SECTION 19.4

IMPACTS OF PROPOSED CONSTRUCTION, OPERATIONS, AND DECOMMISSIONING

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
$\mu g/m^3$	micrograms per cubic meter
χ/Q	relative atmospheric concentration
ac.	acre
acfm	actual cubic feet per minute
ALARA	As Low As Reasonably Achievable
AMSL	above mean sea level
BLS	Bureau of Labor Statistics
BMP	best management practice
Btu	british thermal unit
Btu/hr	Btu per hour
Btu/scf	Btu per standard cubic foot
Bu.	bushel
C	Celsius
CAM	continuous air monitor
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Ci/yr	Curies per year
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalent
D/Q	ground level deposition factor
dBA	decibels

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
DBA	design basis accident
DOE	U.S. Department of Energy
DOR	Wisconsin Department of Revenue
DOT	U.S. Department of Transportation
DPI	Wisconsin Department of Public Instruction
DSSI	Diversified Scientific Services, Inc.
ECL	effluent concentration limit
EDE	effective dose equivalent
EJ	Environmental Justice
ESF	engineered safety feature
F	Fahrenheit
FR	Federal Register
ft.	feet
ft/sec	feet per second
GHG	greenhouse gas
GIS	Geographic Information System
gpd	gallons per day
grams/bhp-hr	grams per brake horsepower-hour
H1H	high, first high
H2H	high, second high
ha	hectare
HAT	Hazard Analysis Team
HAZOPS	Hazard and Operability Study

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
HC	hydrocarbons
HEPA	high-efficiency particulate air
hr.	hour
HVAC	heating, ventilation, and air conditioning
I-129	iodine-129
I-131	iodine-131
IA	Iowa
IE	initiating event
IL	Illinois
IN	Indiana
ISA	Integrated Safety Analysis
ISC	Industrial Source Complex
ISG	Interim Staff Guidance
JSD	Janesville School District
k_{eff}	neutron multiplication factor
km	kilometer
km^2	square kilometer
Kr-85	krypton-85
L/cyl	liters per cylinder
lb/hr	pounds per hour
lb/MMBtu	pounds per million Btu
lb/yr	pounds per year

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
lb.	pound
LEU	low enriched uranium
LNB	low NO_x burners
LOS	level of service
lpd	liters per day
LSA	low specific activity
m	meter
m/s	meter per second
MA	Massachusetts
MAR	material-at-risk
MEB	mass and energy balance
MEI	maximally exposed individual
Mgd	million gallons per day
MHA	maximum hypothetical accident
mi.	mile
Mld	million liters per day
MMBtu/hr	million Btu per hour
MO	Missouri
Mo-99	molybdenum-99
mrem	millirem
mrem/yr	millirem per year
mSv	millisievert
mSv/yr	millisievert per year
NAAQS	National Ambient Air Quality Standards

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
NAVD 88	North American Vertical Datum 1988
NE	Nebraska
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHRP	National Register of Historic Properties
NLCD	National Land Cover Database
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NR	Natural Resources
NRC	U.S. Nuclear Regulatory Commission
NSPS	New Source Performance Standards
NWS	National Weather Service
NY	New York
O_3	ozone
OH	Ohio
OK	Oklahoma
OSHA	Occupational Safety and Health Administration
PA	Pennsylvania
PCS	primary cooling system
PHA	Preliminary Hazard Analysis
PM	particulate matter

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
PM_{10}	particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than 2.5 microns
POTW	publically owned treatment works
PPE	personal protective equipment
PrHA	Process Hazard Analysis
PSAR	Preliminary Safety Analysis Report
PSB	primary system boundary
PSD	Prevention of Significant Deterioration
PVVS	process vessel vent system
RCA	Radiologically Controlled Area
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
rem/s	rem per second
ROI	region of influence
RPCS	radioisotope process facility cooling system
RPF	Radioisotope Production Facility
rpm	revolutions per minute
RPS	reactivity protection system
RVZ1	RCA ventilation system Zone 1
RVZ2	RCA ventilation system Zone 2
RVZ3	RCA ventilation system Zone 3
SACTI	Seasonal/Annual Cooling Tower Impact

