jurisdictional traditional navigable water and subject to U.S. Army Corps of Engineers (USACE) regulation. The proximity of the creeks on the MTW site to the Ohio River would be considered a significant nexus with a jurisdictional water of the United States and would subject the creeks to the regulatory authority of the USACE, as well. However, the proposed license renewal is not subject to review by the USACE because it does not require the discharge of dredge or fill material into the Ohio River or adjacent tributaries or wetlands (ENERCON 2017, Section 4.5, p. 4-7).

Honeywell does not allow recreational hunting, fishing, or trapping on its property and has posted signs to that effect; therefore, there would be no impacts to wildlife on the site due to these activities. The proposed action would not involve modifications to or abutting the Ohio River. As the NRC concluded in Section 4.1.4.1 of this EA, no significant surface water impacts would occur because of the proposed action. Therefore, the NRC does not expect that the proposed action would have significant impacts on commercial and recreational fishing.

Based on the information provided above, the NRC concludes that potential impacts from the proposed action on aquatic species in the water column would not be significant, and that potential impacts from contaminants in the sediments on benthic organisms or on species that feed on these organisms could be noticeable, but not significant. The USFWS concurred that the proposed license renewal is not likely to adversely affect fish and wildlife resources (USFWS 2018d).

4.1.5.3 Threatened, Endangered, Proposed, and Candidate Species

Federally Listed Species

As discussed in Section 3.5.3.1 of this EA, there are 16 federally threatened, endangered, or candidate species in Massac County, IL, or in the Ohio River within Massac County or McCracken County, KY. None of these species occurs in the MTW restricted area. There are no critical habitats in Massac County. There is designated critical habitat in McCracken County for one threatened species of mussel (rabbitsfoot) (USFWS 2018a), which could be impacted by the discharge of effluent and by contaminated sediments within the action area. However, no significant mussel beds are known to exist in the area of river adjacent to the MTW site (USFWS 2018a). In addition, Honeywell has been improving its wastewater treatment, as described in Section 2.2 of this EA. Federally listed threatened or endangered terrestrial animals whose ranges include Massac County and McCracken County are the least tern, the Indiana bat, the northern long-eared bat, and the gray bat (USFWS 2018a). Table 4-2 presents a summary of potential impacts.

The proposed action would not involve significant changes to MTW operations. No bat or tern foraging or roosting habitat is present inside the fenced restricted area, where facility operations occur. Potential habitats identified outside the restricted area would not be affected by routine

MTW operations. The proposed action does not include any plans for riverfront development activities that would either directly disturb potential least tern breeding habitat or encroach on potential nesting sites. Continued operation of the MTW would result in restricted public use of the 405-hectare (1,000-acre) site, including potential least tern nesting sites along the Ohio River. Potential bat foraging habitat (riparian vegetation along intermittent tributaries) present near the site is unlikely to become contaminated from continued operations. Least tern foraging habitats within the action area (i.e., where effluent discharges into the Ohio River occur) may be contaminated by fluoride and uranium; forage fish may concentrate these chemicals, which could bioaccumulate in the tissues of piscivorous birds like terns (Thompson et al. 1997). However, population-level impacts and even sublethal effects of these chemicals on piscivorous birds are not well documented (e.g., Burger and Gochfeld 2007). Therefore, significant impacts are unlikely, especially given that foraging activities would be unlikely to be concentrated within the action area, particularly if turbidity is high (Thompson et al. 1997). Least terns are known to travel great distances to forage (i.e., greater than 12 kilometers (7.5 miles)) from their breeding sites (Schweitzer and Leslie 1996). Therefore, the impact of the proposed action on the least tern and federally listed bat species is not expected to be significant.

Table 4-2 Impacts to Federally Listed, Threatened, and Endangered Species

Species	Scientific Name	Impact	Federal Status
least tern	*Sternula antillarum*	Not likely to adversely affect. Breeds on islands nearby, but nesting habitat not affected by operations at MTW site; foraging habitat could be contaminated locally, but not likely to impact breeding terns due to dilution, lack of foraging in turbid waters, and distribution of foraging habitats.	endangered
Indiana bat	*Myotis sodalis*	Not likely to adversely affect. Species' preferred habitat/roosting areas would not be affected by proposed action.	endangered
northern long-eared bat	*Myotis septentrionalis*	Not likely to adversely affect. Species' preferred habitat/roosting areas would not be affected by proposed action.	threatened, 4,d rule
gray bat	*Myotis grisescens*	Not likely to adversely affect. Species' preferred habitat/roosting areas would not be affected by proposed action.	endangered
orangefoot pimpleback (pearlymussel)	*Plethobasus cooperianus*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
pink mucket (pearlymussel)	*Lampsilis abrupta*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
purple cat's paw (pearlymussel)	*Epioblasma obliquata*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered

Species	Scientific Name	Impact	Federal Status
fat pocketbook (mussel)	*Potamilus capax*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
rabbitsfoot (mussel)	*Quadrula cylindrica*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	threatened, critical habitat
sheepnose (mussel)	*Plethobasus cyphyus*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
spectaclecase (mussel)	*Cumberlandia monodonta*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
rough pigtoe (mussel)	*Pleurobema plenum*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
northern riffleshell (mussel)	*Epioblasma torulosa rangiana*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
ring pink (mussel)	*Obovaria retusa*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
clubsell (mussel)	*Pleurobema clava*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered
fanshell (mussel)	*Cyprogenia stegaria*	Not likely to adversely affect. No known significant mussel beds in adjacent area; water treatment improving, so any existing mussels would not likely be affected by proposed action.	endangered

Sources: USFWS 2018a; ILDNR 2012, ILDNR 2016; KDFWR 2018

The proposed action would not involve changes to the quantity or quality of liquid effluents or airborne emissions released as a result of MTW operations. Routine operating procedures currently leave minimal opportunity for direct exposure of local biota and their prey to unacceptable levels of chemicals or radioactive material, as emissions are in accordance with limits established in the NRC's regulations (Title 10 of the *Code of Federal Regulations*) and State-issued permits. The NRC does not expect that normal liquid effluents and infrequent

exceedances of NPDES permit levels would have a significant impact on the Ohio River surface-water quality or the mussel population, as discussed in Section 4.1.4 of this EA. The majority of mussel habitat in the vicinity of the site has been identified upstream from the MTW site (DOE 2003) and would not be affected by routine plant operations; no mussel habitat exists inside the MTW property boundary. Therefore, the NRC concludes that the impact of the proposed action on threatened or endangered aquatic species, including the pink mucket, orangefoot pimpleback, and purple cat's paw pearlymussels, fat pocketbook, ring pink, rabbitsfoot, rough pigtoe, northern riffleshell, clubshell, fanshell, sheepnose, and spectaclecase mussels, would not be significant.

While there is a small potential for exposure of these species to radiation or chemical exposure from an accident during the period of continued operation, the facility is designed and operated to ensure the probability of occurrence for such an event is low. Therefore, the possibility of exposure to any threatened or endangered species would also be low, and the effects of exposure as a result of an accident would not be significant.

The NRC concludes that continued operations at MTW would not have a significant impact to the ecological resources, including threatened and endangered species, in the vicinity of the site. This conclusion is based on continued compliance with environmental regulations and permits controlling the operation of the MTW, access controls to the MTW that do not allow recreational activities, and lack of significant site development. The USFWS concurred that the proposed license renewal is not likely to affect threatened and endangered species (USFWS 2018d).

State-Listed Species

In order to provide a complete assessment of potential impacts of the proposed action, this EA includes State-listed species that are potentially present in the MTW action area. The Illinois Department of Natural Resources lists 57 State-designated threatened or endangered species that occur in Massac County, 21 of which have the potential to occur in or near the Ohio River action area, as aquatic or aerial species, feeding on aquatic species or insects (ILDNR 2016). The Kentucky Department of Fish and Wildlife Resources lists 73 State-designated threatened or endangered species that occur in McCracken County, 63 of which have the potential to occur within the action area, as they are aquatic or aerial (including bats and birds) (KDFWR 2018). Bald eagles are also possible inhabitants of roosts in these counties and may use the river to forage for fish and are protected by the Bald and Golden Eagle Protection Act.

The most likely impact for any of these species that are aquatic or partially aquatic (e.g., piscivorous birds) is bioaccumulation of contaminants, particularly if they are feeding in the river near the effluent discharge. As discussed above, the proposed action would not involve changes to the quantity or quality of liquid effluents or airborne emissions released because of facility operations. Routine operating procedures currently leave minimal opportunity for direct exposure of local biota and their prey to unacceptable levels of chemicals or radioactive material, and emissions are in accordance with limits established in the license, NRC regulations (Title 10 of the *Code of Federal Regulations*), and State-issued permits. The NRC does not expect that normal liquid effluents and infrequent exceedances of NPDES permit levels would have a significant impact on the Ohio River surface water quality, fish and aquatic invertebrate populations, and, in particular, threatened and endangered mussel populations, as discussed in Section 4.1.4 of this EA. Likewise, aquatic and piscivorous birds (like eagles) would also be unlikely to be exposed to significant contaminants from regular MTW operations.

4.1.6 Meteorology, Climatology, and Air Quality

The general climate at the MTW remains the same as described in the NRC's EA for the previous license renewal (NRC 2006a). Meteorological characteristics such as temperatures, precipitation, winds, tornadoes, and storms remain consistent with those described in the 2006 EA. It is expected that these characteristics at the site would remain consistent during the continuation of operations under the proposed action.

4.1.6.1 Nonradiological Air Quality Impacts

The NRC does not anticipate changes in impacts to air quality from nonradiological contaminants from the proposed action. Without changes to the facilities or operations, the type of contaminants produced at the site would be similar to past emissions, with some fluctuation in quantities related to variations in operations. State-issued operating permits for processing activities include release limits for volatile organic material, particulate matter, sulfur dioxide, nitrous oxides, aqueous ammonia, and hazardous air pollutants, excluding volatile organic material and particulate matter. Table 2-3 in Chapter 2 of this EA shows emissions from the MTW.

As discussed in Section 3.6.2 of this EA, as of February 2017, Massac County, IL, and McCracken County, KY (across the river), continue to be in attainment with regard to criteria pollutants (see Table 3-7 in Chapter 3 of this EA). This is not expected to change under the proposed action.

A description of the facility's gaseous effluent control systems is provided in Section 2.3.8.1 of this EA. MTW currently operates under an IEPA-issued CAAPP permit (ID Number 96030014) (IEPA 2016a). The permit contains terms and conditions that address applicability of Title I of the Clean Air Act, including Federal PSD goals and 35 IAC 203, "Major Stationary Sources Construction and Modification." Because of emission controls and regulatory compliance associated with enforcement of the CAAPP permit, the NRC concludes that continued operations at the MTW associated with the proposed action would not have a significant impact on the nonradiological aspects of air quality at the site.

4.1.6.2 Radiological Air Quality Impacts

As discussed in Section 2.3.8 of this EA, uranium is the primary radiological constituent released through the MTW's stacks (see Table 2-2 in Chapter 2 of this EA). Uranium processing areas that produce dusts, mists, or fumes containing uranium or other toxic materials utilize dust collectors or scrubbers to reduce employee or environmental exposure to meet ALARA principles. MTW is subject to NRC's regulations for radionuclide emissions. In addition, the applicable radiological dose or release limits in 10 CFR 20.1301 and 10 CFR 20.1302, "Compliance with Dose Limits for Individual Members of the Public," the dose limit of 0.25 mSv/yr (25 mrem/yr) to the whole body established in 40 CFR 190.10, and the dose limit of 0.01 mSv/yr (10 mrem/yr) established in 10 CFR 20.1101(d) for a member of the public likely to receive the highest dose will continue to apply to the MTW's radiological releases under the proposed action. The radiological air quality impacts are expressed as radiological doses from routine airborne and liquid effluent radioactive releases to the maximally exposed individual and the surrounding population. Impacts are addressed in detail in Section 4.1.11 of this EA.

4.1.6.3 Greenhouse Gas Emissions

MTW's Contribution to Atmospheric Greenhouse Gas Levels

In CLI-09-21 (NRC 2009b), the Commission provided guidance to the staff on addressing GHG issues in environmental reviews and directed the staff to "include consideration of carbon dioxide and other greenhouse gas emissions in its environmental reviews for major licensing actions under the National Environmental Policy Act."

Operation of the MTW would contribute to GHG emissions. During operations, vehicle traffic related to operation and maintenance, employee commuter vehicles, and truck shipments delivering supplies to the site and removing products and wastes from the site, as described in Section 3.2 of this EA, would generate GHG emissions. As shown in Table 2-3 in Chapter 2 of this EA, the operations at the MTW generate less than 19,000 metric tons (20,944 tons) of carbon dioxide, which is approximately 0.008 percent of the estimated carbon dioxide generated by the State of Illinois (see Section 3.6.2, of this EA).

The NRC staff concludes that the incremental impacts of the proposed action would not contribute significantly to the cumulative impact on climate change. These GHG emissions are below the EPA's threshold of 25,000 metric tons (27,558 tons) per year of carbon dioxide equivalent, the level at which facilities must report GHG emissions to the EPA annually in accordance with 40 CFR Part 98, "Mandatory Greenhouse Gas Reporting." Given that GHG emissions during operations are small in comparison to the amount of emissions generated by the State of Illinois and the fact that these emissions are below EPA reportable quantities, the NRC staff concludes that GHG impacts from MTW operations associated with the proposed action would not be significant. Therefore, these emissions would have a negligible impact on climate change.

4.1.7 Noise

An outdoor noise source that Honeywell added to MTW since the previous license renewal (NRC 2006a) are the two cooling towers located near the center of the restricted area. The noise level 0.9 meter (3 feet) from the cooling towers was measured at 76.8 A-weighted decibels (ENERCON 2017, Section 4.7). The noise attenuates with distance and also by structures surrounding the towers. As discussed in Section 3.7.2 of this EA, the nearest noise-sensitive receptor to the MTW is a rural residence 538 meters (1,765 feet) north-northeast of the FMB.

MTW activities also create intermittent noise outside the restricted area fence at the railroad siding adjacent to the MTW. MTW workers move railcars to and from the siding to receive shipments of materials and shipping products and waste (ENERCON 2017, Section 4.7). These railroad siding activities take place during daylight hours. MTW has performed noise surveys for occupational health purposes. Using the maximum noise levels from the FMB near the center of MTW and the standard attenuation of 6 A-weighted decibels for each doubling of distance, noise from the MTW will hypothetically attenuate to well below Category B (see Table 3-9 in Chapter 3 of this EA) levels by distance alone.

Noise levels inside the operation buildings, such as the FMB, can exceed levels that are protective against hearing loss, as described in Section 3.7.2 of this EA. Occupational Safety and Health Administration regulations require that workers use hearing protection in these

areas. To show compliance with 35 IAC 901, Honeywell will perform noise surveys at the site boundary when MTW operations resume (as described in Section 3.7.1 of this EA).

Honeywell proposes to continue operations with minor modifications to onsite systems (see Section 2 of this EA). The NRC concludes that such system modifications would not have any significant impact to noise levels at the site.

The NRC concludes that continued operations at the MTW under the proposed action would not result in significant noise impact because of protective measures in place to minimize impacts to workers and the fact that noise attenuates over the distance between the facility and offsite receptors.

4.1.8 Historic and Cultural Resources

4.1.8.1 National Register of Historic Places Listed or Eligible Properties Outside the Area of Potential Effect

Section 3.8 of this EA describes four sites listed on the NRHP and three historic properties eligible for listing on the NHRP that lie outside the 1,000-acre APE. The seven NRHP-listed and NRHP-eligible properties, the closest of which is the Shawnee Steam Plant that is 2.8 kilometers (1.7 miles) away, are not visible from the ground level of the MTW because they lie in an undeveloped portion of the MTW property covered by deciduous forest. Because the MTW is in an isolated and forested area and the results of viewshed analyses show no changes that affect the viewshed, the NRC staff concludes the facility would not be visible from these historic properties (TVA 2017, Section 3.17). For the proposed license renewal action, MTW's licensed operations would not change and no ground-breaking actions or construction are planned. The Illinois Department of Natural Resources concluded that no historic properties would be affected (ILDNR 2018b). For these reasons, the NRC concludes that the MTW would not have adverse effects on historic resources outside the APE.

4.1.8.2 Cultural Resources in the MTW Area of Potential Effect

As discussed in Section 3.8.1 of this EA, the APE for this proposed action is the entire 405-hectare (1,000-acre) Honeywell-owned site, including the 24-hectare (59-acre) restricted area. Investigators conducted limited cultural resources surveys on areas of the APE that are outside the restricted area. These surveys resulted in the identification of five cultural resources sites. The field investigators did not recommend any of these sites as eligible for the NRHP, and the SHPO has not made a determination.

Honeywell's request to renew its source and byproduct materials license and continue operation would not involve ground-disturbing activities on the facility property. Honeywell does not propose changes in how it processes uranium ore during the proposed 40-year license period. The facility is fully constructed and no modifications to the site or its surroundings, such as construction or demolition of structures, are planned. Honeywell's NRC-licensed uranium conversion activities occur within the fenced, 24-hectare (59-acre) portion of the site, which was heavily disturbed during construction of the facility more than 50 years ago (see Figure 3-6 in Chapter 3 of this EA). Based on the nature of the proposed renewal activities, the NRC has made a determination under 36 CFR 800.3(a)(1) that the proposed action would not cause adverse effects on historic or cultural resources on the Honeywell property, assuming such historic properties are present.

As discussed in Section 3.8.2 of this EA, the NRC staff initiated consultation with several American Indian Tribes to assess the presence of places of religious or traditional cultural importance for Tribes within the APE. The NRC did not receive information from Tribes concerning specific resources of cultural importance on or near the Honeywell property. Chapter 6 of this EA provides further information regarding consultation activities.

As part of the proposed license renewal review, the NRC will add a condition to the MTW's materials license (SUB-526) to ensure proper identification and protection of cultural resources for the proposed licensing term. The text of the license condition is provided below:

License Condition 34: Cultural Resources

(A) Disturbances Associated with Proposed NRC-Regulated Activities and Identification of Cultural Resources: The licensee shall not undertake ground-disturbing activities on its property that are related to a pending or potential NRC licensing action without prior NRC approval. The NRC will assess the proposed activities in accordance with Section 106 of the National Historic Preservation Act of 1966 and its implementing regulations in consultation with American Indian Tribes that might attach religious and cultural significance to affected resources and the Illinois SHPO, as appropriate. If the NRC's initial assessment of the proposed ground-disturbing activities determines further investigation is needed, the licensee, in consultation with the NRC, shall conduct a cultural resources inventory of the APE. The inventory shall be based on information from literature searches, available information on places of significance to consulting American Indian Tribes, the results of any existing surveys, and, if needed, the results of new surveys.

(B) Unevaluated Resources: When ground disturbance could affect unevaluated historic or cultural resources within the APE for the proposed licensing action, the licensee shall avoid direct and indirect impacts until the unevaluated resource is evaluated in accordance with 36 CFR Part 800 in consultation with consulting American Indian Tribes, the Illinois SHPO, and the NRC, as appropriate.

(C) Unanticipated Discoveries and Human Remains: In the event a previously unknown cultural resource is discovered during ground-disturbance activities on any portion of the Honeywell-owned property, the licensee shall cease work to avoid direct or indirect impacts until the cultural resource is evaluated in accordance with 36 CFR Part 800 in consultation with consulting American Indian Tribes, the Illinois SHPO, and the NRC, as appropriate. Native American human remains, funerary objects, sacred objects, or items of cultural patrimony found on the Honeywell property shall be handled respectfully, in accordance with the Illinois Human Skeletal Remains Protection Act (20 ILCS 3440).

4.1.9 Scenic and Visual Resources

MTW is currently operating under an IEPA-issued Title V CAAPP permit (IEPA 2016a). The permit requires that no emission of fugitive particle matter from any process, including any material storage handling or storage activity, be visible by an observer looking generally overhead at a point beyond the property line of the source unless wind speeds are greater than 40 kph (25 mph). In addition, the permit requires that no emission of smoke or other particulate matter be allowed or emitted to the atmosphere from a regulated process in excess of 30 percent opacity. The facility complies with these permit conditions during normal operation.