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
SCAS	subcritical assembly system
scf	standard cubic foot
scf/hr	standard cubic foot per hour
scfm	standard cubic feet per minute
SDG	standby diesel generator
sec.	second
SHINE	SHINE Medical Technologies, Inc.
SH 11	State Highway 11
SHPO	State Historic Preservation Office
SIL	Significant Impact Level
SO	sulfur oxides
SO_2	sulfur dioxide
SP	special purpose district
SPCC	Spill Prevention, Control, and Countermeasure
SSCs	structures, systems, and components
SWPPP	Storm Water Pollution Prevention Plan
T/yr	tons per year
TBP	tri-n-butyl phosphate
TEDE	total effective dose equivalent
TIF	Tax Increment Financing
TLD	thermoluminescent dosimeter
TSV	target solution vessel
TX	Texas

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
U.S.	United States
UREX	uranium extraction
US 14	U.S. Highway 14
US 51	U.S. Highway 51
USCB	U.S. Census Bureau
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UT	Utah
VOC	volatile organic compound
WCS	Waste Control Specialists
WDNR	Wisconsin Department of Natural Resources
WHS	Wisconsin Historical Society
WI	Wisconsin
WIAAQS	Wisconsin Ambient Air Quality Standards
WPDES	Wisconsin Pollutant Discharge Elimination System
WY	Wyoming
Xe-133	xenon-133
yd.	yard
yr	year

CHAPTER 19

19.4 IMPACTS OF PROPOSED CONSTRUCTION, OPERATIONS, AND DECOMMISSIONING

This chapter provides an analysis of the impacts of construction, operation and decommissioning of the SHINE facility. Overall impact rankings are given to each environmental resource evaluated. Unless otherwise defined, criteria followed the guidance given in NRC Impact Rankings 10 CFR 51 Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

- SMALL (S) – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE (M) – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE (L) – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

19.4.1 LAND USE AND VISUAL RESOURCES

This subsection assesses the impacts of construction and operation on land use and visual resources for the SHINE Medical Technologies, Inc. (SHINE) site and region. As described in Subsection 19.3.1, the land use for the site and region is analyzed using the National Land Cover Database 2006 (Fry et al, 2011). Impacts include effects from activities associated with construction and operation, including excavation, grading, placement of fill material, temporary staging and construction laydown, construction of permanent features, and potential operational disturbances.

19.4.1.1 Land Use

This subsection discusses the land use impacts from construction and operation of the SHINE facility.

19.4.1.1.1 Site and Region

As described in Subsections 19.3.1 and 19.3.5, the SHINE site consists of a 91.27-acre (ac.) (36.94-hectare [ha]) parcel that has been historically farmed and is routinely disturbed by the disking, plowing, herbicide application and harvesting activities associated with row crop production. The region surrounding the SHINE site is defined in Subsection 19.3.1.1.2 as the area within a 5-mile (mi.) (8-kilometer [km]) radius of the site centerpoint. The entire region is located within Rock County, Wisconsin.

The potential construction-related land use impacts to the SHINE site and near off-site areas are based on the SHINE facility construction grading plan (Figure 19.4.1-2). Activities such as earthmoving, excavation, pile driving, erection, batch plant operation, and construction-related traffic generate potential disturbances to land use during the construction phase of the SHINE project. Construction-related direct impacts to the site and near site areas are limited to land previously utilized for agricultural/cultivated crop production.

Of the 91.27 ac. (36.94 ha) comprising the SHINE site, construction permanently converts 25.67 ac. (10.39 ha) of agricultural/cultivated crops to industrial facilities (Table 19.4.1-1). Permanent conversions to industrial facilities include the construction of facility buildings, employee parking lot, facility access road/driveway, stormwater detention area, and access road drainage ditches. Direct construction impacts also include the temporary impact of 14.54 ac. (5.88 ha) of agricultural lands on-site used for the construction parking area, construction material staging or lay down area, and temporary disturbance from water and sewer line installation, as well as, the temporary indirect impact of 0.62 ac. (0.25 ha) of off-site agricultural lands immediately adjacent to the northern boundary of the site for temporary disturbance from water and sewer line installation. Temporary impact areas are either returned to agriculture or restored with either cool season grasses or native prairie.

The loss of agricultural/cultivated crops to industrial facilities is minor when compared to the 25,236 ac. (10,213 ha) of agricultural land remaining within a 5-mi. (8-km) radius of the site (see Table 19.4.1-1). Furthermore, lands on-site not utilized for development of industrial facilities are returned to agriculture or restored using cool season grasses or native prairie species. As such, impacts to land use from construction and operations are SMALL.

19.4.1.1.2 Special Land Uses

As discussed in Subsection 19.3.1.1.3, there are no federal special land use classification areas within the region of the SHINE site, but there are two state special land use areas in the region, with neither area located on-site. Permanent and temporary impacts from construction and operation of the facility occur on-site and in near off-site areas, but not within either state special land use areas. No direct or indirect impacts occur to special land use classification areas. Therefore, impacts to special land use classification areas are SMALL.

19.4.1.1.3 Agricultural Resources and Facilities

The agricultural resources and facilities on-site and within the region of the SHINE site are described in Subsection 19.3.1.1.4. Both prime farmland and farmland of state-wide importance occur within the site boundaries, with approximately 41,950 ac. (16,977 ha) of the area within the region having soils classified as prime farmland and farmland of state-wide importance (see Subsection 19.3.1.1.4). Based on the SHINE facility site layout (Figure 19.2.1-1), the direct and indirect impacts from construction and operation of the facility occur on-site and near off-site, impacting 25.67 ac. (10.39 ha) of agricultural/cultivated crops on-site and 0.62 ac. (0.25 ha) of agricultural/cultivated crops near off-site (see Table 19.4.1-1). As described in Subsection 19.3.1.1.4, the potential relative value of the farmland for all 91.27 ac. (36.94 ha) comprising the SHINE site is 13,771 bushels (Bu.) of grain corn or 3947 Bu. of soybeans, while the 10-year production estimate average for Rock County, Wisconsin, is 22,075,540 Bu. of grain corn and 3,786,415 Bu. of soybeans. No other agricultural resources within the region of the SHINE site are located on-site or near off-site, as discussed in Subsection 19.3.1.1.4, and therefore, will not be impacted by construction and operations-related impacts.

The loss of on-site agricultural lands, including prime farmland and farmland of state-wide importance, and the subsequent loss of potential crop production to industrial facilities, is minor when compared to the amount of agricultural land, land designated as prime farmland or farmland of state-wide importance, and potential crop production remaining within the region surrounding the site (see Table 19.4.1-1 and Subsection 19.3.1.1.4). Furthermore, lands on-site not utilized for development of industrial facilities are returned to agriculture or restored using cool season grasses or native prairie species. As such, direct and indirect impacts to agricultural resources and facilities from construction and operations are SMALL.

19.4.1.1.4 Mineral Resources

As described in Subsection 19.3.1.1.5, important mineral resources within the region include sand, gravel, and crushed stone. Two sand and gravel operations occur within the region of the SHINE site, but neither is located on-site. Permanent and temporary impacts from construction and operation of the facility occur on-site and in near off-site areas. Consequently, there are no direct or indirect impacts to mineral resources. Impacts to mineral resources from construction and operations of the facility are SMALL.

Impacts to mineral resources are discussed further in Subsection 19.4.3.

19.4.1.1.5 Major Population Centers and Infrastructure

Subsection 19.3.1.1.6 summarizes the major population centers and infrastructure located within Rock County, which include the major population centers of Janesville and Beloit, several major transportation corridors, and the Southern Wisconsin Regional Airport. While US 51 and the Southern Wisconsin Regional Airport are located just west of the SHINE site, none of the major population centers or infrastructure are located on-site. Permanent and temporary impacts from construction and operations of the facility occur on-site and immediately adjacent to the northern boundary of the site. Therefore, construction and operations-related direct and indirect impacts on major population centers and infrastructure are SMALL.