The site has not made significant process modifications or construction activities that altered aesthetic or visibility impacts since the previous license renewal, nor are such modifications proposed under the proposed action. MTW structures are not easily visible from locations outside the MTW site, and the site is surrounded by forested areas, limiting the impact of the facility on scenic and visual resources. Section 3.5.1 of this EA describes the vegetation at the MTW site and Figure 3-6 in Section 3.10 shows an aerial view of the site.

The NRC concludes that continued operations at the MTW under the proposed action would have no significant impacts on scenic and visual resources at the site.

4.1.10 Socioeconomics and Environmental Justice

The primary socioeconomic impact of continued operation of the MTW is related to local employment and property taxes. Under the proposed action, the MTW would continue to directly employ about the same number of workers, leading to the continuation of positive economic impacts for those employed at the site and to the local communities and county. In addition, continued operation would ensure the annual renewal of "mutual assistance agreements" between MTW and local emergency responders in Massac County and the City of Metropolis. Emergency response agencies within the immediate vicinity currently benefit from training, emergency drills, and emergency response equipment provided by Honeywell. Payment of property taxes generally benefits Massac County and the City of Metropolis.

The NRC concludes that continued operation of the MTW under the proposed action would not have a significant adverse impact, and that it would have a beneficial impact on the socioeconomics of the area because of employment opportunities provided to the local area, payment of property taxes, and assistance to emergency responders that could be applied to other local industries.

The proposed action would not cause noticeable impacts on populations living near the facility. Given that the proposed action would not cause noticeable impacts on any population, there are no disproportionately high and adverse human health and environmental effects on minority or low-income populations. Therefore, an environmental justice review is not necessary. This is consistent with the NRC's "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions" (69 FR 52040, August 24, 2004). The Policy Statement discusses the evaluation of environmental justice in EAs and notes that, "in the case of most EAs there are little or no offsite impacts and, therefore, an EJ [environmental justice] review is generally not necessary to make a Finding of No Significant Impact (FONSI)."

4.1.11 Public and Occupational Health and Safety

Radioactive and nonradioactive materials released from MTW facilities may migrate in the environment through a variety of transport pathways that could result in both internal and external exposures. For atmospheric releases, internal exposures may occur through inhaling radioactive material dispersed in the air or ingesting crops and animal products that come in contact with radioactive material deposited from the air. External exposures may occur through direct radiation from an airborne plume or from particulates deposited on the ground from the plume. For liquid releases, internal exposures could result from ingesting water or irrigated crops, while external exposures may result from recreational activities such as swimming and boating.

This EA assesses the radiological impacts of continued operation of the MTW by calculating the radiation dose to the maximally exposed individual located at the nearest residence and the collective radiation dose to local population living within 80 kilometers (50 miles) of the MTW site.

This section uses the generic term "radiation dose" to refer to the TEDE, which is the sum of the following dose equivalents: (1) the deep dose equivalent from exposure to external radiation for a period of 1 year and (2) the 50-year committed effective dose equivalent from internal exposure from the intake of radionuclides for a period of 1 year. The generic term radiation dose may be applied to an individual, using units of mSv (mrem) per year, or as the collective radiation dose to populations, using person-Sv (person-rem) per year.

4.1.11.1 Public Health and Safety

Doses from Routine Airborne Releases

As discussed in Section 2.3.8 of this EA, MTW monitors operational releases of radioactive material to the atmosphere from 53 release points and reports measurements of the releases to the NRC on a semiannual basis. These releases are primarily uranium, although the facility also releases relatively small amounts of thorium-230 and radium-226. Fluoride is the primary nonradiological gaseous contaminant released through stacks on the FMB. Table 2-2 in Chapter 2 of this EA summarizes the annual uranium release rates for the years 2010 through 2014 combined for all emission points.

Honeywell calculated the doses from routine airborne releases using CAP-88 as the dose modeling software. The EPA issued CAP-88 for estimating the dose from radionuclide emissions to air. CAP-88 allows the modeling of up to six emission points for a single building. All nuclides are assumed to be Class M (i.e., moderate rate of absorption) to better correlate with absorption into the bloodstream from the respiratory tract (ENERCON 2017, Section 4.6.5).

To predict the air impacts over a 40-year licensing term, Honeywell used the projected demand for uranium enrichment services as a basis for emission rates for future years. The projections bound dose rates from routine airborne radiological emissions through the final year of the license renewal (ENERCON 2017, Section 4.6.5.1). Honeywell selected the Energy Resources International 2012 Fuel Cycle Report (ERI 2012) as the best dataset for developing growth factors to be used in CAP-88 modeling. The NRC staff concurs with the use of this dataset because it is a conservative estimator of the nuclear energy market and because uranium production has declined since 2012.

Dose to the Maximally Exposed Individual

The maximally exposed individual is located at the nearest residence north-northeast of the MTW. Figure 4-1 provides the location of the ore sampling plant and the FMB in relation to the nearest residence (NR-7), 538 meters (1,765 feet) away from the FMB. Honeywell staff entered projected emissions for the year 2057 into the CAP-88 model along with meteorological data. The exposure at 0.5 kilometer north of the MTW was calculated to be 0.0217 mSv/yr (2.17 mrem/yr) using model runs computed for an individual (exposure) located at the nearest residence (NR-7). The dose predicted at this distance includes exposure from all radionuclides and all pathways. The estimated TEDE to the maximally exposed individual of 0.0217 mSv/yr is less than the limits established in the NRC's regulations. These limits are 1 mSv/yr (100 mrem/yr) to individual members of the public established in 10 CFR 20.1301(a), 0.25 mSv/yr (25 mrem/yr) to the whole body established in 40 CFR 190.10, and 0.01 mSv/yr

(10 mrem/yr) established in 10 CFR 20.1101(d) for a member of the public likely to receive the highest dose.

For comparison, Section 2.3.9.2 of this EA states that background annual average radiation doses at the airport did not exceed 0.28 mSv (28 mrem) per year for the years 2010 through 2014. Radiation doses at the nearest residence and airport, as measured by TLDs, did not exceed the background levels presented as "control" levels in Table 2-10 of this EA and never exceeded 0.29 mSv (29 mrem) from 2010 through 2014.

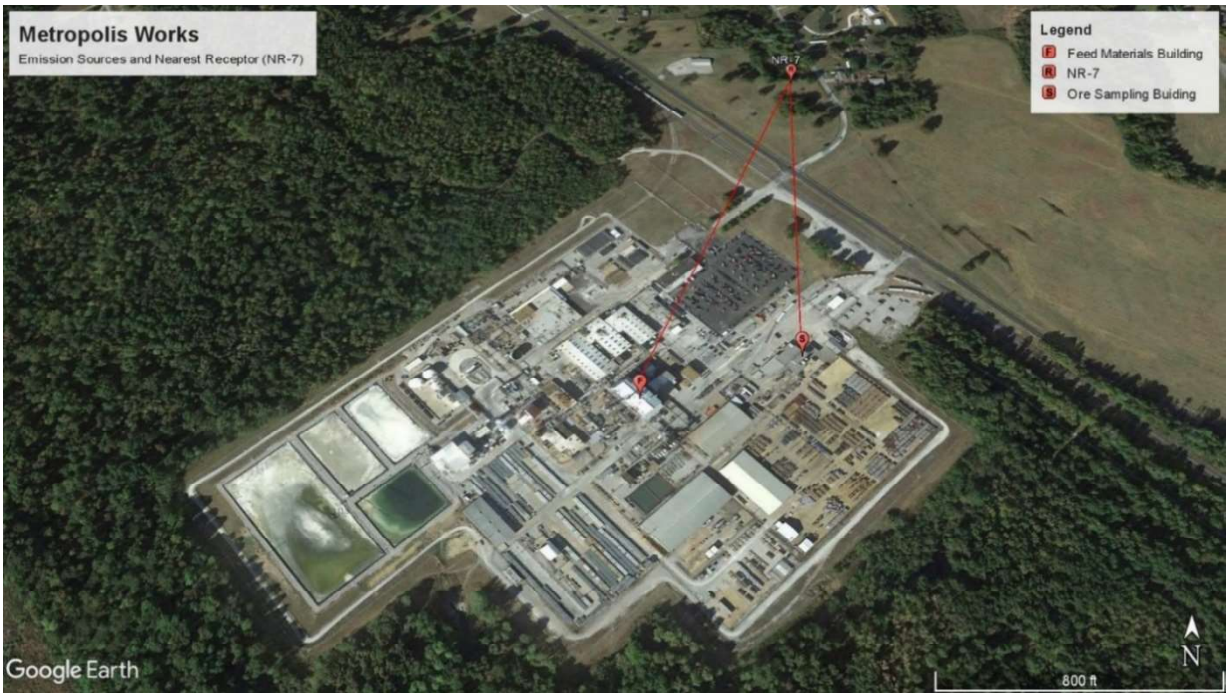

Figure 4-1 Locations of MTW Buildings Relative to the Nearest Offsite Residence (NR-7) (Source: ENERCON 2017, Figure 4.6-1)

The highest internal organ dose is to the lungs from moderately soluble forms of uranium. The estimated lung dose of 0.119 mSv/yr (11.9 mrem/yr) is less than the limit of 0.25 mSv/yr (25 mrem/yr) the EPA established in 40 CFR 190.10. The thyroid doses are also a small fraction of the 0.75 mSv/yr (75 mrem/yr) thyroid dose limit the EPA established in 40 CFR 190.10.

Dose to the Surrounding Population

Honeywell estimated the projected population for the year 2057 within an 80-kilometer (50-mile) radius of the MTW to be 574,948 people. As with the maximally exposed individual, Honeywell used the CAP-88 software to estimate the collective radiation dose to the population.

Honeywell estimated the collective radiation dose to the population within an 80-kilometer radius of the MTW to be 0.0452 person-Sv (4.52 person-rem) per year. Accordingly, the collective radiation dose associated with atmospheric releases from the MTW is a small percentage of the collective radiation dose from background radiation for these same number of people.

The NRC reviewed Honeywell's methodology and assumptions, input to the CAP-88 calculations, and results, and confirmed that continued operations at the MTW would not have significant radiological impacts to the public from airborne releases at the site based on calculated exposures to the nearest residence that are below the limits set forth in 10 CFR Part 20 and 40 CFR Part 190 and the population dose being a small fraction of the dose the population receives from naturally occurring sources of radiation.

Doses from Liquid Effluent Releases

As discussed previously in this EA, the MTW is operating in accordance with its NPDES permit (IEPA 2015a). Liquid process wastes are discharged to the Ohio River via one monitored release point, NPDES Outfall 002. Two other outfalls (003 and 005) discharge stormwater to the Ohio River. Liquid waste streams generated at the MTW are categorized as low-level radioactive and nonradioactive waste streams. Before discharge into the Ohio River, both radioactive and nonradioactive waste from MTW operations is processed through the EPF to meet radiological effluent limits in 10 CFR Part 20 and nonradiological effluent limits specified in the facility's NPDES permit.

The NRC analyzed the radiological effects of liquid effluent releases in previous license renewal applications submitted by Honeywell (NRC 1995, 2006a). The NRC performed a dose analysis as part of its review of the 1996 license renewal, as reported in the 1995 EA (NRC 1995). The analysis concluded that the estimated radiation dose (TEDE) from expected liquid effluent releases to the maximally exposed individual located 8 kilometers (5 miles) downstream of the MTW site was 0.000013 mSv (0.0013 mrem) per year. This estimated radiation dose is far less than the 0.1-mSv (100-mrem) per year limit the NRC established in 10 CFR Part 20 and also far less than the 0.25-mSv (25-mrem) per year limit the EPA established in 40 CFR Part 190. The estimated radiation dose of 0.000013 mSv per year is also much less than the dose of 0.04 mSv (4 mrem) per year that is the basis for the drinking water standard contained in 40 CFR Part 141, "National Primary Drinking Water Regulations."

The NRC's dose analysis, which involved measuring liquid effluent releases for the 1996 license renewal (NRC 1995), provided an estimate of the collective radiation dose to the population of 4,846 people living in Cairo, IL. The dose was estimated to be 0.000030 person-Sv (0.0030 person-rem) per year. Based on an average background radiation dose of 0.00310 Sv (0.310 rem) per year for individuals in the United States (see Section 3.11.1 of this EA), the population of Cairo would receive about 14.80 person-Sv (1,480 person-rem) per year from background radiation. The collective radiation dose associated with liquid effluent releases from the MTW is a very small percentage of the collective radiation dose from natural background radiation.

The dose analysis the NRC performed for the 2006 license renewal (NRC 2006a) compared the annual average uranium concentration in liquid releases from 1989 to 1993 (NRC 1995) to the concentration in liquid releases for the years 2001 to 2004 (see Table 4-3). The NRC concluded the data indicated a declining trend in the 30-day average for uranium concentration. The declining trend in liquid effluent releases, which demonstrated radiation doses far less than regulatory limits, provided the basis for the NRC's conclusion in 2006 that the releases would continue to produce doses far less than the regulatory limits.

Table 4-3 Summary of Monitoring Results of Total Uranium, 2001–2004

Total Uranium	2001	2002	2003	2004
Quantity (pounds per day)	4.97	2.97	3.46	2.46
30-day average concentration (milligrams per liter)	0.18	0.10	0.11	0.08

Source: NRC 2006a, Table 2.5

In addition, uranium concentrations in the surface water of the Ohio River have remained near or below detection limits over the last four decades (see Table 2-6 of this EA; Marschke and Gorden 2019, Figure 10). For these reasons, doses to downstream water users resulting from MTW operations are expected to remain well below regulatory limits.

Doses from Direct Radiation

Table 2-10 in Chapter 2 of this EA provides annual averages for external gamma monitoring for the years 2010 through 2014. As discussed in Section 2.3.9.2 of this EA, the maximum annual average of the direct gamma radiation normally occurs at the east and south fence lines of the restricted area. This pattern occurs because a large ore concentrate storage area is located immediately adjacent to the sampling station. The average annual environmental dosimeter dose at the east fence is 0.834 mSv (83.4 mrem), approximately 83 percent of the 1-mSv (100-mrem) limit specified in 10 CFR 20.1301(a)(1) for dose from external sources in any unrestricted area (ENERCON 2017, Section 4.6.8.3). The shortest distance from the eastern restricted area fence to the MTW site boundary is approximately 1 kilometer (0.6 mile). The direct dose to any potential offsite individual would be substantially less than the regulatory limit because dose decreases with distance (dose is inversely proportional to the square of the distance; that is, at 1 kilometer, the dose will be reduced by at least four orders of magnitude).

The proposed action would continue licensed operation of the MTW for 40 years at the current level of production. Direct radiation levels during a renewed license term are expected to be similar to those shown in Table 2-10 of Chapter 2 of this EA and are less than 10 CFR Part 20 limits for occupational and public exposures. Therefore, the NRC expects that impacts to public health will continue to be within regulatory limits and will meet ALARA principles. The NRC concludes that continued operations at the MTW would not result in a significant impact to the public from exposure to direct radiation.

4.1.11.2 Occupational Health and Safety

MTW workers have occupational health and safety risks from exposure to industrial hazards, hazardous materials, and radioactive materials.

As discussed in Section 3.11.3 of this EA, the industrial hazards at the MTW include chemical exposures, heavy-machinery accidents, crush injuries, and cuts and abrasions, which are similar to the hazards of other industrial facilities of the same size. These hazards apply to workers conducting material processing operations as well as monitoring, research, general office, and industrial site activities. The MTW had no work-related fatalities and its average recordable injury rate was 2.5 per year for the years 2010 through 2014.

Uranium hexafluoride processing equipment that produces dusts, mists, or fumes containing uranium or other toxic materials is fitted with dust collectors and scrubbers or other ventilation equipment to reduce employee and environmental exposure and maintain ALARA levels.

Honeywell established a system to take samples from operating exhaust points to measure the uranium content of exhaust. Honeywell implements a program of effluent monitoring to identify failure in the effluent clean-up systems. If effluents are detected, Honeywell imposes operational controls to ensure effluents remain within established limits. Honeywell also implements a process safety management program that is compliant with the Occupational Safety and Health Administration requirements at 29 CFR 1910.119. The requirements provide a comprehensive assessment of chemical safety hazards and describe specific processes and procedures that mitigate hazards. Honeywell's process safety management program implements periodic reviews and assessments of operations to improve administrative and engineering controls. Honeywell uses engineering controls to limit concentrations of hazardous and radioactive constituents in the work place (ENERCON 2017, Section 4.12).

Honeywell implements a respiratory protection program consistent with the requirements of 10 CFR Part 20, 29 CFR 1910.134, "Respiratory Protection," and Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection" (NRC 1999). These measures limit the exposure of employees to hazardous chemicals and radioactive materials. Consistent with applicable regulatory requirements and good industrial practice, as described in this EA in Section 3.7.1 for noise hazards and Section 3.11.3 for other hazards, Honeywell conducts extensive air and noise sampling to characterize workplace hazards and to establish appropriate workplace controls.

Honeywell also implements an environmental monitoring program that addresses radiological and nonradiological hazards. As discussed in Section 3.11.3 of this EA, Honeywell's radiation protection program routinely surveys work spaces to identify and mitigate radiation hazards. In addition, dosimeters and a bioassay program monitor the exposures of individual workers to radiation hazards. As shown in Table 3-18 in Chapter 3 of this EA, individual occupational radiation doses at the MTW, which includes the effective dose equivalent from external exposures and the committed effective dose equivalent from internal exposures, are maintained well below the limits established in 10 CFR 20.1201, "Occupational Dose Limits for Adults," which are designed to protect workers' health.

Low-level deposition of uranium in soils on and off site would occur with continued operation of the MTW during the license renewal period. Natural uranium has a low specific activity and is not a significant chemical hazard to MTW workers. The effluent controls in place at the MTW ensure that the exposures of individuals stay within regulatory limits. For these reasons, the very limited exposure of workers to industrial hazards, hazardous materials, and radioactive materials at the MTW are not expected to result in significant health effects. Therefore, the NRC concludes that continued operations at MTW under the proposed action would not have a significant impact on workers.

4.1.11.3 Discussion of Potential Accidents

It is possible that accidents could release radioactive materials or chemicals to the environment, potentially affecting workers and members of the public. The MTW ISA Summary (Honeywell 2016) provides details on Honeywell's analyses of the hazards arising from accident sequences identified using the criteria provided in 10 CFR 70.61, "Performance Requirements." The ISA Summary identifies potential accident sequences and designates MTW features and procedures in place to prevent accidents or to mitigate accident consequences to an acceptable level. The ISA Summary further describes management measures that provide reasonable assurance that the MTW features and procedures will be available and are reliable. The hazard identification process identifies the physical, radiological, and chemical hazards with the potential to cause

harm to site workers, the public, and the environment. The hazard identification method also identifies potentially hazardous conditions that could impact discrete components of the process systems.

The ISA Summary provides reasonable assurance that the potential failures, hazards, accident sequences, and scenarios have been comprehensively investigated. In addition, the features and procedures in place at MTW evaluate common-mode and common-cause situations. Honeywell also evaluated selected high-consequence chemical accident sequences. These high-consequence accidents bound all consequences from credible accidents at the MTW. The accidents analyzed include the following (Honeywell 2016, Table 7-2):

- rupture of the hydrogen fluoride unloading hose
- failure of the nitrogen pressure supply line to the delivery railcar
- failure of the process gas incinerator system
- failure of the redactors from overheating
- contact of hydrocarbons (oil) with gaseous fluorine or uranium hexafluoride
- a potential release of uranium hexafluoride due to the overpressure failure of a uranium hexafluoride product cylinder

Possible initiators for these accidents are personnel errors, maintenance activities, seismic events, tornadoes, tornado missile and high winds, snow and ice, flooding, heavy rain, transportation, aircraft, pipelines, highway traffic, railroads, onsite natural gas, and the effects of operations of nearby industrial facilities. Honeywell tabulated the potential radiological and chemical consequences of these accidents and identified those that are credible. For credible events with a potential for high consequences, the ISA Summary provides a description of plant features and procedures in place to mitigate consequences.

Section 4.1.2.3 of this EA presents the consequences of and measures to mitigate rail transportation accidents. Rail cars store anhydrous hydrogen fluoride and potassium hydroxide at MTW, as described in Table 2-1 in Chapter 2 of this EA. As stated in Section 4.1.2.3, compliance with NRC and U.S. Department of Transportation packaging and transportation regulations, 10 CFR Part 71, and 49 CFR Parts 100–199 protects workers and the public by limiting the potential for releases of hazardous and radioactive materials during transportation accidents. Honeywell is required to comply with these regulations while the rail cars are used as storage units within the MTW.