19.4.1.1.6 Impacts from Decommissioning

Construction of the SHINE facility is expected to begin in 2015. Following the cessation of operations, the facility will be decommissioned. Decommissioning activities, however, are similar to construction activities and involve heavy equipment to dismantle buildings and remove roadway and parking facilities. Resultant land uses following decommissioning are undetermined but may consist of agricultural lands or open space. As such, direct and indirect impacts from decommissioning are anticipated to be similar to the impacts associated with construction and SMALL.

19.4.1.2 Visual Resources

The visual setting of the area affected by the construction and operation of the SHINE site is described in Subsection 19.3.1.2. Illustrations of the bounding condition of the SHINE facility superimposed on the current viewshed are shown on Figure 19.4.1-1.

The existing site is composed entirely of land used for agricultural purposes and has no existing architectural features, established structures, or natural or built barriers, screens or buffers. Consequently, the SHINE facility alters the on-site condition and partially obstructs views of the existing landscape. However, the visual setting of the site is generally flat and uniform in landform with low vegetation diversity and a low visual quality rating (see Subsection 19.3.1.2). Bounding dimensions of the production facility building for visual impact assessment include a height of 86 feet (ft.) (26 meters [m]), a length of 416 ft. (127 m), and a width of 167 ft. (51 m). The high bay footprint has bounded dimensions of 58 ft. (18 m) wide by 190 ft. (58 m) long. The facility's main building has an exhaust vent stack that under the bounding condition extends to

96 ft. (29 m) above grade. Figure 19.4.1-1 presents a conceptual rendering of the facility and the arrangements on-site based upon bounded dimensions. As discussed in Subsection 19.4.2.1.2.2.5, plume visibility from the production process is expected to be minimal. Additionally, the facility does not utilize cooling towers, radar towers or other large structures that visibly intrude upon the existing landscape. Based upon these site characteristics and the bounded dimensions of the facility as illustrated in Figure 19.4.1-1, facility structures have a relatively low profile, so any impacts to the viewshed are SMALL.

The operation of the SHINE facility results in minor increases in noise as described in Subsection 19.4.2. However, noise levels are localized to the SHINE site and not elevated above background noise emissions from US 51, immediately adjacent to the site. Therefore, noise emissions from the site do not create audible intrusions that are out of character with the setting around the SHINE site.

As described in Subsection 19.3.1.2, two large warehouses are located immediately adjacent to the southern border of the site that support local agricultural operations and provide storage for large farming equipment. The viewshed to the west of the site across US 51 is a light industrial development landscape that consists of the Southern Wisconsin Regional Airport and its associated facilities, which include the airport control tower and several large warehouses and hangers. Additionally, the viewshed to the south includes several stacks associated with power generation facilities. Together with the buildings and structures to the south and west, the SHINE facility does not significantly alter the visual setting. Therefore, impacts to visual resources from construction and operation of the SHINE facility are SMALL.

Table 19.4.1-1 Summary of Impacts to Land Use/Land Cover

NLCD 2006 Land Cover Class	Permanent Site Impacts		Temporary Site Impacts		Total Land Cover within the Region[a]		
	ac.	ha	ac.	ha	ac.	ha	Percent
Open Water					796	322	1.6
Developed, Open Space	0.18	0.07			3043	1231	6.1
Developed, Low Intensity					5858	2371	11.7
Developed, Medium Intensity					1968	796	3.9
Developed, High Intensity					992	401	2
Barren					43	17	0.1
Deciduous Forest					3298	1335	6.6
Evergreen Forest					68	28	0.1
Mixed Forest					1	0	0
Shrub/Scrub					505	204	1
Grassland					1049	425	2.1
Pasture/Hay					5896	2386	11.7
Cultivated Crops	25.67[b]	10.39[b]	14.54[b]	5.88[b]	25,236	10,213	50.2
Woody Wetlands					722	292	1.4
Emergent Herbaceous Wetland					787	318	1.6
Total[c]	**28.85**	**10.46**	**14.54**	**5.88**	**50,262**	**20,339**	**100**

a) Reference: Fry et al., 2011.
b) Cultivated Crops on the SHINE site are entirely prime farmland and farmland of state-wide importance.
c) Total may add up to more or less than 100 percent due to rounding.