Honeywell maintains an emergency response plan that describes measures developed and implemented at the MTW for preventing, recognizing, and responding to emergency conditions that may arise (Honeywell 2015). The facility's risk management plan update describes a worst-case scenario for the release of hydrogen fluoride that is highly unlikely, and alternative scenarios for the accidental release of ammonia (anhydrous) and fluorine (liquid) from onsite bulk storage tanks. In conjunction with the NRC, IEPA, and the local emergency response agencies, MTW developed protective action and supporting notification plans to minimize the potential of any adverse consequences to the workers and members of the public in the unlikely event that such a release occurs (Honeywell 2016). Honeywell interactions with local emergency responders are further described in Sections 3.10.1.3 and 4.1.10 of this EA.

The NRC is performing a detailed safety review of the MTW. The review considers potential accident scenarios, potential consequences, and the licensee's overall record of compliance with NRC regulations. The staff findings will be documented in the SER for this license renewal. The ISA Summary identifies protective measures to mitigate the impacts of accidents that could release radioactive materials or chemicals with the potential to affect the public health and the environment. The NRC staff will describe the accident impacts in its SER. NRC regulations require that licensees identify and maintain controls to provide reasonable assurance that high-consequence accidents are highly unlikely.

4.1.12 Waste Management

As discussed in greater detail in Section 3.12 of this EA, current MTW operations produce low-level radioactive, nonradioactive hazardous, mixed, and nonradioactive solid wastes. The MTW manages these wastes by using a combination of recycling and offsite disposal. Two byproduct streams, synthetic fluorspar (calcium fluoride) and filter fines, are sent off site for reclamation and reuse; these are not considered waste streams (ENERCON 2017, Section 3.12).

Chapter 2 and Section 3.12 of this EA present a detailed description of the sources, types, quantities, and composition of solid, hazardous, and mixed wastes generated during current operations at the MTW. Under the proposed action, the MTW would continue generating the waste streams in the same quantities described in Section 3.12. No new waste streams are anticipated. Honeywell would continue to manage the waste as presented in Section 3.12 (ENERCON 2017, Section 4.13). Section 3.12 also discusses the availability of the various recycling and disposal facilities available for treatment and disposal of MTW waste. The NRC staff expects that ample capacity will remain available for the disposal of nonhazardous solid waste, hazardous waste, and construction and demolition wastes under the proposed action. The NRC staff also assumes that sufficient low-level waste disposal capacity will be available when needed. Historically, the demand for low-level waste disposal capacity has been met by private industry, and the NRC expects that this trend will continue in the future (NRC 2014c).

Honeywell maintains worker and public radiological safety for waste management operations at the MTW site by implementing a radiation protection program that complies with the regulations in 10 CFR Part 20. The NRC staff's safety review of that program will be documented in the SER. The potential environmental impacts from plant effluents to air and surface water are evaluated in Sections 4.1.6, 4.1.4.1, and 4.1.11 of this EA. The environmental impacts of waste-management-related transportation are evaluated in Section 4.1.2 of this EA.

The NRC staff also considered the waste minimization practices employed at the MTW. The MTW has a waste minimization plan in compliance with its RCRA permit (Honeywell 2018c). The facility recycles potassium hydroxide muds and reclaims both potassium hydroxide and uranium, which are reused in the production of uranium hexafluoride. Additionally, MTW has a procedure that requires that all trash be sorted and segregated based on its radioactivity. The staff concluded that the MTW practices on waste minimization continue to be sufficient.

Given the types and volumes of wastes the proposed 40-year license renewal would generate and the available waste management options and capacities, the NRC staff concludes the overall impacts on waste management resources at the MTW under the proposed action would not be significant.

Waste Management Upgrades

As discussed in Section 2.2 of this EA, Honeywell made upgrades and modifications to the process facilities and site infrastructure since the NRC published the last license renewal EA in 2006. The upgrades to the waste management system include:

- In 2006, the existing EPF was expanded during the construction and completion of the STF. The expansion increased the capacity of the EPF and added a clarifier and sand filter. This upgrade reduced fluoride and pH excursions in wastewater leaving the plant through the permitted outfalls (Honeywell 2018a, Response to RAI PA-2(A)).

- Outdated oil-cooled rectifiers in the fluorine production facility were replaced with new water-cooled units. The water-cooled units eliminate the use of oil in the coolers, thus reducing the generation of mixed wastes (Honeywell 2018a, Response to RAI PA-2(B)).

- The new cooling tower cools the waste heat from the new rectifiers before discharging to the Ohio River. The upgrade enables the use of less water to cool the rectifiers (Honeywell 2018a, Response to RAI PA-2(C)).

- A new sewage treatment facility came into operation in 2015, which improved the ability to treat the sewage generated from the MTW and ensure compliance with the NPDES permit (Honeywell 2018a, Response to RAI PA-2(D)).

The NRC concludes the upgrades and modifications to the process facilities and infrastructure since the last license renewal in 2006 provide a positive environmental impact.

4.1.13 Environmental Impact Accumulation from the Proposed Action

The NRC evaluated whether environmental impacts for some resources have the potential to accumulate over the extended duration of the license renewal period. Honeywell provided supplemental information on these potential accumulated impacts in response to the staff's RAIs (see Honeywell 2018a, Response to RAI ALT-1, for details on Honeywell's response).

- Geology and soils—Impacts to soils from soil disturbance, leaks, and spills could occur, for example, during maintenance activities. The implementation of best management practices and stormwater management controls are expected to control soil erosion. However, the accumulated contaminants in the sediments of the channel leading to Outfall 002 demonstrate the potential for accumulation of pollutants within soil and sediment.

- Groundwater—Contaminants from leaks or spills may affect onsite geology and soils and could accumulate in onsite groundwater. Existing nonradiological contamination of groundwater is limited to the MTW site and is managed under the conditions of Honeywell's RCRA permit. Radiological data available on the groundwater monitoring programs administered under the RCRA permit indicate that exceedances of maximum contaminant levels (MCLs) for radiological parameters have been rare and isolated. Resampling and reanalysis after each exceedance demonstrated that the parameter in question is below the MCL.

- Ecological resources—As noted in the discussion of geology and soils above, there is a potential for accumulation of pollutants in sediments and soils at the MTW and in terrestrial and aquatic wildlife.

- Socioeconomics—Honeywell's continued payment of property and State taxes and continued employment of local residents at the facility are anticipated and provide positive impacts to the regional community.

- Public and occupational health—There is a potential for accumulation of pollutants in offsite vegetation, sediment, and soil. Based on the fluctuation of uranium concentrations in these media over time and Honeywell's compliance with NRC regulations, it is unlikely that members of the public would experience cumulative effects from exposure to offsite vegetation, sediments, or soils containing residual amounts of uranium. As discussed in Section 4.1.11.1, the dose to the maximally exposed individual from all pathways is significantly below the NRC's regulatory limits to members of the public.

- Waste management—Land disposal of waste would result in the continued accumulation of land acreage used for waste disposal.

Honeywell presented monitoring results for sediment, vegetation, and soil surrounding the MTW site at offsite locations, as discussed in Chapter 2 of this EA. These data for the years 2010 through 2014 were compared to data from 2000 through 2003 to assess changes in accumulations; no significant accumulations were identified (see Tables 2-7, 2-8, and 2-9). The monitoring results indicate that radioactive material and fluoride released within the restricted area have not accumulated in other areas of the MTW site. The following are exceptions to this pattern of accumulation: (1) the channel leading to Outfall 002 (Honeywell 2018a, Response to RAI ALT-1), (2) the drainage swale east of the ore storage pads, (3) an area extending 8 meters (25 feet) on either side of a 229-meter (750-foot) section along River Road, and (4) isolated areas along the road to the inactive landfill, as described in Section 2.4 of this EA. Uranium concentrations have fluctuated over time in the soils and sediments in Outfall 002. Uranium contamination in these areas must be addressed during decontamination and decommissioning of the facility at closure, as described in Section 4.4 of this EA. For offsite locations, monitoring results appear to indicate that accumulation off site, if present, is not significant, as discussed in Sections 4.1.3, 4.1.4.1, 4.1.5.1, and 4.1.5.2 of this EA. The NRC concludes that the potential additional accumulation of pollutants in the resource areas discussed above will not be significant under the proposed 40-year licensing renewal.

4.2 Reduced Duration Alternative

Under the reduced duration alternative, the NRC would approve a license renewal period of less than 40 years. A shorter license renewal period is considered a reasonable alternative considering the NRC's past practice of issuing 10-year licensing renewals for this and other similar facilities. The NRC's safety review of the Honeywell licensing renewal application may determine a license renewal period shorter than 40 years is reasonable and appropriate.

The NRC staff determined that the potential environmental impacts of site operations during the proposed 40-year license renewal period bound the impacts of a shorter license renewal period. For this reason, this EA does not address the operational impacts for the reduced duration alternative separately. Although the timing of decommissioning will be earlier under this alternative, the impacts of decommissioning would be similar.

The NRC staff concludes that the potential environmental impacts from the reduced duration alternative are bounded by those analyzed for the proposed action.

4.3 No-Action Alternative

Under the no-action alternative, the NRC would discontinue activities under MTW operating license SUB-526. If Honeywell's license to continue operations was not renewed, the facility would move into the decontamination and decommissioning phase earlier. Section 4.4 of this EA addresses decommissioning impacts, which must occur at some point in time regardless of the alternative implemented. Once the facility ceases operations, Honeywell must survey the site grounds and buildings and develop a detailed decontamination and decommissioning plan. The plan must address the decontamination of buildings, the offsite shipment of significant quantities of low-level radioactive waste generated during decontamination, and the removal of contaminated soils.

The short-term and long-term effects of the no-action alternative would include a negative local socioeconomic impact because decontamination and decommissioning activities would require fewer workers than currently employed at the site. In addition, because local employment opportunities associated with the MTW would no longer exist after decommissioning, the anticipated socioeconomic impact to the region would be significant. Under the no-action alternative, operational impacts on transportation would be limited since site operations would cease. The facility would be required to shut down in accordance with NRC's regulations at 10 CFR 40.42 in order to protect the environment and public health and safety. As the shutdown progresses, daily commuting trips for operational workers and operational shipping traffic would decrease. In addition, the cessation of operations at the MTW would close the only operating facility within the United States that is capable of converting uranium ore to uranium hexafluoride. The no-action alternative would very likely impact the commercial nuclear fuel industry.

4.4 Decontamination and Decommissioning Impacts

When the MTW ceases operations, Honeywell must, in accordance with 10 CFR 40.42, complete decontamination and decommissioning before the NRC will terminate the license. The NRC will conduct a safety and environmental review of the decommissioning plan before approving proposed decommissioning activities. Section 2.4 of this EA describes the actions Honeywell will take to decontaminate the facilities while providing for the protection of the environment and public health and safety. Honeywell will reduce radiological contamination to levels that allow for release of the facility for unrestricted use under 10 CFR Part 20, Subpart E. However, a portion of the site will remain restricted by the State because chemical contamination will affect the long-term land use (see Section 2.3.9.2 of this EA). Following the completion of decontamination activities, Honeywell will complete a comprehensive radiological survey and a report documenting the cleanup of the MTW to the target levels. Before Honeywell's license is terminated, the NRC staff will review and verify that decontamination activities and the site final survey were conducted in accordance with the requirements of 10 CFR 40.42.

The potential impacts to the environmental resource areas from decontaminating and decommissioning the MTW are described below (see a detailed description in Chapter 3 of this EA).

- Land use—Future use of portions of the MTW site is limited by the ELUC established to restrict the types of use in those areas (see Figure 3-1 in Chapter 3 of this EA). Long-term impacts to land use in these areas are anticipated due to the ELUC.

- Transportation—Transportation activities will temporarily increase because of the removal of equipment, materials, and wastes from the MTW (see Section 2.4 of this EA). Once decommissioning activities are completed, transportation impacts will lessen with the cessation of transportation activities related to truck and rail shipments and commuting.

- Geology and soils—Short-term soil disturbance will occur across the site; the associated impacts will be moderately significant. Long-term impacts will depend on whether final radiological conditions at the site support unrestricted or restricted release of the site in accordance with 10 CFR 20.1401, "General Provisions and Scope," or 10 CFR 20.1402.

- Water resources—With the cessation of operations, the generation of process-related effluents will cease, eliminating process-related discharges to NPDES Outfall 002 and water discharge impacts to the Ohio River. Best management practices, erosion-control barriers, and discharges under approved permits will limit near-term impacts to surface waters during decommissioning. Limited, insignificant groundwater contamination occurred in the past and there may be future limited impacts to groundwater. Honeywell must address any groundwater impacts through the RCRA process with regulatory oversight by the IEPA and additional oversight by the NRC if radionuclides are involved.

- Ecology—Potential impacts from increased sedimentation and intermittent noise may occur from decontamination and decommissioning activities. Sedimentation impacts can be controlled through best management practices. It is expected that wildlife would avoid the area if noise levels are increased. In the long term, Honeywell would return the restricted area to its undisturbed state and general noise levels from industrial activities and traffic would decline in the area, depending on future land-use decisions.

- Air quality—Decommissioning activities might impact air quality by increasing dust and particulate emissions during facility demolition and emissions from construction equipment. Honeywell will complete a detailed assessment of air quality during decommissioning planning (Honeywell 2018a, Response to RAI AIR-1).

- Noise—Facility demolition and the use of heavy equipment is expected to result in short-term noise impacts during normal daylight working hours and will be intermittent. Long-term noise impacts will decline with the cessation of truck and rail shipments, the reduction in general traffic noise, and the elimination of industrial activities. Future land-use decisions related to decontamination and decommissioning may produce noise issues not currently associated with the MTW.

- Historic and cultural resources—Decontamination and decommissioning activities will be conducted primarily in the restricted area. Therefore, the potential for impacts to undiscovered historic properties and cultural resources on the site is expected to be small. If the site is transferred to new ownership and undisturbed land is developed, impacts to historic properties or cultural resources could occur.

- Scenic and visual resources—Decontamination and decommissioning activities will increase activity at the MTW. However, visual impacts will be limited to the site property

and the area immediately surrounding the site. Over the long term, it is anticipated that the majority of the site will return to unrestricted use. Industrial development of the MTW site may occur, in which case scenic and visual impacts would likely be similar to those of current operations.

- Socioeconomics—A small, short-term, positive economic impact associated with employment of workers, local purchases of goods and services, and the continued payment of property taxes is anticipated during decontamination and decommissioning. Over the long term, there would be a minor negative socioeconomic impact as activities cease, employment at the MTW ends, and the local tax base and purchasing power of the community decreases.

- Public and occupational health— Chemical or radiological releases during demolition activities have the potential to impact public and occupational health. Honeywell will be required to implement the actions described in its NRC-approved decommissioning plan to protect the public and workers. Long-term impacts to public health are expected to be limited because the NRC-approved site decommissioning standards for radiological protection will protect the public health and safety, regardless of the future use of the site after decommissioning. In addition, Honeywell will continue to comply with RCRA requirements.

- Waste management—ENERCON estimates the disposal of about 11,800 cubic meters (416,000 cubic feet) of low-level radioactive waste from the MTW (ENERCON 2016). Disposal activities will also generate chemical and industrial wastes. All wastes requiring disposal will be disposed of at licensed disposal facilities; however, some materials will be repurposed or recycled, as appropriate.

In conclusion, short-term impacts during decontamination and decommissioning are anticipated, but these impacts are expected to be localized. Over the long term, the impacts associated with removing the MTW buildings from the site will depend on future land-use decisions. The ELUC imposes restrictions on land use. The NRC determined that overall impacts of decontamination and decommissioning of the MTW will not be significant. Even though the impacts of decontamination and decommissioning cannot be predicted precisely, these impacts are bounded by the NRC's assessment of past and future impacts from operations. When Honeywell submits a decommissioning plan, the NRC staff will conduct a technical review of the plan and prepare a detailed environmental analysis of the potential impacts associated with implementing it.

5 CUMULATIVE IMPACTS

Cumulative impacts are defined as "the impact on the environment that results from the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7, "Cumulative Impact"). The preceding sections discuss the potential impacts from the proposed action.

The cumulative impacts analysis does not separately address cumulative impacts specific to the reduced duration alternative or no-action alternative because the NRC staff determined that the types of potential cumulative impacts related to these alternatives would be the same as or less than those associated with the proposed action. The NRC staff considered an area of review for cumulative impacts within an 8-kilometer (5-mile) radius of the MTW site and the nearby Ohio River management projects because of the proximity of the river to the MTW site.

5.1 Past Actions

Past activities include the operation of the MTW since 1958 and the operation of the uranium enrichment facility at the DOE's PGDP across the Ohio River from the MTW site. In addition to assessing potential impacts from the proposed action, Chapter 4 of this EA analyzes environmental impacts from past activities at the MTW. Since the NRC published the 2006 EA (NRC 2006a) and accompanying SER (NRC 2006a), Honeywell made upgrades to its operations (see Section 2.2 of this EA). Because these upgrades either resulted in no changes to potential environmental impacts or reduced the potential impacts (e.g., through wastewater treatment system improvements; structural improvements to account for seismic and tornado risks), the NRC determined that these changes would not result in an increase in cumulative impacts associated with MTW.

The PGDP enriched uranium from 1952 to 2013 (DOE 2015) and is undergoing remediation that is scheduled to continue through the year 2040 (NCSL 2016). The PGDP has contaminated buildings, while chemicals such as trichloroethylene, polychlorinated biphenyl, technetium-99, and uranium have contaminated onsite and offsite groundwater, surface water, and soils. DOE is performing environmental cleanup activities to address the legacy impacts from PGDP operations. Because DOE is addressing environmental impacts from past PGDP operations, potential cumulative impacts to overlapping resource areas, such as groundwater, are expected to lessen with time. Subsurface impacts from MTW operations are limited to onsite areas, with no offsite excursions. For these reasons, the NRC concludes that the potential incremental impacts on the environment from continued MTW operation will not contribute significantly to cumulative impacts.

As described in Section 2.2 of this EA, a wood treatment facility in the eastern part of the site predated the establishment of the MTW. This facility was located adjacent to the inactive landfill area. Honeywell monitors groundwater in this area, which is referred to as the Old Creosoter Area (NRC 2018c). Remedial actions (excavation of soils in these areas and capping) have been completed; only administrative controls, such as the delineation of an ELUC, remain to be finalized (NRC 2018c). Because the environmental impacts from past operations have been or are being addressed, potential cumulative impacts to overlapping resource areas, such as soils or groundwater, are expected to lessen over time. The NRC concludes that the potential incremental impacts from continued MTW operation will not contribute significantly to cumulative impacts when the former and now remediated impacts in the Old Creosoter Area are considered.

5.2 Present Actions

Present and continuing activities include two nearby coal-burning power plants (TVA's Shawnee Steam Plant and EEI's Joppa Power Station), the Depleted Uranium Hexafluoride Conversion Facility located at the PGDP, and residential and agricultural uses (USDA 2012). The most significant environmental impact from the two power plants is the emission of air pollutants. Each power plant annually emits several million tons of carbon dioxide and thousands of tons of sulfur dioxide (CEC 2018). By comparison, the MTW's emissions are less than 1/100th of the emissions from the coal plants (see Table 2-3). Because air emissions from the MTW are small in comparison to the two power plants, the NRC concludes that the MTW will not contribute significantly to cumulative effects.

In addition, the two power plants emit 200 times more hydrogen fluoride into the atmosphere than the MTW site (Marschke and Gorden 2019). Chapter 2, Table 2-9, of this EA shows the concentrations of fluoride in vegetation. Because the power plants emit significantly more fluoride than the MTW, the concentrations of fluoride in vegetation are likely attributable to the power plants. Because the MTW contributes only a very small amount of fluoride to the air, the NRC concludes that the incremental impacts of fluoride emissions from the MTW would not contribute significantly to cumulative effects.

Both coal power plants have contributed to groundwater contamination (TVA 2018; Sierra Club 2018). Because the groundwater contamination from the MTW site is localized within the site boundary, the NRC concludes that the incremental groundwater impacts from the MTW would not contribute significantly to cumulative effects.