19.4.2 AIR QUALITY AND NOISE

This subsection addresses the direct physical impacts of construction and operation on the communities within the vicinity of the SHINE site. Direct physical impacts include the effects from air emissions and noise. This evaluation indicates the magnitude of potential impacts and whether mitigation measures are required.

19.4.2.1 Air Quality

19.4.2.1.1 Impacts from Construction

Construction activities result in localized increases in air emissions. Earthmoving, excavation, clearing, pile driving, erection, batch plant operation, and construction-related traffic generate fugitive dust and fine particulate matter that potentially impact both on-site workers and off-site residents of the community. Vehicles and engine-driven equipment (e.g., generators and compressors) generate combustion product emissions such as carbon monoxide, nitrogen oxides and, to a lesser extent, sulfur dioxides. Painting, coating, and similar operations also generate emissions from the use of volatile organic compounds.

People living near or working at or near construction sites may be subject to the physical impacts of construction activities. Activities associated with the use of construction equipment may result in varying amounts of dust, air emissions, noise, and vibration. The magnitude and area of extent of the impacts from these emissions depends on atmospheric conditions at the time of the activity. The magnitude of these potential impacts is typically related to the specific construction activities that occur at a given site, the nature and effectiveness of implemented environmental controls, and the proximity of the site to populated areas. Contractors, vendors, and subcontractors are required to adhere to appropriate federal and state occupational health and safety regulations. These regulations set limits to protect workers from adverse conditions, including air emissions.

On-site equipment use and traffic due to construction activities can also result in local increases in emissions. Subsection 19.4.7 provides information regarding the type and volume of traffic generated by the SHINE facility during construction. While guidance from the Final ISG Augmenting NUREG-1537 suggests that emissions from on-site and off-site vehicle use (including fugitive dust) be estimated, SHINE believes that this information is not necessary to evaluate the impacts of the SHINE facility given the absence of near off-site receptors, the short term duration of such emissions, and the classification of the regional air quality as “attainment.” Analysis of on-site and off-site vehicle use, including fugitive dust, are more appropriate for projects requiring a Conformity Analysis in non-attainment areas. Because construction equipment use and generated traffic volumes are relatively minor compared to other regional traffic generated emissions, and because the SHINE site is largely surrounded by agricultural fields and other undeveloped areas associated with the airport, potential air quality impacts from construction are limited. Implementation of controls and limits at the source of emissions on the construction site result in reduction of impacts off-site. For example, the dust control program reduces dust due to construction activities to minimize dust reaching site boundaries. Transportation and other off-site activities result in emissions from vehicle usage. Off-site transportation activities generally occur on improved surfaces, limiting fugitive dust emissions.

Specific mitigation measures to control fugitive dust may include any or all of the following:

- Stabilizing construction roads and spoil piles.
- Limiting speeds on unpaved construction roads.
- Periodically watering unpaved construction roads.
- Performing housekeeping (e.g., remove dirt spilled onto paved roads).
- Covering haul trucks when loaded or unloaded.
- Minimizing material handling (e.g., drop heights, double-handling).
- Phased grading to minimize the area of disturbed soils.
- Re-vegetating road medians and slopes.

While emissions from construction activities and equipment are unavoidable, implementation of mitigation measures minimize impacts to local ambient air quality and the nuisance impacts to the public in proximity to the project. The mitigation may include any or all of the following:

- Implementing controls to minimize daily emissions such as reducing engine idle time, using cleaner fuels (e.g., ultra low sulfur diesel fuel or biodiesel), installing pollution control equipment on construction equipment (e.g., diesel oxidation catalysts and particulate matter filters), and curtailing or controlling the time of day construction activities are performed.
- Performing proper maintenance of construction vehicles to maximize efficiency and minimize emissions.