The PGDP's Depleted Uranium Hexafluoride Conversion Facility converts depleted uranium hexafluoride to a more stable form of uranium oxide powder. DOE determined in 2004 that the construction and operation of this facility would not result in significant cumulative impacts at the Paducah site and its vicinity (69 FR 44654; July 27, 2004) (DOE 2004b).

Continued residential and agricultural land use near the MTW site could result in soil, nutrients, and other pollutants continuing to enter the Ohio River as stormwater runoff. These land uses could contribute to fragmentation of wildlife habitat and introduce invasive species. Species with threatened, endangered, or declining populations are sensitive to declines in habitat availability and quality and to the introduction of invasive species. The NRC staff does not expect significant changes in land uses in the area during the license renewal period. For these reasons, the NRC staff concludes that impacts to the land would be similar to present-day conditions. Therefore, the small incremental impacts from the proposed action would not contribute significantly to cumulative impacts.

5.3 Reasonably Foreseeable Future Actions

As presented in Chapter 2, Section 2.3.10 of this EA, Honeywell submitted a final closure plan for four surface impoundments (calcium fluoride Ponds B, C, D, and E) to IEPA in March 2018 (Honeywell 2018d). The EPA and IEPA require that Honeywell remove wastes from calcium fluoride Ponds B, C, D, and E by the end of 2020 (Honeywell 2018d). In the long term, removal of these calcium fluoride ponds would eliminate a potential source of fluoride and uranium contamination, with the potential to reduce impacts to the Ohio River. The removal of trees and the construction of a rail spur to facilitate waste removal have the potential to contribute to the cumulative impacts on historic properties if unidentified historic properties are present on the rail spur site.

Regarding future activities, Massac County, IL, has not reported plans for significant economic development; however, the Illinois Department of Commerce recently designated the county as an enterprise zone (Hathcock 2017). The city of Metropolis is developing an industrial park and currently has one tenant (Metropolis 2018).

Investors are being sought to team with Cameco to build a global laser enrichment facility at PGDP (WNA 2016). Progress on developing and constructing the facility is on hold because of market conditions; PGDP has not yet submitted a license application to the NRC (NRC 2017e).

McCracken County, KY, is part of the Western Kentucky Economic Development Partnership, which proposed the development of two industrial properties near the MTW. The Ohio River Triple Rail Megasite is a planned transportation infrastructure site on the Kentucky side of the Ohio River between the Shawnee Steam Plant and PGDP. The site has 271 hectares (670 acres) of land available for development (KCED 2016a). Proposals have not yet been submitted to build facilities on this site (DOE 2015). The West Kentucky Chemical Site has 81 hectares (201 acres) of land for development (KCED 2016a). The most recent edition of the Kentucky New and Expanding Industries Report does not identify any planned new industrial plants or expansion of existing industrial plants in McCracken County (KCED 2016b).

The economic developments proposed for Kentucky and Illinois would increase industrial activities in the area near the MTW. However, the extent and types of potential industrial development over the next 40 years is extremely difficult to accurately predict. New industrial activities could result in additional air and water emissions, as well as soil, surface-water, and groundwater contamination, all of which could impact ecological resources and human health. In addition, future activities could bring beneficial socioeconomics impacts because of increased tax revenues and employment opportunities for the region. Negative impacts are expected to be minimal because the industrial development would be subject to Federal and State laws and regulations for the protection of the environment and human health, as well as government oversight. General land-use patterns will continue because economic development would likely remain in areas already designated as industrial. For these same reasons, potential impacts to scenic and cultural resources would be minimal. Increased industrial development could lead to increased residential and commercial development. However, estimates of the impacts of future industrial projects remain speculative. The NRC concludes that the incremental impacts associated with the proposed action on all resource areas would not be significant. Therefore, the proposed action's contribution to cumulative impacts also would not be significant.

The Olmsted Lock and Dam Works is a multibillion-dollar USACE construction project to replace two existing lock and dam structures along the Ohio River near the MTW site (USACE 2015): lock and dam 52, located approximately 11 kilometers (7 miles) upstream from the MTW near Brookport, IL, and lock and dam 53, located approximately 32 kilometers (18 miles) downstream from the MTW. The Olmsted replacement dam began operations in 2018 and is located approximately 1.6 kilometer (1 mile) downstream from lock and dam 53 (Glass 2018). Lock and dams 52 and 53 are planned to be removed by 2022 (Glass 2018). The lock and dam structures are designed solely for navigation purposes and not for flood control or water storage purposes. The dams produce small elevation changes to the natural level of the river. Therefore, the staff does not anticipate the dams would contribute to cumulative surface water impacts.

5.4 Conclusion

The NRC staff has assessed the potential incremental impacts of the proposed action in consideration with the past, present, and reasonably foreseeable future actions discussed above and has determined that the incremental impacts from the proposed action would not contribute significantly to cumulative impacts.

6 AGENCIES AND PERSONS CONSULTED

The NRC staff consulted with the Illinois State Historic Preservation Officer and invited 11 potentially affected American Indian Tribes to consult under the requirements of Section 106 of the NHPA. As part of the ESA Section 7 consultation process, the NRC staff contacted the USFWS to discuss the federally listed species that may occur near the MTW. The NRC staff also consulted with State of Illinois (IEPA staff) and with local officials. Table 6-1 provides a list of the documentation associated with these various contacts. The sections below summarize the consultation efforts with State agencies and Tribes under Section 106 of the NHPA.

6.1 State Historic Preservation Offices

The NRC notified the Illinois SHPO of the proposed Honeywell license renewal in a letter dated July 11, 2018 (ADAMS Accession No. ML18187A232), indicating the NRC's preliminary determination that the proposed license renewal would not affect cultural and historic resources. The Illinois SHPO concurred that no historic properties would be affected and stated it has no objection to continued Honeywell operations (ILDNR 2018b).

In addition, because the Honeywell MTW site is located along the Ohio River, which serves as the Illinois-Kentucky border, the NRC staff notified the Kentucky Heritage Council (KHC) of the proposed license renewal. The NRC staff discussed via telephone conversation the proposed license renewal with KHC staff on September 7, 2018. The KHC staff advised the NRC staff to document the staff's determination that the proposed action would not affect historic properties located in Kentucky and to submit the finding to the KHC. The NRC staff sent a letter to the KHC dated December 7, 2018, documenting this finding. The KHC responded by letter dated January 17, 2019, indicating its agreement that the proposed license renewal would not affect historic properties in Kentucky. These letters are listed in Table 6-1.

6.2 American Indian Tribes

The NRC staff initiated consultation with seven federally recognized American Indian Tribes by telephone in May and June of 2018, as indicated in Table 6-1. By letters dated July 3, 2018, the staff invited the seven Tribes to consult on the project. The staff sent project update letters to the seven tribes on August 23, 2018. Subsequently, the NRC initiated consultation by telephone in August and September and by letter dated September 7, 2018, with four additional Tribes, as shown in Table 6-1. The staff sent verifying e-mails to each of the Tribes as follow-up to the formal letters. Before publication of the draft EA in October 2018, the Osage Nation, Kaw Nation, Miami Tribe of Oklahoma, and Ponca Tribe of Oklahoma indicated their interest in consultation with the NRC on the proposed action. The Chickasaw Nation and the Shawnee Tribe of Oklahoma advised the NRC that consultation was not necessary. The communications between the consulting Tribes and the NRC staff are listed in Table 6-1. The NRC staff provided the text of the proposed license condition to the four consulting Tribes for their review (see text of license condition in Chapter 4, Section 4.1.8.2 of this EA). The Tribes had no comments on the license condition text.

Table 6-1 Documentation—Agencies and Persons Consulted

Agency or Person Consulted		Date of Contact or Correspondence	ADAMS Accession Number
Matt Mangan, USFWS		April 23, 2018, May 10, 2018, November 29, 2018	ML18177A062 ML19183A075
Illinois Environmental Protection Agency		June 26, 2018	ML18185A168
Mayor of the city of Metropolis and Chair of the Massac County Commission		May 31, 2017	ML17194B085
Illinois SHPO		July 11, 2018 November 9, 2018	ML18187A232 ML19081A271
Kentucky Heritage Council		September 7, 2018 December 7, 2018 January 17, 2019	ML18271A149 ML18338A443 ML19081A236
Telephone Calls to 7 Initially Identified Tribes	Miami Tribe of Oklahoma	June 8, 2018	All call logs in package ML18218A521
	Osage Nation	June 18, 2018	
	Peoria Tribe of Indians of Oklahoma	June 15, 2018	
	Kaw Nation	May 16, 2018	
	Ponca Tribe of Oklahoma	June 19, 2018	
	Omaha Tribe of Nebraska	June 8, 2018	
	Quapaw Tribe of Oklahoma	June 8, 2018	
Invitation letters to 7 Initially Identified Tribes	See list above	July 3, 2018	All letters in package ML18134A139
Update letters to 7 Initially Identified Tribes	See list above	August 23, 2018	All letters in package ML18227A094
Telephone Calls to 4 Additional Tribes	Chickasaw Nation	August 15, 2018	All call logs in package ML18218A521
	Shawnee Tribe of Oklahoma	September 5, 2018	
	Absentee-Shawnee Tribe of Oklahoma	September 5, 2018	
	Delaware Tribe of Oklahoma	September 5, 2018	
Invitation Letters to 4 Additional Tribes	See list above	September 7, 2018	All letters in package ML18240A038
Responses Received from Tribes	Osage Nation	July 27, 2018	All responses in package ML18221A120
	Kaw Nation	July 16, 2018	
	Ponca Tribe of Oklahoma	July 26, 2018	
	Miami Tribe of Oklahoma	August 6, 2018	
	Chickasaw Nation	September 26, 2018	
	Shawnee Tribe of Oklahoma	September 26, 2018	

7 CONCLUSION

In this EA, the NRC staff evaluated the potential environmental impacts of the proposed action and the alternatives to the proposed action in accordance with the requirements presented in 10 CFR Part 51. In conducting the evaluation, the staff considered information in the license amendment application; information in the responses to the staff's requests for additional information; communications with Honeywell, IEPA, Illinois SHPO, American Indian Tribes, and others as indicated in Chapter 6; information from NRC staff site visits; comments received during the draft EA public comment period (see Appendix B to this EA); and the NRC staff's independent analysis. Based on the information provided in this EA, the NRC staff concludes that the proposed action—the renewal of Honeywell's license for operations at the MTW for a period of 40 years—would not significantly affect the quality of the human environment.

Specifically, the proposed action would not have significant impacts on land use, transportation, geology and soils, surface water and groundwater resources, air quality, historic and cultural resources, scenic and visual resources, and waste management. Existing nonradiological groundwater contamination is limited to the MTW site and is being managed under the conditions of Honeywell's RCRA permit. Radiological data available for the groundwater monitoring programs administered under the conditions of Honeywell's RCRA permit indicate that the rare exceedances of MCLs for radiological parameters have been isolated. Resampling and reanalysis after each exceedance have demonstrated that the parameters in question are below the MCLs. Radiological soil and sediment contamination on the MTW site is temporary because at the time of decommissioning, Honeywell will meet the NRC's regulatory standards for unrestricted use, as stated in 10 CFR 20.1402, that correspond to a calculated dose to the public that is less than 0.25 mSv/yr (25 mrem/yr) from applicable pathways. Honeywell must also continue to meet IEPA requirements regarding investigation and remedial action in the event of a release of nonradiological materials, as well as limitations on future land use.

The NRC staff concludes that the proposed action would have a beneficial impact on the socioeconomic aspects of the area. Further, the staff concludes that there would be no disproportionately high and adverse impacts on minority or low-income populations. The staff also concludes that the proposed action is not likely to adversely affect federally listed species or federally designated critical habitat because no expansion or significant changes to the facility are planned, and MTW wastewater discharges will improve because of the EPF expansion and elimination of the calcium fluoride ponds. Airborne effluents released through stacks and liquid effluents released in the Ohio River are below regulatory limits for both nonradiological and radiological constituents.

The radiological dose associated with exposure to these effluents for the maximally exposed individual is less than the NRC's 1.0 mSv (100 mrem) annual limit. This dose is below the dose limit for individual members of the public specified in 10 CFR 20.1301, is less than the limit of 0.25 mSv/yr (25 mrem/yr) to the whole body established in 40 CFR 190.10, and less than the limit of 0.01 mSv/yr (10 mrem/yr) established in 10 CFR 20.1101(d) for a member of the public likely to receive the highest dose. Occupational doses are also well below regulatory limits. The NRC expects that Honeywell would continue to meet applicable local, State, and Federal requirements, including the requirements specified in its air and wastewater discharge permits.

The NRC staff concludes that the continuation of operations at the MTW for the 40-year license renewal term will not contribute significantly to cumulative impacts when added to the impacts of past, present, and reasonably foreseeable future actions. Honeywell's environmental monitoring programs are expected to provide information about existing contamination on the

MTW site and in the surrounding area. Continued monitoring, which is required, will help identify future unintended releases into the environment. Honeywell will be required to implement corrective actions to address the impacts of such releases, should they occur. The NRC expects that Honeywell will continue to meet all local, State, and Federal requirements.

The NRC staff evaluated the potential environmental impacts of the alternatives to the license renewal and concludes that potential impacts of the reduced duration alternative are bounded by the environmental impacts of the proposed action (see Chapter 4, Section 4.2, of this EA). In addition, the staff concludes that no significant environmental impacts are anticipated under the no-action alternative (see Chapter 4, Section 4.3, of this EA). However, under the no-action alternative, the cessation of operations at the MTW would result in the closure of the only facility within the United States that converts uranium ore to uranium hexafluoride. The closure of the MTW would have the potential to significantly impact the commercial nuclear fuel industry in the United States.

Based on the analyses in this EA, in accordance with 10 CFR 51.31, “Determinations Based on Environmental Assessment,” the NRC concludes that preparation of an environmental impact statement is not required for the proposed action, and in accordance with 10 CFR 51.32, “Finding of No Significant Impact,” a FONSI is appropriate. The NRC staff’s final determination will be published in the *Federal Register*.

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[2] References that include an ADAMS Accession Number are also available electronically through the NRC's ADAMS Web site at http://www.nrc.gov/reading-rm/adams.html. The documents can be viewed online or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD. For problems with ADAMS, contact the PDR staff at 301-415-4737 or (800) 397-4209; fax (301) 415-3548; or e-mail pdr.resource@nrc.gov.

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APPENDIX A

GROUNDWATER MONITORING DATA

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Groundwater Monitoring Data

A.1 Sanitary and Process Well Monitoring Program

Table A-1 Results of Monitoring Associated with Deep Water Wells (radiological)

Date	Alpha Activity (pCi/L)	Alpha Error (pCi/L)	Beta Activity (pCi/L)	Beta Error (pCi/L)
MCL	**15**	**NS**	**15**	**NS**
Sanitary Well				
2/9/2010	<1.3	<1.4	<1.2	<1.1
5/13/2010	<0.6	1.5	<2.8	2.3
7/21/2010	<1.3	1.8	<0.3	2.4
10/7/2010	<0.6	1.2	<0.32	0.59
4/6/2011	<3.09	1.68	<3.93	2.52
9/6/2011	<2.25	1.41	<3.23	2
10/5/2011	<1.7	1.28	<3.04	1.85
Process Well Number 3				
4/8/2011	<3.07	1.67	<4.06	2.53
9/6/2011	<2.37	1.47	<2.37	1.47
10/5/2011	<1.59	1.19	<3.27	2.05

MCL = maximum contaminant level, NS = not specified; pCi/L = picocurie per liter.
Source: ENERCON 2017a

A.2 Calcium Fluoride Pond Monitoring Well Program

Table A-2 Results of Groundwater Monitoring Associated with Calcium Fluoride Ponds (radiological)

Well ID	Year	Average Alpha Activity	Maximum Alpha Activity	Alpha Error (av)	Average Beta Activity	Maximum Beta Activity	Beta Error	Reference
G-101								
	2010	3.99	6.40	2.60	2.41	5.00	1.70	(a)
	2011	1.90	2.89	1.59	4.20	5.97	1.24	(a)
	2012	1.11	1.48	0.58	3.10	4.17	0.86	(a)
	2013	0.87	0.87	0.56	2.62	3.34	0.90	(a)
	2014	1.65	2.17	1.55	2.63	3.07	2.02	(a)
	2015	1.56	1.71		2.37	2.96		(c)
	2016	2.75	4.90		4.30	6.69		(c)
	2017	1.82	2.48		2.90	4.04		(c)
	2018	2.06	3.12		3.28	4.96		(c)
G-102								
	2010	3.77	5.50	2.80	2.31	3.30	1.80	(a)
	2011	2.69	4.17	1.96	3.57	6.02	1.37	(a)
	2012	1.05	1.05	0.57	2.75	3.60	0.97	(a)
	2013	<2.49	<2.49	1.47	2.44	3.39	0.91	(a)
	2014	<2.28	<2.28	1.33	2.88	3.50	1.13	(a)
	2015	1.22	1.43		2.00	2.26		(c)
	2016	1.97	2.24		2.74	2.94		(c)
	2017	1.68	2.30		2.81	3.49		(c)
	2018	2.24	2.70		2.63	2.77		(c)

Well ID	Year	Average Alpha Activity	Maximum Alpha Activity	Alpha Error (av)	Average Beta Activity	Maximum Beta Activity	Beta Error	Reference
G-103								
	2010	6.32	10.00	4.40	2.23	3.40	1.90	(a)
	2011	2.02	3.04	1.87	3.22	3.71	1.30	(a)
	2012	1.19	1.40	0.65	3.12	5.69	1.13	(a)
	2013	<0.98	<0.98	0.62	2.76	3.68	0.95	(a)
	2014	1.62	2.33	2.14	3.00	3.93	1.59	(c)
	2015	1.22	1.38		2.20	3.11		(c)
	2016	2.01	2.56		3.01	3.43		(c)
	2017	2.12	2.73		2.88	3.64		(c)
	2018	1.88	2.30		2.78	2.90		(c)
G-105 and G-111								
	2010	4.00	6.20	2.40	2.20	3.90	1.50	(a)
	2011	4.94	8.02	3.16	5.86	8.27	1.27	(a)
	2012	1.50	3.98	0.97	4.57	10.60	1.33	(a)
	2013	1.37	1.79	0.72	3.54	6.22	0.98	(a)
	2014	1.43	1.81	1.61	2.59	4.04	1.21	(c)
	2015	1.71	1.77		2.00	2.21		(c)
	2016	2.03	2.70		3.23	3.90		(c)
	2017	1.76	2.24		2.65	3.12		(c)
	2018	2.21	3.14		3.02	3.43		(c)
G-106 and G-112								
	2010	3.27	4.70	2.20	2.45	5.20	1.50	(a)
	2011	1.51	1.96	0.72	3.82	5.35	0.99	(a)
	2012	2.37	3.60	1.06	4.22	10.30	1.27	(a)
	2013	<1.02	<1.02	0.62	2.48	3.96	0.84	(a)
	2014	1.51	1.65	1.08	2.31	3.37	1.34	(c)
	2015	1.59	2.02		2.07	2.54		(c)
	2016	2.07	2.56		3.06	3.77		(c)
	2017	1.83	2.34		2.97	3.49		(c)
	2018	1.79	2.32		3.44	6.06		(c)
G-107								
	2010	5.25	8.20	3.00	3.81	6.00	1.30	(a)
	2011	<2.91	<2.91	2.39	2.38	2.82	0.91	(a)
	2012	<1.32	<1.32	0.69	2.66	3.62	1.09	(a)
	2013	<0.951	<0.951	0.65	2.29	2.95	0.86	(a)
	2014	1.83	2.37	1.71	2.74	3.84	1.37	(c)
	2015	1.54	2.34		2.20	3.42		(c)
	2016	2.01	2.60		2.90	3.07		(c)
	2017	2.04	2.91		3.03	3.29		(c)
	2018	2.15	2.85		3.70	5.37		(c)
G-108								
	2010	9.57	15.10	3.60	3.70	7.70	1.40	(a)
	2011	<2.77	<2.77	1.88	2.04	2.47	0.89	(a)
	2012	<1.55	<1.55	0.63	2.04	2.77	0.85	(a)
	2013	<0.851	<0.851	0.56	1.97	3.00	0.85	(a)
	2014	1.43	1.95	1.01	2.10	2.81	1.16	(c)
	2015	1.41	1.96		2.06	2.06		(c)

Well ID	Year	Average Alpha Activity	Maximum Alpha Activity	Alpha Error (av)	Average Beta Activity	Maximum Beta Activity	Beta Error	Reference
	2016	2.08	2.67		2.77	3.69		(c)
	2017	1.64	2.77		2.74	3.56		(c)
	2018	1.74	2.35		2.52	2.84		(c)
G-109								
	2013	1.46	2.20	0.81	3.71	5.95	1.03	(a)
	2014	<2.27	<2.27	1.23	3.21	4.32	1.40	(a)
G1B7								
	2013	1.44	2.14	0.84	3.90	4.89	2.87	(a)
	2014	<2.27	<2.27	1.38	3.43	3.74	1.27	(a)
R-104								
	2010	10.18	21.20	5.30	4.25	10.30	3.10	(a)
	2011	3.79	4.79	1.95	3.94	5.84	1.86	(a)
	2012	1.10	1.20	0.69	3.37	5.40	0.74	(a)
	2013	<1.28	<1.28	0.81	3.08	4.96	0.95	(a)
	2014	1.36	1.93	1.14	2.68	3.55	1.32	(a)
	2015	1.21	1.86		2.27	2.80		(c)
	2016	2.10	2.67		2.72	2.87		(c)
	2017	1.43	1.50		2.71	3.41		(c)
	2018	1.75	2.11		2.60	3.27		(c)
R-110								
	2010	5.70	11.50	3.50	5.75	14.70	2.30	(a)
	2011	<3.07	<3.07	1.92	1.65	2.00	0.82	(a)
	2012	<0.979	<0.979	0.60	2.31	3.10	0.99	(a)
	2013	<0.904	<0.904	0.57	1.73	2.20	0.87	(a)
	2014	0.65	0.65	0.62	2.33	2.54	1.08	(a)
	2015	1.14	1.48		2.22	2.53		(c)
	2016	1.81	2.37		2.58	2.78		(c)
	2017	1.91	2.92		2.99	3.58		(c)
	2018	2.11	3.04		2.68	2.83		(c)

a Source: ENERCON 2017b
b Source: ENERCON 2017c
c Developed from quarterly RCRA compliance reports listed in Table A-6 below.
Note: Hatched cells indicate no data available.

Table A-3 Results of Groundwater Monitoring Associated with Calcium Fluoride Ponds (nonradiological)

Well ID	Year	Average Fluoride	Maximum Fluoride	Average pH	Maximum pH	Average Specific Conductivity	Maximum Specific Conductivity	Reference
G-101								
	2010	0.28	0.33	6.6	7.2	575	905	(a)
	2011	0.3	0.35	7.1	8.0	542	659	(a)
	2012	0.28	0.32	6.5	6.8	464	519	(a)
	2013	0.25	0.29	6.3	6.6	508	555	(a)
	2014	0.3	0.38	6.7	6.7	594	831	(a)
	2015	0.295	0.33	6.8	7.5	582	796	(b)
	2016	0.3325	0.39	6.8	7.5	770	1668	(b)
	2017	0.2975	0.36	6.2	6.9	427	461	(b)
	2018	0.305	0.37	7.0	7.5	643	1100	(b)
G-102								
	2010	0.28	0.37	6.8	7.8	520	574	(a)
	2011	0.28	0.4	7.1	7.9	550	622	(a)
	2012	0.25	0.3	6.5	6.8	529	610	(a)
	2013	0.25	0.4	6.5	6.9	525	553	(a)
	2014	0.25	0.29	6.5	6.7	574	640	(a)
	2015	0.2325	0.25	6.8	7.5	547	605	(b)
	2016	0.2725	0.29	6.9	7.3	564	642	(b)
	2017	0.245	0.27	6.5	7.0	510	532	(b)
	2018	0.2375	0.29	6.7	7.3	578	740	(b)
G-103								
	2010	0.27	0.3	6.5	7.0	701	929	(a)
	2011	0.27	0.33	7.2	8.1	708	820	(a)
	2012	0.24	0.31	6.4	6.7	674	856	(a)
	2013	0.23	0.29	6.3	6.5	613	749	(a)
	2014	0.27	0.35	6.7	6.8	704	861	(a)
	2015	0.2425	0.26	6.8	7.4	677	744	(b)
	2016	0.29	0.31	7.0	7.9	638	715	(b)
	2017	0.2575	0.3	6.5	6.9	605	678	(b)
	2018	0.255	0.36	6.9	7.7	627	748	(b)
G-105 and G-111								
	2010	0.18	0.21	6.0	6.3	427	462	(a)
	2011	0.16	0.21	6.8	7.8	407	462	(a)

Well ID	Year	Average Fluoride	Maximum Fluoride	Average pH	Maximum pH	Average Specific Conductivity	Maximum Specific Conductivity	Reference
	2012	0.16	0.2	6.0	6.5	388	459	(a)
	2013	0.13	0.15	6.2	6.4	360	429	(a)
	2014	0.16	0.25	6.3	6.5	367	384	(b)
	2015	0.1575	0.17	6.4	7.1	374	407	(b)
	2016	0.175	0.19	6.5	6.8	433	463	(b)
	2017	0.1225	0.15	6.0	6.7	333	457	(b)
	2018	0.17575	0.26	6.4	6.8	414	515	(b)
G-106 and G-112								
	2010	0.26	0.28	6.5	6.7	474	482	(a)
	2011	0.23	0.28	7.0	7.2	491	513	(a)
	2012	0.22	0.27	6.2	6.7	487	499	(a)
	2013	0.21	0.24	6.4	6.6	490	508	(a)
	2014	0.25	0.31	6.5	6.8	490	546	(a)
	2015	0.225	0.23	6.9	7.5	539	631	(b)
	2016	0.26	0.27	7.4	9.1	456	484	(b)
	2017	0.235	0.25	6.5	7.1	464	490	(b)
	2018	0.225	0.25	6.8	7.3	488	517	(b)
G-107								
	2010	0.24	0.28	6.3	6.6	561	709	(a)
	2011	0.21	0.24	6.9	7.6	578	695	(a)
	2012	0.21	0.25	6.5	6.7	610	754	(a)
	2013	0.20	0.23	6.3	6.5	549	686	(a)
	2014	0.24	0.31	6.5	6.7	569	663	(a)
	2015	0.23	0.24	6.7	7.4	608	681	(b)
	2016	0.25	0.28	6.7	7.1	625	726	(b)
	2017	0.22	0.26	6.4	7.0	567	801	(b)
	2018	0.22	0.25	6.7	7.0	582	710	(b)
G-108								
	2010	0.19	0.21	6.5	7.1	513	578	(a)
	2011	0.19	0.27	7.0	8.0	549	617	(a)
	2012	0.17	0.20	6.0	6.6	525	589	(a)
	2013	0.16	0.20	6.1	6.5	494	503	(a)
	2014	0.20	0.31	6.5	6.6	538	626	(a)
	2015	0.17	0.18	6.7	7.4	570	723	(b)
	2016	0.21	0.23	6.6	6.8	505	621	(b)

Well ID	Year	Average Fluoride	Maximum Fluoride	Average pH	Maximum pH	Average Specific Conductivity	Maximum Specific Conductivity	Reference
	2017	0.17	0.20	6.6	7.4	493	516	(b)
	2018	0.17	0.21	6.7	7.3	517	581	(b)
G-109								
	2013	0.19	0.22	6.35	6.53	519	569	(a)
	2014	0.22	0.26					(a)
G1B7								
	2013	0.21	0.23					(a)
	2014	0.24	0.26					(a)
R-104								
	2010	0.22	0.25	6.5	6.9	558	596	(a)
	2011	0.21	0.24	6.9	8.0	568	600	(a)
	2012	0.20	0.24	6.4	6.6	549	599	(a)
	2013	0.19	0.22	6.3	6.5	590	622	(a)
	2014	0.26	0.34	6.5	6.5	545	564	(a)
	2015	0.32	0.39	7.2	8.5	599	748	(b)
	2016	0.33	0.46	6.7	7.2	515	561	(b)
	2017	0.33	0.42	6.6	7.4	567	607	(b)
	2018	0.31	0.38	6.8	7.3	559	595	(b)
R-110								
	2010	0.15	0.20	6.0	6.5	536	613	(a)
	2011	0.15	0.22	6.9	7.9	511	577	(a)
	2012	0.15	0.20	6.3	6.8	543	622	(a)
	2013	0.11	0.12	6.0	6.2	576	610	(a)
	2014	0.13	0.16	6.2	6.3	621	660	(a)
	2015	0.12	0.15	6.4	7.3	687	885	(b)
	2016	0.12	0.14	6.7	7.6	607	697	(b)
	2017	0.12	0.20	6.1	6.6	547	704	(b)
	2018	0.12	0.19	6.6	7.2	659	735	(b)

a ENERCON 2017b
b ENERCON 2017c
c Developed from quarterly RCRA compliance reports listed in Table A-6 below.
Note: Hatched cells indicate no data available.

A.3 Inactive Landfill Monitoring Program

Table A-4 Results of Groundwater Monitoring at the Inactive Landfill (Radiological)

Well ID	Year	Average Alpha Activity	Maximum Alpha Activity	Alpha Error (av)	Average Beta Activity	Maximum Beta Activity	Beta Error	Reference
SU-1122								
	2016	1.44	1.96	0.78	2.20	2.32	1.37	(c)
	2017	1.20	1.57	0.92	2.31	2.99	1.50	(c)
	2018	1.46	2.45	1.09	2.87	3.18	1.49	(c)
SU-1126								
	2015	0.35	1.39	1.05	1.83	3.47	1.31	(c)
	2016	1.44	1.96	1.16	2.58	2.91	1.48	(c)
	2017	1.20	1.57	1.25	3.35	4.14	1.54	(c)
	2018	1.46	2.45	1.48	2.57	3.61	1.46	(c)
SU-1129								
	2015	0.44	1.29	0.70	1.85	2.78	1.11	(c)
	2016	1.51	1.90	0.85	2.40	2.90	1.38	(c)
	2017	2.12	4.39	1.28	3.74	7.42	1.70	(c)
	2018	1.83	2.20	1.23	2.69	3.69	1.52	(c)
SU-1142								
	2015	0.34	1.35	0.72	1.58	2.52	1.18	(c)
	2016	1.44	1.71	0.79	1.91	2.18	1.27	(c)
	2017	0.96	1.25	0.72	1.99	2.02	1.26	(c)
	2018	1.24	2.15	0.63	1.88	2.16	1.22	(c)
SU-1143								
	2015	0.50	2.01	0.83	1.50	2.29	1.26	(c)
	2016	1.44	1.79	1.02	2.19	2.29	1.39	(c)
	2017	1.01	1.30	0.74	1.85	2.08	1.23	(c)
	2018	1.53	2.58	1.14	2.65	3.40	1.45	(c)
SU-1144								
	2015	0.50	2.01	0.85	0.00	0.00	1.26	(c)
	2016	1.60	2.12	0.97	2.24	2.26	1.41	(c)
	2017	1.17	1.34	0.94	2.34	3.54	1.33	(c)
	2018	1.06	1.68	0.82	1.97	2.18	1.30	(c)
SU-1145								
	2015	0.48	1.90	0.72	0.94	2.28	1.16	(c)

Well ID	Year	Average Alpha Activity	Maximum Alpha Activity	Alpha Error (av)	Average Beta Activity	Maximum Beta Activity	Beta Error	Reference
	2016	1.26	2.05	0.88	2.10	2.29	1.40	(c)
	2017	2.23	4.70	1.22	4.17	9.55	1.72	(c)
	2018	1.77	3.47	1.15	2.23	2.98	1.36	(c)
SU-1146								
	2015	0.69	1.99	0.74	0.00	0.00	1.08	(c)
	2016	1.28	1.63	0.93	2.00	2.38	1.28	(c)
	2017	1.04	1.58	0.73	1.85	2.09	1.20	(c)
	2018	1.03	1.46	0.71	1.94	2.07	1.21	(c)

a ENERCON 2017b
b ENERCON 2017c
c Developed from quarterly RCRA compliance reports listed in Table A-6 below.

Table A-5 Results of Groundwater Monitoring at the Inactive Landfill (Nonradiological)

Well ID	Year	Average pH	Maximum pH	Average Specific Conductivity	Maximum Specific Conductivity	Reference
SU-1122						
	2014	5.9	6.1	288	335	(c)
	2015	6.0	6.2	343	578	(c)
	2016	5.8	6.1	302	388	(c)
	2017	6.0	6.5	268	300	(c)
	2018	6.3	6.7	267	282	(c)
SU-1126						
	2014	6.0	6.1	355	380	(c)
	2015	6.0	6.2	405	651	(c)
	2016	6.0	6.2	359	397	(c)
	2017	6.0	6.6	331	345	(c)
	2018	6.2	6.6	342	363	(c)
SU-1129						
	2014	5.9	6.5	268	296	(c)
	2015	5.8	6.0	344	595	(c)
	2016	6.0	6.3	278	311	(c)
	2017	5.7	6.3	265	276	(c)
	2018	6.0	6.5	270	280	(c)
SU-1142						
	2014	6.1	6.2	318	400	(c)
	2015	6.0	6.3	356	632	(c)
	2016	5.9	6.5	298	367	(c)
	2017	5.8	6.5	280	309	(c)
	2018	6.2	6.7	266	282	(c)
SU-1143						
	2014	6.0	6.1	309	324	(c)
	2015	6.1	6.2	366	616	(c)
	2016	6.1	6.3	324	344	(c)
	2017	6.0	6.6	321	331	(c)
	2018	6.1	6.5	300	317	(c)
SU-1144						
	2014	6.0	6.0	353	436	(c)
	2015	6.1	6.2	402	662	(c)
	2016	6.2	6.5	333	358	(c)
	2017	6.0	6.6	330	343	(c)
	2018	6.2	6.6	325	331	(c)
SU-1145						
	2014	5.8	5.9	341	425	(c)
	2015	5.9	6.1	368	597	(c)
	2016	6.0	6.0	326	341	(c)
	2017	6.0	6.5	305	329	(c)
	2018	6.1	6.4	312	319	(c)
SU-1146						
	2014	6.1	6.2	348	451	(c)
	2015	6.2	6.4	374	602	(c)
	2016	6.0	6.4	331	356	(c)
	2017	6.0	6.6	310	364	(c)
	2018	6.1	6.4	314	362	(c)

a ENERCON 2017b
b ENERCON 2017c
c Developed from quarterly RCRA compliance reports listed in Table A-6 below.

Table A-6 References of Quarterly Reports by Honeywell

Year/Quarter	ID of Quarterly RCRA Report for Ponds and Landfill to IEPA
2015/1	127854002-Massac County Honeywell International Inc., ILD006278170. First Quarter 2015 RCRA Groundwater Monitoring Results
2015/2	file not available
2015/3	127854002-Massac County Honeywell International Inc., ILD006278170. Third Quarter 2015 RCRA Groundwater Monitoring Results. Third Quarter 2015 Landfill Groundwater Monitoring Results
2015/4	file not available
2016/1	127854002-Massac County Honeywell International Inc., ILD006278170. First Quarter 2016 RCRA Groundwater Monitoring Results. First Quarter 2016 Landfill Groundwater Monitoring Results
2016/2	127854002-Massac County Honeywell International Inc., ILD006278170. Second Quarter 2016 RCRA Groundwater Monitoring Results. Second Quarter 2016 Landfill Groundwater Monitoring Results
2016/3	127854002-Massac County Honeywell International Inc., ILD006278170. Third Quarter 2016 RCRA Groundwater Monitoring Results. Third Quarter 2016 Landfill Groundwater Monitoring Results
2016/4	127854002-Massac County Honeywell International Inc., ILD006278170. First Quarter 2016 RCRA Groundwater Monitoring Results. First Quarter 2016 Landfill Groundwater Monitoring Results
2017/1	127854002-Massac County Honeywell International Inc., ILD006278170. First Quarter 2017 RCRA Groundwater Monitoring Results. First Quarter 2017 Landfill Groundwater Monitoring Results
2017/2	127854002-Massac County Honeywell International Inc., ILD006278170. Second Quarter 2017 RCRA Groundwater Monitoring Results. Second Quarter 2017 Landfill Groundwater Monitoring Results
2017/3	127854002-Massac County Honeywell International Inc., ILD006278170. Third Quarter 2017 RCRA Groundwater Monitoring Results. Third Quarter 2017 Landfill Groundwater Monitoring Results
2017/4	127854002-Massac County Honeywell International Inc., ILD006278170. First Quarter 2017 RCRA Groundwater Monitoring Results. First Quarter 2017 Landfill Groundwater Monitoring Results
2018/1	127854002-Massac County Honeywell International Inc., ILD006278170. First Quarter 2018 RCRA Groundwater Monitoring Results. First Quarter 2018 Landfill Groundwater Monitoring Results
2018/2	127854002-Massac County Honeywell International Inc., ILD006278170. Second Quarter 2018 RCRA Groundwater Monitoring Results. Second Quarter 2018 Landfill Groundwater Monitoring Results
2018/3	127854002-Massac County Honeywell International Inc., ILD006278170. Third Quarter 2018 RCRA Groundwater Monitoring Results. Third Quarter 2018 Landfill Groundwater Monitoring Results
2018/4	127854002-Massac County Honeywell International Inc., ILD006278170. First Quarter 2018 RCRA Groundwater Monitoring Results. First Quarter 2018 Landfill Groundwater Monitoring Results

A.4 References

ENERCON 2017a, "Environmental Report, Renewal of Source Materials License SUB 526," Table 3.4-11a, "Analysis of Compliance Parameters in Deep Water Wells (Radiological)," Enercon Services, Inc., February 8, ADAMS Accession No. ML17048A244.

ENERCON 2017b, "Environmental Report, Renewal of Source Materials License SUB 526," Table 3.4-12, "Historical RCRA Compliance Monitoring Data -Alpha and Beta Activity," Enercon Services, Inc., February 8, ADAMS Accession No. ML17048A244.

ENERCON 2017c, "Environmental Report, Renewal of Source Materials License SUB 526," Table 3.4-13, "Historical RCRA Compliance Monitoring Data - Fluoride, pH, and Specific Conductivity," Enercon Services, Inc., February 8, ADAMS Accession No. ML17048A244.

APPENDIX B

PUBLIC COMMENTS ON THE DRAFT ENVIRONMENTAL ASSESSMENT
FOR THE PROPOSED RENEWAL OF SOURCE MATERIAL LICENSE SUB–526
METROPOLIS WORKS URANIUM CONVERSION FACILITY
(MASSAC COUNTY, ILLINOIS)

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ABBREVIATIONS AND ACRONYMS

ADAMS	Agencywide Documents Access and Management System
ALARA	as low as is reasonably achievable
ALI	annual limits on intake
AOC	area of concern
CFR	*Code of Federal Regulations*
DAC	derived air concentration
EA	environmental assessment
EIS	environmental impact statement
ELUC	environmental land use control
ENERCON	Enercon Services, Inc.
EPF	environmental protection facility
FONSI	Finding of No Significant Impact
FR	*Federal Register*
Honeywell	Honeywell International, Inc.
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
IL	Illinois
mrem	millirem
mSv	milliSieverts
MTW	Metropolis Works Plant
NEPA	National Environmental Policy Act
NOA	Notice of Availability
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
ppm	parts per million
SUB-526	Source Materials License SUB-526
TEDE	total effective dose equivalent
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
yr	year

Public Comments on the Draft EA for the Proposed Renewal of the License for the Metropolis Works Uranium Conversion Facility

B.1 Overview

This appendix discusses the public participation process for the U.S. Nuclear Regulatory Commission (NRC) staff's environmental review of the proposed renewal of source material license SUB-526 to authorize Honeywell to continue operation of a uranium hexafluoride processing plant at the Metropolis Works Plant (MTW) in Massac County, Illinois (IL), for up to 40 years. This appendix also summarizes the comments received on the NRC's draft Environmental Assessment (EA) and draft Finding of No Significant Impact (FONSI) regarding the renewal and provides the NRC staff's response to those comments.

B.2 Public Participation

This section describes the opportunities afforded the public to participate in the NRC staff's development of the EA.

B.2.1 Issuance and Availability of the Draft EA and Draft FONSI

On October 31, 2018, the NRC staff published a Notice of Availability (NOA) and request for comment for the draft EA and draft FONSI in the *Federal Register* (Volume 83 of the *Federal Register*, page 54787 (83 FR 54787)). By this notice, the staff requested public review and comment on the draft EA and draft FONSI and set November 30, 2018, as the closing date for submitting public comments.

Electronic versions of the draft EA, draft FONSI, and supporting information were made accessible through the NRC Agencywide Documents Access and Management System (ADAMS) Web site. The public also had the opportunity to examine and have copied, for a fee, the draft EA, draft FONSI, and other related publicly available documents from the NRC Public Document Room. Finally, copies of the draft EA and the draft FONSI were also made available at the Metropolis Public Library in Metropolis, IL.

B.2.2 Public Comment Period

In the October 31, 2018 NOA, the NRC staff invited members of the public to submit comments on the draft EA and draft FONSI either electronically to the Federal Rulemaking Web site or by email, U.S. postal mail, or facsimile to addresses provided in the NOA over a 30-day period ending on November 30, 2018. The NRC staff received five written comment documents through the Federal Rulemaking Web site, email, or postal mail. All comments submitted after the deadline were considered.

B.3 Comment Identification and Review Methodology

The NRC staff identified a total of 49 comments from the five comment documents received. Each of the identified comments is included in the following comment summaries and addressed in the corresponding NRC staff responses.

To aid in the identification and sorting of comments, the NRC staff used a two-part numbering system. The first part of a specific comment's number corresponds to the document within which the comment was identified. The second part of a specific comment's number identifies its relative order within the comment document. For example, Comment 1-2 identifies the second comment (2) in the first comment document addressed by NRC staff (1), while Comment 5-1 identifies the first comment (1) in the fifth comment document addressed by NRC staff (5).

Table B-1 lists the commenter names, their affiliations (when provided), the comment document number assigned to their comment letter, and the ADAMS Accession Number for the commenter letter. Readers can use the ADAMS Accession Numbers provided in this table to electronically search for the comments on the NRC's public Web site. Table B-2 provides similar information to that provided in Table B-1 but is sorted by comment document number in the first column. In addition, this table identifies the number of comments the NRC staff identified in each comment document.

Table B-1 Public Commenter Name, Affiliation, Comment Document Number, and ADAMS Accession Number

Last Name	First Name	Affiliation	Comment Document Number	ADAMS Accession Number
Appleman	Robert	Illinois Department of Natural Resources	2	ML19081A271
Dragovich	Theodore	Illinois Environmental Protection Agency	4	ML19260E832
Mangan	Matthew	U.S. Department of the Interior, U.S. Fish and Wildlife Service	3	ML18334A202
Munkres	James	Osage Nation Historic Preservation Office	1	ML19008A030
Osborn	Harold	Illinois Emergency Management Agency	5	ML18337A199

Table B-2 Number of Comments Attributed to Each Comment Document

Comment Document Number	Last Name	First Name	Affiliation	Number of Comments
1	Munkres	James	Osage Nation Historic Preservation Office	3
2	Appleman	Robert	Illinois Department of Natural Resources	1
3	Mangan	Matthew	U.S. Department of the Interior, U.S. Fish and Wildlife Service	1
4	Dragovich	Theodore	Illinois Environmental Protection Agency	14
5	Osborn	Harold	Illinois Emergency Management Agency	30

Following the identification and numbering of comments, each comment was assigned a topic category based on the content and issues raised in the comment. This allowed the NRC staff to

facilitate sorting and reviewing comments that raised similar issues. The topic categories used are those provided as headings in Section B.5.

When appropriate, the NRC staff consolidated the same or similar comments received either from an individual commenter or from multiple commenters within each topic to develop responses. This approach allowed multiple comments that were the same or similar to be addressed in a single response to avoid duplication of effort and to enhance readability of this appendix. The NRC staff developed a response for each comment or group of comments and indicated as part of that response whether the EA was modified as a result of the comment or comments.

The NRC staff acknowledges the comments made on the draft EA and draft FONSI and appreciates the commenters' participation in the NRC staff's environmental review process.

B.4 Major Issues and Topics of Concern

All comments received specifically addressed items within the scope of the EA.

Topics raised included a variety of concerns about the following topics:

- general
- environmental monitoring program
- land use
- transportation
- geology and soils
- water resources
- ecology
- air quality
- noise
- historic and cultural resources
- public and occupational health
- safety
- waste management
- environmental impact accumulation

B.5 Comments and NRC Responses

This section provides detailed comment responses. The structure of this section is based on the NRC staff's categorization of the comment topics. Within each topic-specific section, the detailed presentation of comment and response information includes the applicable comment identification numbers and the NRC staff's response.

B.5.1 General

Comment 5-24

One commenter noted that EA Section 2.1, "General Site Location," incorrectly refers to Figure 1-2 to illustrate the restricted area. The commenter indicated that this is most likely a transcription error and the reference should be changed to Figure 2-1.

Response: *The NRC agrees with the comment. In response to this comment, the NRC revised the first paragraph of Section 2.1 to refer to Figure 2-1 instead of Figure 1-2.*

B.5.2 Environmental Monitoring Program

Comment 5-7

A commenter noted that EA Figure 2-5, "Environmental Monitoring Sampling Locations for Surface Water, Sediment, Soil, and Vegetation," does not display all of the sample locations listed in Table 2-7, 'Sediment Monitoring Annual Averages.' The commenter noted specifically the sample locations for the effluent channel and the sampling points labelled as North of FMB, West of FMB, South of FMB, Northwest of FMB, East of FMB, North of FMB, and Nearest Resident are missing from Figure 2-5. The commenter also noted inconsistencies in the labeling of locations in Figure 2-5 and Table 2-6, "Surface Water Monitoring Annual Averages."

Response: *Figure 2-5 shows offsite sampling locations while EA Figure 2-4, "Environmental Air, Soil, and Vegetation Sampling Locations," focuses on sampling locations on the MTW site. In response to this comment, the NRC revised Figure 2-4 and Figure 2-5 to show the location of all sampling locations shown in the tables and to ensure consistency in labeling*.

Comment 5-16

A commenter stated that he was not able retrieve radiological environmental monitoring data for MTW from the NRC Web site. The commenter also noted that Source Material License SUB-526 does not include a specific requirement to report this data and recommended that MTW annually report this data, as is required for nuclear power stations.

Response: *As stated in EA Section 2.3.9.1, "Effluent Monitoring Program," Honeywell is required to submit semiannual reports to the NRC summarizing effluent releases in accordance with 10 CFR 40.65(a), which states that "…the report must specify the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents during the previous six months of operation." These reports are available in NRC's ADAMS document system using the search term "facility effluent report," as well as the Honeywell docket number (04003392) and license number (SUB-0526) as search criteria. To make it easier for the public to find these reports, the NRC can make the reports available upon request or provide their ADAMS accession numbers for retrieval from ADAMS. Staff members in the NRC's Public Document Room are available to assist with searches for documents in ADAMS (see https://www.nrc.gov/reading-rm/pdr.html).*

EA Table 2-5 summarizes the environmental monitoring programs, including the sample medium (i.e., air, soil, vegetation, ambient radiation, surface water, groundwater, and sediment), analytical frequency (i.e., weekly, monthly, quarterly, and semiannually), and type of analysis performed. The NRC does not require that these data be reported to the NRC; however, data must be made available upon request during inspections of the MTW conducted by NRC Region II inspectors. In addition, Honeywell provided these data in its environmental report (ENERCON 2017). The NRC staff did not make changes to the EA as a result of this comment.

Comment 4-4

A commenter stated that the first paragraph of EA Section 2.3.9.2, "Environmental Monitoring Program," indicates that Honeywell employs three groundwater contaminant monitoring

programs at the MTW but that there are four monitoring programs at the MTW, when the Old Creosoter Area groundwater detection monitoring program is counted. The commenter recommended the following revision to the first paragraph of Section 2.3.9.2: "Honeywell employs four groundwater contaminant monitoring programs at the MTW, including the sanitary well monitoring program, the process wells under routine monitoring, the Old Creosoter Area detection monitoring program, and the inactive landfill monitoring program…"

In addition, the commenter noted that groundwater monitoring results for any of the four programs are not provided or discussed within Section 2.3.9.2.

Response: *The NRC staff did not include the Old Creosoter Area detection monitoring program in the draft EA because it is not associated with NRC-licensed activities. However, the NRC staff agrees that the Old Creosoter Area detection monitoring should be added to completely describe groundwater monitoring programs ongoing within the MTW site boundary. In response to this comment, the NRC staff revised EA Section 2.3.9.2 to describe the Old Creosoter Area, its relationship to the MTW, and its detection monitoring program.*

In response to the commenter's observation that the draft EA does not provide or discuss groundwater monitoring data, the NRC staff added an appendix (Appendix A) to the final EA that contains groundwater data associated with monitoring the sanitary well monitoring program, process well monitoring program related to the RCRA calcium fluoride ponds, and the inactive landfill monitoring program. The NRC staff did not add groundwater monitoring data to Appendix A for the Old Creosoter Area because data is not readily available and contamination in this area is not associated with MTW operations. Section 2.3.9.2 includes a discussion of groundwater monitoring results.

Comment 4-5

A commenter recommended the text in the first bullet point in the Groundwater Monitoring section within EA Section 2.3.9.2 be revised to make editorial changes and identify the Illinois Department of Public Health as the agency responsible for regulating the sanitary and process wells at the MTW. The commenter recommended the following revised text: "The first program monitors both the sanitary well and process well #3, which are tested for inorganic constituents, volatile organic compounds, radionuclides, and general parameters, including pH, turbidity, chlorine, total coliform, and fecal coliform. These two wells are regulated by the Illinois Department of Public Health as non-transient non-community water supply wells."

Response: *The NRC staff revised Section 2.3.9.2 as the commenter recommended.*

Comment 4-6

A commenter stated that the surface impoundments (i.e., calcium fluoride ponds B, C, D, and E) have a single liner with a leachate collection system, but the second bullet point in the Groundwater Monitoring section within EA Section 2.3.9.2 states that the calcium fluoride ponds have a two-part liner. The commenter also suggested adding a statement indicating the Illinois Bureau of Land regulates the monitoring program for these RCRA units.

Response: *The two-part liner system referred to in the second bullet point in EA Section 2.3.9.2 consists of an ethylene propylene diene monomer liner and a clay layer. In response to this comment, the NRC staff revised the text in the second bullet point in Section 2.3.9.2 to delete reference to a two-part liner system and instead specified that the calcium fluoride ponds have an*

ethylene propylene diene monomer liner and a clay layer. In addition, the NRC staff added a sentence indicating that the monitoring program for the calcium fluoride ponds is regulated by the Illinois Environmental Protection Agency Bureau of Land.

Comment 4-7

A commenter recommended that the NRC make editorial changes in the third bullet point in the Groundwater Monitoring section within EA Section 2.3.9.2. The commenter also recommended stating the Illinois Environmental Protection Agency Bureau of Land is the regulator for the RCRA program at the inactive landfill area.

Response: *In response to this comment, the NRC staff revised the third bullet point in Section 2.3.9.2. These revisions clarify that the IEPA Bureau of Land regulates the inactive landfill, made minor editorial changes, and referred to EA Appendix A for related groundwater data.*

Comment 4-8

A commenter stated that text in the first paragraph after the bullet points in the Groundwater Monitoring section within EA Section 2.3.9.2 refers to EA Figure 2-6, "Location of Groundwater Monitoring Wells Associated with the Calcium Fluoride Ponds," for the locations of the groundwater wells for the sanitary well and process well monitoring, the calcium fluoride pond monitoring program, and inactive landfill area monitoring program. However, the commenter noted that Figure 2-6 does not show the wells for the landfill monitoring program. In addition, the commenter noted that the figure does not show monitoring well locations for the Old Creosoter Area monitoring program.

Response: *In response to this comment, the NRC staff revised the EA to illustrate the location of groundwater monitoring wells in two figures that cover all known active monitor wells at the facility: an updated Figure 2-6 and a new Figure 2-7. Figure 2-6 shows groundwater monitoring wells across the western half of the facility, including the Restricted Area and wells downgradient. Figure 2-7 shows groundwater monitoring wells across the eastern half of the facility, including the Inactive Landfill and the Old Creosoter Area.*

Comment 4-9

A commenter noted that EA Table 2-5 does not include groundwater monitoring programs.

Response: *In response to this comment, the NRC staff revised Table 2-5 to include the four groundwater monitoring programs conducted at the MTW including the sanitary well monitoring program, process well monitoring program, inactive landfill monitoring program, and Old Creosoter Area monitoring program.*

Comment 4-10

A commenter stated that in the last sentence of the Groundwater Monitoring section of EA Section 2.3.9.2, the RCRA groundwater corrective action associated with the underground process sewers should be described as an ongoing inspection, and not closure, of the process sewers.

Response: *The NRC staff agrees that the RCRA corrective action measures currently being undertaken should be described as an ongoing inspection. In response to this comment, the NRC staff revised the Process Sewers section of Section 2.3.9.2 to replace the term "closure" with "ongoing inspection."*

B.5.3 Land Use

Comment 5-15

A commenter stated that the MTW should perform an annual land use census to verify whether conditions are changing over the term of the proposed 40-year license renewal. The commenter specifically expressed concerns that, at some time in the future, the Ohio River could be used as a drinking-water supply, mussel beds associated with federally threatened and endangered species might develop in the river, and farmers might use the river for irrigation downstream of the MTW. The commenter further stated that the draft EA does not identify the source of drinking water for the nearest residence.

Response: *EA Section 5.3, "Reasonably Foreseeable Future Actions," identifies and assesses the potential impacts associated with reasonably foreseeable future actions. Neither the NRC staff nor the commenter identified any reasonably foreseeable future actions (such as those identified in a water use report or other planning documents from, for example, the Ohio River Valley Water Sanitation Commission) associated with using the Ohio River as a drinking-water supply or as a source of irrigation water. Regardless, as presented in the Doses from Liquid Effluent Releases section within EA Section 4.1.11.1, "Public Health and Safety," any doses that could be received by drinking water from the Ohio River would be far less than the primary drinking water standard in 40 CFR Part 141, "National Primary Drinking Water Regulations," and the standards in 10 CFR Part 20, "Standards for Protection against Radiation," and 40 CFR Part 190 "Environmental Radiation Protection Standards for Nuclear Power Operations." As shown in EA Table 2-6, the presence of uranium in the Ohio River outside the mixing zone of Outfall 002 is predominantly below detection limits. The NRC staff concludes that performing an annual land use census in support of this EA is not necessary.*

Concerning the potential for mussel beds to develop, the NRC staff revised EA Section 4.1.5.1, "Terrestrial," to state that the U.S. Fish and Wildlife Service (USFWS) concurs that the proposed license renewal is not likely to adversely affect wildlife resources (USFWS 2018). However, the NRC staff recognizes that a localized impact on benthic (bottom-dwelling) organisms could occur in the mixing zone of Outfall 002 because of the potential for higher concentrations of uranium in sediments in that location, depending on MTW operations and storm events. Upon reviewing historical data from previous MTW license renewal applications, the NRC staff observed that uranium concentrations in sediments and surface water at the MTW outflow at Outfall 002 can be highly variable, with available historical values ranging from 0.2 parts per million (ppm) to 34.4 ppm. Elsewhere in the Ohio River, sediment samples have generally remained less than 3 ppm (Marschke and Gorden 2019), and there are no significant differences between concentrations upstream and downstream of the MTW site. Uranium concentrations in surface water outside the mixing zone at the MTW outflow at Outfall 002 consistently remain near or below the uranium detection limit of 0.001 ppm, with no apparent differences between upstream and downstream values.

In response to this comment, the NRC staff revised EA Section 4.1.4.1, "Surface Water and Sediments," to summarize the NRC staff's analysis of uranium concentrations in sediments and surface water of the Ohio River, as described above.

B.5.4 Transportation

Comment 5-8

A commenter stated that EA Table 4-1, "Estimated Highway and Rail Fatalities," appears to incorrectly list kilometers and miles in the second column when compared to the Annual Risk of Fatalities in the last column. The commenter recommended evaluating Table 4-1 for adequacy.

Response: *The NRC staff reviewed Table 4-1 and agrees that the values for annual mileage provided in the second column of Table 4-1 are reversed between English and metric units. In response to this comment, the NRC staff corrected the mileage values to show that 6,300,000 kilometers (3,900,000 miles) of commuting plus truck shipments were evaluated, and 497,000 kilometers (309,000 miles) of rail shipments were evaluated. The annual risks of fatalities of 0.043 fatality for commuting plus truck shipments, and 0.003 fatality for rail shipments as shown in the third column of Table 4-1 are correct and remain unchanged for the final EA.*

B.5.5 Geology and Soils

Comment 4-11

A commenter noted that the second paragraph in the Process Sewers section of EA Section 2.3.9.2 should be revised to state that remedial measures included repairing (not filling) the trenches in the GF_2 building. The commenter clarified that the trenches that were filled were in the GF_2 South building because this building is no longer in use. The commenter also stated that Honeywell is required to establish an institutional control and environmental land use control for area of concern (AOC)-1 and that no further remediation is required for AOC-2 (sump SU-562).

Response: *In response to this comment, the NRC staff revised the text in Section 2.3.9.2 that describes remedial measures Honeywell has undertaken for the process sewers to reflect the commenter's clarifications regarding the remedial measures associated with AOC-1 and AOC-2.*

Comment 4-12

A commenter noted that the Process Sewers section of EA Section 2.3.9.2 states that the MTW will continue its soil investigation. The commenter requested the NRC to clarify that this should refer to investigations of the process sewers, and that soil investigation would be conducted only if warranted. The commenter further clarified that the phrase "additional areas of groundwater contamination" in Section 2.3.9.2 should be replaced with "contamination."

Response: *In response to this comment, the NRC staff revised the text in Section 2.3.9.2 to state that the MTW will continue its investigation under the Sewer Inspection & Maintenance Plan authorized by the IEPA, and that if ongoing investigations identify contamination, Honeywell will delineate the new areas of concern and undertake corrective actions under the authority of the IEPA.*

Comment 5-1

A commenter referred to the discussion of soil sampling in the Soil and Vegetation Monitoring section within EA Section 2.3.9.2 and the annual average uranium concentration in soil provided in EA Table 2-8, "Soil Monitoring Annual Averages, 2010–2014." Specifically, the commenter

disagreed with the following text in that section: "Sampling results from 2010 through 2014 show constant uranium concentrations in soils at the nearest residence ranging from 5.21 to 9 ppm. Uranium concentrations at other offsite locations have not fluctuated significantly during those years." The commenter stated that uranium concentrations measured at the nearest residence appear to have increased from 2010 through 2014 and that in 2014, the measured uranium concentration value is 15 times the preoperational value of 0.6 ppm. The commenter recommends further explanation and evaluation of the validity of the soil sample results provided in the draft EA.

Response: *The NRC staff reviewed uranium concentration data from the nearest residence location for the years 2006 through 2018 to determine if there is a discernable trend over time in uranium concentrations (Marschke and Gorden 2019). Upon review, the NRC staff determined that a trend could not be established because the data over these years are highly variable.*

Regarding the commenter's statements that the uranium concentrations in soils at the nearest residence are up to 15 times the preoperational value for uranium in soil (0.6 ppm), after further investigation, the NRC staff has determined that the naturally occurring value should be 3 ppm, as determined in the response to Comment 5-4 (see below). Assuming the naturally occurring value for uranium is 3 ppm, the peak values of uranium in soil at the nearest residence are about 6 times greater than naturally occurring uranium soil concentrations. The mean value at the nearest residence between 2006 and 2018 was about 3 times greater than naturally occurring uranium soil concentrations. The NRC will continue to require that Honeywell monitor the soil uranium concentration at the nearest residence. The Dose to the Maximally Exposed Individual section within EA Section 4.1.11.1 shows that, when considering all pathways (i.e., external exposure, inhalation, and ingestion), the total effective dose equivalent (TEDE) to the maximally exposed individual (at the nearest residence) is 0.0217 milliSieverts per year (mSv/yr) (2.17 millirem per year (mrem/yr)). This potential exposure is less than the limit of 1 mSv/yr (100 mrem/yr) in 10 CFR 20.1301(a), less than the limit of 0.25 mSv/yr (25 mrem/yr) to the whole body established in 40 CFR 190.10, and less than the limit of 0.01 mSv/yr (10 mrem/yr) established in 10 CFR 20.1101(d) for a member of the public likely to receive the highest dose.

In response to this comment, the NRC staff revised the text in Section 4.1.3, Geology and Soils, to describe the NRC staff's analysis of the peak values of uranium in soil at the nearest residence as described above.

Comment 5-2

A commenter noted that the 2010 uranium concentration in soil at the Reiniking property is 6.65 ppm, as shown in EA Table 2-8. The commenter stated that this is an unusually high result when compared to most other sample locations. The commenter questioned the accuracy of this value and noted that it is approximately 11 times the preoperational soil concentration of 0.6 ppm that the NRC had previously established (NRC 2006). The commenter recommended that the NRC further evaluate this validity of the soil sample result.

Response: *The MTW uses a laboratory certified under the National Environmental Laboratory Accreditation Program and the Nuclear Procurement Issues Corporation; this laboratory is also certified by a number of States (Marschke and Gorden 2019). The NRC staff, therefore, has confidence in the laboratory results for the environmental samples at the offsite locations surrounding the MTW site. The NRC staff also reviewed uranium soil concentrations from 1999 through 2018 for the offsite sampling locations. Because of the variability of the data, the NRC*

staff could not make any determinations regarding trends in contaminant concentrations at the offsite locations over time (Marschke and Gorden 2019).

As discussed in the response to Comment 5-4 below, the NRC staff has determined that the naturally occurring value for uranium in soil should be 3 ppm. Assuming the naturally occurring value for uranium is 3 ppm, the peak value of uranium in soil at the Reiniking property is about 2 times greater than naturally occurring uranium soil concentrations.

In response to this comment, the NRC staff revised the text in Section 4.1.3, Geology and Soils, to state that statistically significant trends, either increasing or decreasing, could not be identified at the offsite locations because of the variability in the data at each of the offsite locations.

Comment 5-4

A commenter noted that the Soil and Vegetation Monitoring section within EA Section 2.3.9.2 lists a soil preoperational uranium soil concentration of 0.6 ppm. The commenter stated that this value appears low when compared to other scientific references. The commenter cited the Health Physics Society uranium fact sheet (HPS 2018), which states that uranium soil concentrations in the United States typically are about 3 ppm, or about 2 picocuries per gram. The commenter noted that the uranium fact sheet also references a 2005 U.S. Geological Survey (USGS) map that indicates that the region where the MTW site is located has a uranium soil concentration of about 2 ppm. The commenter also noted that data from historical soil sampling by the Illinois Emergency Management Agency are consistent with the USGS values. The commenter recommended that the NRC further evaluate the use of 0.6 ppm as a preoperational value for uranium concentrations in the soil.

Response: *The NRC staff reviewed available literature regarding background uranium soil concentrations. This literature included information from IEMA regarding background concentrations in Kincaid, IL, uranium soil concentrations from nearby industrial sites (e.g., the Westinghouse Hematite site in Hematite, MO, Mallinckrodt Chemical Works in St. Louis, MO, and Paducah Gaseous Diffusion Plant in Paducah, KY), and literature from the USGS. Based on this review (Marschke and Gorden 2019), the NRC staff agrees with the information provided in the comment and has determined that the background soil concentration should reflect the IEMA-recommended value of 3 ppm. In response to this comment, the NRC staff revised Section 2.3.9.2 to reflect a preoperational uranium soil concentration of 3 ppm.*

Comment 5-23

A commenter recommended that the NRC insert two USGS maps in EA Section 3.3.3, "Seismicity," that are merely referenced in that section of the draft EA. Specifically, the commenter recommended including a map that identifies the MTW site as lying within an area with a risk of approximately 1 to 2 percent chance in 2018 for a potentially minor-damage ground shaking (referenced in the draft EA as USGS 2018a), and a map that identifies the MTW site within a zone that has a 2-percent probability of exceedance in 50 years of relatively significant peak ground acceleration (referenced in the draft EA as USGS 2018b).

Response: *In response to this comment, the NRC staff revised EA Section 3.3.3 to include the two USGS maps referenced in the draft EA as USGS 2018a and USGS 2018b. Respectively, these maps are titled, "Chance of Potentially Minor-Damage Ground Shaking in 2018," and "Two-Percent Probability of Exceedance in 50 Years Map for Peak Ground Acceleration."*

Comment 5-28

A commenter noted that the Soil and Vegetation Monitoring section within EA Section 2.3.9.2 states that soil fluoride concentrations at the nearest residence were at or below 1.8 ppm, and that this contradicts EA Table 2-8, which lists a fluoride soil concentration of 2.6 ppm in 2013. The commenter recommended correcting this inconsistency.

Response: *The NRC staff agrees that the paragraph in Section 2.3.9.2 should be revised to state that soil concentrations of fluoride at the nearest residence were at or below 2.6 ppm. In response to this comment, the NRC staff revised Section 2.3.9.2 accordingly.*

B.5.6 Water Resources

Comment 5-9

A commenter stated that descriptions of liquid effluent flow paths in the draft EA appear to be conflicting. The commenter noted that EA Section 4.1.4.1, states the following: "Most of the uranium hexafluoride process related liquid effluents from the MTW are discharged through Outfall 002 into the Ohio River." The commenter asserted this statement "implies other process liquid effluent release outfalls exist at a site where there are several outfalls listed on NPDES IL0004421." The commenter noted that, in contrast, the Doses from Liquid Effluent Releases section within EA Section 4.1.11.1 states the following: "Liquid wastes are discharged to the Ohio River via one monitored release point, NPDES Outfall 002. Two other outfalls discharge storm water to the Ohio River." The commenter noted that the statements in EA Section 4.1.11.1 also appear to contradict the information in EA Section 3.4.1.1, "Features and Flow Characteristics," which states the following: "Four creeks are located outside of the restricted area, as indicated in Figure 3-4. Three of the creeks have intermittent flow from storm water runoff. The fourth creek receives discharges from NPDES Outfall 002, resulting in continuous flow." The commenter stated it is unclear how National Pollutant Discharge Elimination System (NPDES) Outfall 002 receives discharges from a creek. The commenter recommended that the NRC clarify these statements in the final EA.

Response: *In response to this comment, the NRC staff revised EA Section 3.4.1.1 and Section 4.1.5.2, "Aquatic," to refer to three creeks and one channel to differentiate the surface water feature leading to Outfall 002 from the other creeks (or streams). The channel refers to the water feature "R4SBC" shown in EA Figure 3-1, "Environmental Land Use Control Boundary and Surface Water Features" that discharges to Outfall 002. The NRC staff revised Figure 3-1 and other sections of the EA to refer to this feature as a channel, including EA Section 2.4, "Decontamination and Decommissioning," EA Section 3.1.1, "MTW Site," EA Section 3.4.1.2, "Quality and Use," EA Section 4.1.4.1, and EA Section 4.1.13, "Environmental Impact Accumulation from the Proposed Action." The NRC staff also revised EA Section 4.1.4.1 to reflect that all liquid process effluents are sent to Outfall 002.*

Comment 5-10

A commenter stated that EA Figure 3-4, "Surface Water Features," includes undefined labels for what apparently are wetlands and creeks. The commenter recommended defining these locations and identifying which creek discharges to NPDES Outfall 002, as mentioned in EA Section 3.4.1.1. In addition, the commenter recommended combining EA Figures 3-1 and 3-4 for clarity.

Response: *The NRC staff agrees that the labels for wetland designations in Figure 3-4 of the draft EA should be defined. The wetlands are defined as follows (USFWS 2017):*

- *PF01A—freshwater forested/shrub wetland*
- *PF01Ah—freshwater forested/shrub wetland modified by a manmade barrier that obstructs the inflow or outflow of the water.*
- *R4SBC—intermittent, seasonally flooded riverine streambed*
- *PUBHx—constructed pond*
- *PUSCx—constructed pond*

None of the labels for the streams can be further defined based on USFWS available information.

In response to this comment, the NRC staff combined Figures 3-1 and 3-4 of the draft EA to create a new Figure 3-1 for the final EA and added the above wetland descriptions to the key of the new figure.

Comment 5-25

A commenter stated that Section 3.5.2.4 of the licensee's environmental report (ENERCON 2017) states that a portion of the site is in the 500-year floodplain, but EA Section 3.4.1.1 references only the 100-year flood level. The commenter observed that the 100-year flood stage of 103 meters (337 feet) was exceeded twice in the past 80 years and, thus, recommended that the final EA include the more conservative flood assessment of a 500-year flood stage. The commenter noted that this is important since the licensee is allowed to store hazardous chemicals and source material onsite.

Response: *EA Section 3.1.1 states that the site is at an elevation of between 91 and 116 meters (300 and 380 feet) above mean sea level. The restricted area is on an alluvial terrace about 18 meters (60 feet) above the floodplain of the Ohio River and, for comparison, the probable elevation of the 100-year flood is 103 meters (338 feet) above mean sea level (NRC 2006a). In response to this comment, the NRC staff revised Section 3.1.1 to state that the 500-year floodplain is 104 meters (341 feet) above mean sea level (FEMA 2018). The NRC staff also revised Section 3.4.1.1 to address the 500-year floodplain in relation to the southern portion of the MTW site and the eastern portion of the MTW site where the inactive landfill and Old Creosoter Area are located. Both the inactive landfill and the Old Creosoter Area are above the 500-year floodplain.*

Comment 5-29

A commenter noted that EA Chapter 7, "Conclusion," states the following: "Existing groundwater contamination is limited to the MTW site and is being managed under conditions of Honeywell's RCRA permit." The commenter stated that, despite this statement, EA Table 2-5 and EA Figure 2-5 do not include groundwater sampling or sample locations. The commenter further noted that EA Figure 2-6 includes sample locations for 3 deep wells and 1 sanitary well but sample results are not provided. The commenter noted that the second bullet point in the Chlorinated Solvent/Arsenic Area section within EA Section 2.3.9.2 states the following: "Groundwater cannot be used as a potable water supply with the environmental land use control (ELUC) area," but Chapter 7 states that groundwater samples offsite are needed to ensure groundwater contamination is limited to the MTW site.

The commenter recommended adding groundwater sample results to the final EA and adding offsite (nearest residence) groundwater sample locations to the environmental monitoring program to ensure groundwater contamination is contained within the MTW site during the 40-year license extension period.

Response: *EA Figure 2-6 shows the location of the wells associated with the sanitary well monitoring program (labeled as the sanitary well and deep well in the figure), and the process well monitoring program (labeled as monitoring well hazardous waste in the figure). In this program, Honeywell only collects data from the sanitary well and deep well #3 because these wells are used for potable water; wells #1 and #2 are strictly for obtaining process water (ENERCON 2017, Section 3.4.7). In response to this comment, the NRC staff added Figure 2-7 in the final EA to show the locations of wells associated with the inactive landfill and Old Creosoter Area. The NRC staff revised EA Table 2-5 to include the groundwater monitoring programs, including the constituents monitored, and added Appendix A to the final EA to show groundwater monitoring data associated with the sanitary monitoring well monitoring program, process well monitoring program, and the inactive landfill monitoring program. The NRC staff did not add groundwater monitoring data to Appendix A for the Old Creosoter Area because data are not readily available and contamination in this area is not associated with MTW operations.*

If continued monitoring at the MTW site indicates in the future that contaminants are present in the groundwater and could be migrating offsite, then the NRC staff would require offsite monitoring at that time. Further, because the Ohio River is considered a major groundwater divide, at least for shallow aquifers, the NRC staff does not expect that groundwater would migrate beyond the Ohio River via the shallow aquifers. The nearest residence using groundwater for domestic purposes is upgradient topographically and hydraulically of the MTW. Therefore, the NRC staff does not expect groundwater to become contaminated at the nearest residence.

B.5.7 Ecology

Comment 3-1

A commenter stated that, based upon information in the draft EA regarding fish and wildlife resources, the USFWS has no objection to the proposal renewal. Regarding threatened and endangered species, the commenter expressed the USFWS's concurrence that, based on information in draft EA, the proposed license renewal is not likely to adversely affect the gray bat, Indiana bat, northern long-eared bat, and least tern. The commenter also stated that, based on the information provided in the draft EA, the USFWS concurs that the proposed license renewal is not likely to adversely affect federally listed mussel resources and is not likely to result in destruction or adverse modification of critical habitat for the rabbitsfoot mussel. Finally, the commenter stated that consultation or additional coordination with the USFWS should be initiated if the proposed action is modified or if new information indicates that listed or proposed species may be affected.

Response: *The NRC staff acknowledges the USFWS's concurrence regarding the impacts to fish and wildlife resources and to threatened and endangered species. In response to this comment, the NRC staff revised EA Table 6-1, "Documentation—Agencies and Persons Consulted," to reference this comment letter.*

Comment 5-3

A commenter stated that vegetation sample results for uranium were unusually high in 2011 at all sample locations, as shown in EA Table 2-9, "Vegetation Monitoring Annual Averages, 2010–2014," and that the draft EA does not discuss these unusual spikes. The commenter stated that the sample results for 2010 and 2011 appear to be questionable when compared to preoperational data and sample results from 2013 and 2014, except for vegetation samples from the nearest residence in 2013. These 2013 vegetation results were approximately 28 times the preoperational value for uranium in vegetation of 0.28 ppm. The commenter recommended further explanation and evaluation of the vegetation sample results.

Response: *As noted in the response to Comment 5-2 in Section B.5.5 of this appendix, the MTW uses a laboratory certified under the National Environmental Laboratory Accreditation Program and the Nuclear Procurement Issues Corporation. The NRC staff, therefore, has confidence in the laboratory results for the environmental samples at the offsite locations surrounding the MTW site. The NRC staff reviewed historical data from 2000 through 2018 for uranium concentrations in vegetation at the offsite sampling locations and compared these measurements against reported MTW air emissions (Marschke and Gorden 2019). The NRC staff could not identify a correlation between peaks in uranium concentrations in vegetation and peaks in air emissions. The NRC staff also reviewed meteorological data to determine if the spikes in uranium concentrations in vegetation could be attributed to wind patterns but could not identify such a correlation. The NRC staff compared uranium soil concentration to uranium vegetation concentrations for four of the offsite locations that had vegetation uranium concentration peaks in 2011. As a result of this comparison, the NRC staff concluded that it could take two to three years before increased soil uranium concentrations result in an increase in vegetation concentrations based on this data (Marschke and Gorden 2019). The NRC will continue to* require *that Honeywell monitor the vegetation uranium concentration at offsite locations.*

Comments 5-13 and 5-18

The commenter noted that EA Section 4.1.5.2 states that sediment sampling results in EA Table 2-7 indicate increasing uranium concentrations for the years 2010 through 2014. The commenter also noted that EA Section 3.4.1.2 states that the Ohio River "supports aquatic life, public water supply, and contact recreation" and that certain fish are covered under a fish consumption advisory. The commenter stated that periodic fish sampling is not included in the MTW's radiological environmental monitoring program despite consumption warnings and increasing uranium concentrations in sediment, and that the draft EA does not give a preoperational sediment value. The commenter recommended including fish sampling as part of the MTW's radiological environmental monitoring program and establishing a baseline and preoperational sediment value in the EA. The commenter also stated that the discussion of collective dose in EA Section 4.1.11 does not mention fish consumption as a pathway for liquid effluent dose. The commenter recommended adding this pathway to the discussion, if applicable.

Response: *Based on information obtained from the Ohio River Valley Sanitation Commission, there is no commercial fishing in the Ohio River. Consumption of fish from the Ohio River is currently limited to one meal per month from recreational fishing because of the presence of nonradiological contaminants such as polychlorinated biphenyls and mercury (ORSANCO 2017). There are no specific regulatory requirements for 10 CFR Part 40, "Domestic Licensing of Source Material," licensees to perform fish sampling. The NRC staff was not able to identify*

any data from other Federal, State, or river management organizations concerning radionuclides in Ohio River fish for this geographic area.

The NRC staff recognizes that there may be a localized impact on benthic (bottom-dwelling) organisms in the effluent mixing zone in the river at Outfall 002 because of the potential that higher concentrations of uranium in sediment could occur, depending on MTW operations and storm events (see Section 4.1.5.2). The NRC staff reviewed uranium concentrations in sediment provided in historical records from as early as 1979.

Over the last four decades, while uranium concentrations vary from less than 1 ppm to about 35 ppm in the plant outflow, uranium concentrations in sediments upstream (at the Brookport Dam), across the river opposite the MTW site, and downstream (at the Joppa boat ramp) have remained consistently below 3 ppm (Marschke and Gorden 2019), with no significant differences between upstream and downstream concentrations.

Uranium concentrations in surface water in the localized area where Outfall 002 discharges to the Ohio River have historically ranged from 0.01 ppm to 0.145 ppm, but surface water directly across the river and upstream and downstream have not exceeded 0.057 ppm, with uranium concentrations being unmeasurable (less than 0.001 ppm) from 2011 through 2014 (Marschke and Gorden 2019).

In response to these comments, the NRC staff revised EA Section 4.1.4.1 to add detail to the discussion of impacts in Ohio River sediments and surface water.

Comment 5-30

A commenter noted that the draft EA states that the State of Illinois does not have an applicable fluoride standard, but that the State of Kentucky does have a standard at Title 401 of the Kentucky Administrative Regulations "Ambient Air Quality," Section 010, "Ambient Air Quality Standards." The commenter stated that semiannual vegetation sample results for 2012 (as shown in EA Table 2-9) indicate significant spikes in all the offsite sample results for fluoride, and that these spikes warrant further investigation.

Response: *The primary source of fluoride in vegetation is the absorption of airborne fluoride, not fluoride absorbed from the soil (Marschke and Gorden 2019). The NRC staff reviewed possible industrial sources of airborne fluoride, including nearby sources other than the MTW site (Marschke and Gorden 2019). The NRC staff found that two coal-fired power plants near the MTW site, the Tennessee Valley Authority's Shawnee Steam Plant directly across the Ohio River from the MTW site, and the Electric Energy, Inc., power plant (Joppa Power Station), emit significantly more airborne fluoride than the MTW, sometimes 200 times more hydrogen fluoride than the MTW (Marschke and Gorden 2019). Thus, the presence and variability of fluoride in vegetation at offsite locations cannot be attributed to a single source, and it is likely that these power plants are the primary contributors. The NRC staff did not identify any literature documenting the effects of fluoride on vegetation in the region surrounding the MTW.*

In response to this comment, the NRC staff revised the cumulative impacts discussion presented in EA Section 5.2, "Present Actions," to include fluoride as an air pollutant from these two power plants and to state that the incremental impacts of fluoride emissions from the MTW would not contribute significantly to cumulative effects when considering these other major sources.

B.5.8 Air Quality

Comment 5-14

A commenter noted that EA Section 3.6.2, "Air Quality," states the following: "MTW released 18,489 metric tons (20,381 short tons) of carbon dioxide in 2014…which is about 0.0000008 percent of the State total emissions." The commenter's opinion is that this should state "0.008 percent."

Response: *The NRC staff agrees with the comment and has made the correction in Section 3.6.2 of the final EA to "0.008 percent."*

B.5.9 Noise

Comment 5-20

A commenter noted that EA Section 3.7.2, "Existing Levels at the MTW Site," states that Honeywell has not performed noise surveys at the boundary of the restricted area, and that no ambient noise survey data are available for the area around the MTW site. The commenter stated that Illinois Administrative Code Title 35, "Procedural and Environmental Rules," Section 901.102(b), "Sound Emitted to Class A Land" (35 IAC 901.102b) provides that "[s]ound pressure levels must be measured at least 25 feet from the property line noise source." The commenter recommended that noise levels be measured as required by this Illinois regulation.

Response: *Honeywell will perform noise surveys at the site boundary to show compliance with 35 IAC 901, "Sound Emission Standards and Limitations for Property Line Noise Sources." In response to this comment, the NRC staff revised EA Section 4.1.7, "Noise," to state that Honeywell will perform noise surveys at the site boundary when the MTW resumes operations.*

B.5.10 Cultural Resources

Comment 1-1

The commenter stated that the Osage Nation should not be referred to as the Osage Nation of Oklahoma.

Response: *EA Section 3.8.2, "Tribal Associations for the Metropolis Works Site," shows the name of the Osage Nation as "Osage Nation of Oklahoma." In response to this comment, the NRC staff revised EA Section 3.8.2 to correct the name to "Osage Nation."*

Comment 1-2

The commenter noted that the NRC has proposed to add a condition to Honeywell's materials license (SUB-526) to ensure proper identification and protection of cultural resources for the proposed licensing term, as described in EA Section 4.1.8.2, "Cultural Resources in the MTW Area of Potential Effect." The commenter concurred with this proposal. The commenter requested that it be contacted and consulted if Honeywell proposes any modifications to the site, including construction or ground-disturbing activities.

Response: *The NRC staff acknowledges the commenter's concurrence with the proposed addition of the license condition. If there are any modifications to the site associated with*

NRC-regulated activities and that include construction or ground-disturbing activities, the NRC staff will conduct consultations with American Indian Tribes as necessary. The NRC staff did not make any changes to the EA based on this comment.

Comment 1-3

The commenter expressed an interest in reviewing and commenting on the final EA.

Response: *The NRC staff acknowledges the commenter's interest in this EA. NEPA regulations do not require agencies, including the NRC, to address public comments on a final EA; however, the NRC always welcomes public input on its licensing actions.*

The NRC staff did not make any changes to the EA based on this comment.

Comment 2-1

The commenter determined that based upon the information in the draft EA, no historic properties are affected, and the commenter has no objection to the undertaking proceeding as planned.

Response: *The NRC staff acknowledges the commenter's determination. In response to this comment, the NRC staff revised EA Section 4.1.8.1, "National Register of Historic Places Listed or Eligible Properties Outside the Area of Potential Effect," and EA Section 6.1, "State Historic Preservation Offices," to reflect this determination.*

B.5.11 Public and Occupational Health

Comment 5-5

A commenter stated that the draft EA did not evaluate the public dose limits in 10 CFR 20.1101(d), and only references 40 CFR Part 190 and 10 CFR 20.1301, "Dose Limits for Individual Members of the Public Dose Limits. The commenter provided the text of this regulation, as follows:

> Pursuant to 10 CFR 20.1101(d), to implement the ALARA requirements of 10 CFR 20.1101 (b), and notwithstanding the requirements in 10 CFR 20.1301, a constraint on air emissions of radioactive material to the environment, excluding radon-222 and its daughters, shall be established by licensees other than those subject to 10 CFR 50.34a, such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 0.1 milliSievert (mSv) (10 mrem) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in 10 CFR 20.2203 and promptly take appropriate corrective action to ensure against recurrence.

The commenter recommended the EA further evaluate MTW compliance with these limits.

Response: *The Dose to the Maximally Exposed Individual section within EA Section 4.1.11.1 describes the location of the maximally exposed individual and identifies the calculated dose to that individual. The maximally exposed individual is the nearest resident. The estimated TEDE to that individual, as shown in EA Section 4.1.11.1, is 0.0217 mSv/yr (2.17 mrem/yr) from all*

radionuclides and all pathways. This estimated dose is less than the 10 CFR 20.1101(d) TEDE limit of 0.1 mSv/yr (10 mrem/yr) for air emissions for a member of the public likely to receive the highest dose. In response to this comment, the NRC staff revised the Dose to the Maximally Exposed Individual section within Section 4.1.11.1 to state that the estimated radiation dose to the maximally exposed individual of 0.0217 mSv/yr is less than the dose limit identified in 10 CFR 20.1101(d).

Comment 5-11

A commenter stated that the Doses from Direct Radiation section within EA Section 4.1.11.1 does not address the dose limits of 40 CFR Part 190, Subpart B, "Environmental Standards for the Uranium Fuel Cycle," which includes direct dose as well as dose from gaseous and liquid effluents, and specifies an annual whole-body dose equivalent limit of 0.25 mSv (25 mrem). The commenter recommended including an evaluation of 40 CFR Part 190 dose limits with regard to public dose in the final EA.

Response: *EA Section 4.1.11.1 focuses on measured direct radiation exposures at the MTW site boundary. A discussion of compliance with 40 CFR Part 190, Subpart B, is more appropriate in the Dose to the Maximally Exposed Individual section within EA Section 4.1.11.1, which includes the dose from all pathways. In response to this comment, the NRC staff revised this section to state that the estimated radiation dose to the maximally exposed individual of 0.0217 mSv/yr (2.17 mrem/yr) is less than the dose to the whole-body limit of 0.25 mSv/yr (25 mrem/yr) established in 40 CFR 190.10.*

Comment 5-12

One commenter stated that several sections in the EA that refer to liquid and gaseous effluents do not include a discussion or evaluation of 10 CFR Part 20, Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage." The commenter specifically referred to the following sections in the draft EA:

- EA Section 4.1.5.2 states that the volume of water discharged from Outfall 002 is negligible (0.0015 percent) when compared to the average flow of the Ohio River but does not discuss liquid effluent concentration limits.

- EA Section 3.11.2, "Public Health and Safety," does not include a discussion of 10 CFR Part 20, Appendix B, effluent concentration limits for liquid or gaseous effluent releases.

- EA Section 4.1.5.3, "Threatened, Endangered, Proposed, and Candidate Species," states that routine operating procedures leave minimal opportunity for direct exposure of local biota and their prey to unacceptable levels of chemicals or radioactive material because emissions are in accordance with NRC limits but does not clearly reference the specific 10 CFR Part 20, Appendix B, effluent concentration limits.

- EA Section 4.1.6.2, "Radiological Air Quality Impacts," points to the 0 CFR Part 20 release limits but does not specifically state which limits are being referenced.

The commenter recommended including a discussion on liquid and gaseous effluent concentration limits as provided in 10 CFR Part 20, Appendix B, if applicable.

Response: *The commenter stated that Section 4.1.5.2 does not discuss liquid effluent concentration limits. However, the NPDES permit for the MTW does not specify any effluent limits for uranium, as shown in EA Table 2-4, "Summary of Outfall 002 Monitoring." There are no regulatory limits for liquid effluent that would be associated with protecting aquatic organisms.*

Section 3.11.2 refers to exposure limits in 10 CFR Part 20 for occupational and public exposures and 40 CFR Part 190 for public exposures. According to 10 CFR 20.1302, "Compliance with Dose Limits for Individual Members of the Public," compliance with the 1 mSv (0.1 rem) dose limit for an individual member of the public specified in 10 CFR 20.1301(a)(1) must be demonstrated either by measurement or calculation that the TEDE to the individual likely to receive the highest dose does not exceed the annual dose limit, or by showing that the annual average concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in Table 2 of 10 CFR Part 20, Appendix B. In the EA, the NRC staff chose to demonstrate compliance with the dose limit in 10 CFR 20.1301(a)(1) using the calculated TEDE to the maximally exposed individual as described in EA Section 4.1.11.1. This calculated dose is less than the 1 mSv (0.1 rem) dose limit.

Section 4.1.5.3 addresses threatened, endangered, proposed, and candidate species. The effluent limits in 10 CFR Part 20, Appendix B, are not applicable to biota other than humans; however, it is generally accepted that regulatory limits protective of humans are also protective of other biota. The NRC staff compared air and water effluent concentrations to 10 CFR Part 20, Appendix B, values for natural uranium and concluded that any doses to members of the public from these effluents would not exceed the 10 CFR 20.1301 limits.

As the commenter noted, Section 4.1.6.2 states that MTW is subject to 10 CFR Part 20. The NRC staff agrees that Sections 4.1.6.2 and 4.1.11.1 should be revised to specifically reference 10 CFR 20.1101(d), 10 CFR 20.1301, and 40 CFR Part 190. In response to this comment, the NRC staff revised EA Sections 4.1.6.2 and 4.1.11.1 to cite 10 CFR 20.1301 and 40 CFR Part 190.

Comment 5-17

The commenter stated that semiannual effluent reports issued by MTW do not include effluent dose calculations to the maximally exposed individual and collective public radiation exposure. The commenter recommended that MTW annually report the results of its radioactive effluent dose calculations, similar to nuclear power stations, and that these reports include dose to the maximally exposed individual, collective dose, and a discussion of the assumptions and pathways considered.

Response: *The regulations in 10 CFR Part 40 do not require performing and reporting effluent dose calculations. EA Section 4.1.11.1 summarizes dose calculations performed as part of the license renewal process. Honeywell's calculated dose to the maximally exposed individual from radiological air emissions is 0.0217 mSv/yr (2.17 mrem/yr), which is about 50 times less than the limit of 1 mSv/yr (100 mrem/yr) the NRC established in 10 CFR Part 20, about 12 times less than the dose to the whole-body limit of 0.25 mSv/yr (25 mrem/yr) established in 40 CFR Part 190, and about 5 times less than the limit of 0.01 mSv/yr (10 mrem/yr) established in 10 CFR 20.1101(d) for a member of public likely to receive the highest dose. In response to this comment, the NRC staff revised EA Section 4.1.11.1 to state that the NRC concludes that individual exposures would be below 10 CFR Part 20, Appendix B, dose limits for liquid and air*

effluents. Honeywell also estimated the collective radiation dose to the population within an 80-kilometer (50-mile) radius of the MTW to be 0.0452 person-Sv/yr (4.52 person-rem/yr), which is a small percentage of the radiation dose to the population from background radiation. Finally, EA Table 2-10, "Average of External Gamma Monitoring Quarterly Results," provides data related to external gamma monitoring annual averages for the years 2010 through 2014. The average annual environmental dosimeter dose at the east fence is 0.834 mSv (83.4 mrem), approximately 83 percent of the 1-mSv (100-mrem) limit specified in 10 CFR 20.1301(a)(1) for dose in any unrestricted area from external sources (ENERCON 2017, Section 4.6.8.3). The shortest distance from the eastern restricted area fence to the MTW site boundary is approximately 1 kilometer (0.6 mile); thus, the direct dose to any potential offsite individual would be substantially less than the regulatory limit because the dose decreases with distance (the dose is inversely proportional to the square of the distance).

Because all radiation dose calculations performed in support of the license application and summarized in Section 4.1.11.1 show compliance with NRC requirements, the NRC staff has determined that adding a requirement to regularly perform and report effluent dose calculations is not needed to demonstrate protection of the public and the environment. The NRC staff did not make any changes to the EA based on this comment.

Comment 5-19

A commenter noted that the last paragraph of EA Section 4.1.11.2, "Occupational Health and Safety," states that there would be "no impact to workers from exposure to direct radiation," which implies the only pathway for exposure to workers is direct radiation. The commenter recommended including all applicable pathways (e.g., inhalation, resuspension) in the evaluation of occupational health and safety of workers.

Response: *Section 4.1.11.2 references EA Table 3-18, "Occupational Exposure," which shows the TEDE to workers. As defined in 10 CFR 20.1003, TEDE "means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures)." The TEDE exposures in EA Table 3-18 were determined using measured releases of airborne uranium in conjunction with dose coefficients for intakes of radionuclides by workers from the International Commission on Radiological Protection Publication 68 (ENERCON 2017, Section 3.11.2). In response to this comment, the NRC staff revised the next-to-last paragraph in Section 4.1.11.2 to specify that Table 3-18 identifies the TEDE that is being used as the basis for comparison with the 10 CFR Part 20 limit. The NRC staff also revised the last paragraph in Section 4.1.11.2 to delete mention of exposure to direct radiation.*

B.5.12 Safety

Comment 5-21

A commenter stated that the draft EA does not discuss efforts to fortify systems, structures, and components to prevent unpermitted releases of chemicals and radioactivity. The commenter recommended including in the EA a discussion of efforts to ensure system reliability and integrity for those systems containing chemical and radiological hazards during the 40-year license extension period.

Response: *EA Section 2.2, "Facilities and Other Site Features," summarizes facility upgrades since the last license renewal in 2006. As described further in that section, these upgrades include expanding the existing environmental protection facility (EPF) in 2006 with the*

construction and completion of the surface treatment facility to reduce releases of fluoride; replacing oil-cooled rectifiers in the fluoride production facility; installing a new cooling tower to cool waste heat before discharge to the Ohio River; using a new sewage treatment facility that was constructed onsite; completing seismic/tornado protection upgrades to strengthen the feed materials building structure, piping supports, and vessel restraints; and replacing the process used to produce hydrogen gas with vendor-supplied liquid-hydrogen.

The licensee is required to maintain a configuration management program and facility change process. This process requires Honeywell to prepare and submit to the NRC a brief summary of all changes to site, structures, processes, systems, components, computer programs, and activities of personnel within the plant features and procedures and safety control boundaries on a yearly basis. This process is contained as part of the license application and is codified in license conditions.

The NRC staff did not make any changes to the EA based on this comment.

Comment 5-22

A commenter stated that the draft EA does not discuss SUB-526 Section 6-8A for the natural uranium limits of yellow cake, triuranium octoxide, uranium dioxide, uranium trioxide, uranium tetrafluoride, uranium hexafluoride, and chemical intermediates of these compounds. The commenter noted that the draft EA does not address the adequacy of the existing storage limits for the proposed 40-year license renewal. The commenter recommended assessing these storage limits for uranium ore for the license extension period.

Response: *The regulations at 10 CFR Part 40 do not contain any requirements with respect to storage limits for a uranium conversion facility. Additionally, Honeywell did not request a change to storage limits for the licensed uranium compounds as part of the license renewal application.*

The NRC staff did not make any changes to the EA based on this comment.

B.5.13 Waste Management

Comments 4-1 and 4-2

A commenter suggested that it is not necessary in EA Table 1-1, "Federal and State Licenses and Permits for Activities at the MTW," to provide the latest version of the RCRA permit. The commenter also stated Table 1-1 should be revised to state that the RCRA permit regulates the storage of calcium fluoride sludge in surface impoundments (Ponds B, C, D, and E) and the storage of drummed hazardous waste in two hazardous waste container storage buildings.

Response: *In response to this comment, the NRC staff revised EA Table 1-1 to remove the permit modification number and change the text as noted in the comment.*

Comments 4-3 and 5-27

A commenter stated that the EA should clearly indicate the status of Pond D (whether it is active, not active, or periodically used). Another commenter stated that the draft EA has potentially conflicting statements regarding releases from Pond D. The commenter identified the following statements in the draft EA as inconsistent and recommended that NRC add

clarifying statements regarding releases to Outfall 002 from Pond D or the environmental protection facility (EPF):

- EA Section 3.4.1.2 states the following: "Until recently, Outfall 002 received discharge from calcium fluoride Pond D (a surface impoundment), which was part of the MTW's wastewater treatment system. Effluent from Pond D mixed with other MTW effluents before discharging at Outfall 002 (ENERCON 2017, Section 3.4.1). Presently, Outfall 002 receives wastewater directly from the recently upgraded EPF instead of Pond D."

- EA Section 2.3.8.2, "Liquid Waste Management," states the following: "Effluent from Pond D discharges to Outfall 002." This appears to contradict the statement in Section 3.4.1.2 above.

The commenter recommended revising statements in the EA regarding releases to Outfall 002 from Pond D or the EPF to more accurately reflect MTW's operational status.

Response: *Calcium fluoride Pond D stopped receiving process wastewater about May 2018. Outfall 002 currently receives stormwater and liquors encountered during pond closure activities (Patterson 2019). In response to this comment, the NRC staff revised the Low-Level Radioactive Liquid Waste Streams and Treatment section within Section 2.3.8.2 to reflect the removal of calcium fluoride Pond D from operational service about May 2018 and to state that only stormwater and liquids associated with closure activities of this pond, as well as effluent from the EPF, are routed through the drainage channel to Outfall 002. The NRC staff also revised Section 3.4.1.2 to be consistent with these changes to Section 2.3.8.2.*

Comment 4-13

A commenter noted that in EA Section 3.12.1, "Low-Level Radioactive Waste," the NRC states the following: "The facility holds a RCRA Part B permit and is permitted to dispose of waste that includes residuals of source material in permitted levels." The commenter stated that Honeywell's RCRA permit is for storage purposes only, and this waste cannot be disposed of onsite. The commenter further stated that Honeywell will remove all waste from the surface impoundments and dispose of it offsite at a properly permitted landfill by December 31, 2020.

Response: *The NRC staff concurs that the RCRA Part B permit applicable to the MTW only allows storage of waste. The term "facility" in the sentence refers to the U.S Ecology waste disposal facility. In response to this comment, the NRC staff revised the sentence to refer to the U.S. Ecology facility.*

Comment 4-14

A commenter requested that EA Section 3.12.3, "Hazardous Waste," be revised to replace the term "ponds" with the term "surface impoundments."

Response: *In response to this comment, the NRC staff revised the text in Section 3.12.3 to clarify the types of storage areas under the RCRA permit.*

Comment 5-6

A commenter noted that EA Section 3.12.4, "Nonradioactive, Nonhazardous Waste," states the following: "In 2014, the MTW also generated about 526 metric tons (580 U.S. tons) of soil from nonroutine remediation activities." The commenter recommended that the final EA explain the reason the soil was remediated and sent to the Southern Illinois Regional Landfill for disposal.

Response: *The 526 metric tons (580 U.S. tons) of soil generated in 2014 was associated with excavation activities in the Old Creosoter Area to address polycyclic aromatic hydrocarbon and arsenic impacts in the soil. The soil was not considered RCRA-listed waste based on waste characterization sampling and historical data from site investigations (CH2MHILL 2014). The NRC staff did not make any changes to the EA based on this comment.*

B.5.14 Environmental Impact Accumulation

Comment 5-26

A commenter stated that the discussion on public and occupational health in EA Section 4.1.13 states there is a potential for accumulation; however, environmental data clearly indicate an increase in uranium levels in soils and vegetation when compared to preoperational data. The commenter noted that the last paragraph in Section 4.1.13 states the following: "The monitoring results indicate that the surrounding area has not experienced an accumulation of radioactive material and fluoride releases." The commenter referred to his other comments on the draft EA (see Comments 5-1 through 5-13, and 5-30 in this appendix) stating those comments illustrate accumulations of uranium in soil and vegetation. The commenter stated that the draft EA shows an increase in uranium activity in sediment near the site discharge, but does not include preoperational uranium levels for sediment. The commenter recommended revising the draft EA to reflect accumulation of uranium offsite in soil, vegetation, and sediment and to include a discussion on the potential radiological and chemical risks from these exposures to workers and members of the public.

Response: *Based on an analysis (Marschke and Gorden 2019) performed in response to comments on spikes in uranium and fluoride concentrations in the soil and sediment (see responses to Comments 5-1, 5-2, 5-3, 5-4, 5-13, and 5-30 in this appendix), the NRC staff has determined that it is not possible to statistically establish an increasing or decreasing trend in offsite uranium or fluoride contamination in soils and vegetation because of the variability in the data. The NRC staff also evaluated the peaks in uranium concentrations that occurred in 2009 and 2015 to determine possible causes for the peaks as described in the NRC staff responses to Comment 5-1, Comment 5-2, and Comment 5-3. Although a slight increasing trend in the uranium concentration might be established after eliminating two data spikes, the apparent trend does not indicate a significant increase. In addition, uranium concentrations in soils and vegetation do not remain elevated, thereby signifying little accumulation (Marschke and Gorden 2019). The NRC staff's response to Comment 5-30 explains that two coal-fired power plants near the MTW site emit significantly more airborne fluoride than the MTW and are likely the primary contributors of fluoride emissions. The NRC will continue to require that Honeywell monitor uranium and fluoride concentrations in soils and vegetation at offsite locations.*

Regarding onsite soil and sediment uranium contamination, EA Section 2.4 describes the NRC requirements with which Honeywell must comply and states that radiological contamination will be reduced to levels that allow the release of the site for unrestricted use, as specified in the License Termination Rule. EA Section 4.4, "Decontamination and Decommissioning Impacts,"

states that there would be some short-term impacts during decontamination and decommissioning, but these impacts would be localized. Regarding the comment about the need for the EA to show preoperational uranium levels for sediment, a preoperational value for uranium in sediment is not available. As described in the response to Comment 5-4, the background uranium concentration for soil is 3 ppm.

In response to this comment, the NRC staff revised Section 4.1.13 to add groundwater to the list of resources that could experience accumulation of environmental impacts. The NRC staff also revised EA Section 4.1.13 to state that offsite accumulations of uranium in soils and vegetation are not significant. The NRC staff also revised EA Section 4.1.13 to identify all contaminated areas within the MTW site, including along the channel to Outfall 002, the drainage swale east of the ore storage pads, areas along River Road, and isolated areas along the road to the inactive landfill, as described in EA Section 2.4.

B.6 References

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