In summary, air emission impacts from construction are SMALL because emissions are controlled at the source where practicable; maintained within established regulatory limits designed to minimize impacts; and located a significant distance from the public.

19.4.2.1.2 Impacts from Operation

Section 19.2 provides information regarding the cooling and heating dissipation systems and the waste systems for the SHINE facility. The design of the new plant includes a cooling system that does not require the use of either mechanical or natural draft cooling towers.

The SHINE site is located in Rock County, Wisconsin, which is part of the Rockford (Illinois)-Janesville-Beloit (Wisconsin) Interstate Air Quality Control Region (40 Code of Federal Regulations [CFR] 81.71, Natural Resources [NR] 404.03 Wisconsin Administrative Code) (Section 14.4.3.2.2). The Clean Air Act and its amendments establish National Ambient Air Quality Standards (NAAQS) for ambient pollutant concentrations that are considered harmful to public health and the environment. Similarly, Wisconsin has established the Wisconsin Ambient Air Quality Standards (WIAAQS) (NR 404.03 Wisconsin Administrative Code). Primary standards set limits to protect public health and secondary standards set limits to protect public welfare such as decreased visibility, and damage to animals, crops, vegetation, and buildings. The principal pollutants for which NAAQS have been set are carbon monoxide (CO), nitrogen dioxide (NO_2), lead, sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}), particulate matter with an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$), and ozone (O_3). One or more averaging times are associated with each pollutant for which the standard must be attained.

Areas having air quality as good as, or better than, the NAAQS are designated as attainment areas. Areas having air quality that is worse than the NAAQS are designated as nonattainment areas. Rock County is designated as better than national Standards for SO_2 and unclassifiable/ attainment for CO, 1-hour (hr.) ozone, 8-hr. ozone (1997 and 2008 standards), NO_2, $PM_{2.5}$, and lead (2008 standard) (40 CFR 81, Subpart C, §350). Rock County is near (but not part of) the Milwaukee-Racine $PM_{2.5}$ (2006) and 8-hr. ozone nonattainment areas (Subsection 19.3.2.2). Walworth County separates Rock County from the nonattainment area.

The nearest Class I area is Rainbow Lake, a U.S. Forest Service site about 311 mi. (500 km) north of Janesville, Wisconsin (Subsection 19.3.2.2). Rainbow Lake is not a federally mandated Class I area (40 CFR 81, Subpart D). A Prevention of Significant Deterioration (PSD) source within 31 mi. (50 km) of the Rainbow Lake Class I area must perform a significance analysis for the increase in emissions. In addition, any PSD source that locates within approximately 124 mi. (200 km) of a Class I Area, must notify the applicable Federal Land Manager. Since Rainbow Lake is well beyond the distance limits, the additional analysis and notification are not required.

19.4.2.1.2.1 Gaseous Effluents

Gaseous effluents at the SHINE facility are from two types of processes: isotope production and fuel combustion.

19.4.2.1.2.1.1 Isotope Production

Gaseous effluents from the SHINE isotope production process originate from two main sources: Mo-99, Xe-133, and I-131 production and purification and uranium recycling. Process off-gases are treated in two separate, but connected, systems: the target solution vessel (TSV) off-gas system and the process vessel vent system (PVVS).

Tritium gas is the accelerator target in the accelerator-based neutron source used in the production process. Maintenance operations on the accelerator will result in the release of tritium gas that will be exhausted by the ventilation system.

The TSV off-gas system is dedicated to treating only the off-gas from the TSVs, with each TSV being equipped with its own system. The PVVS treats gases from the following sources: vent streams from process vessels in contact with streams containing fissile or radioactive materials, thermal denitration off-gas, after initial caustic scrubbing, and off-gas from the uranium oxidation furnace.

The SHINE production facility utilizes a ventilation scheme for the process operating areas that is typical for nuclear processing facilities of this type. The operating areas are divided into zones, with each zone representing a specific hazard, and being subject to specific constraints, in terms of the potential for radioactive contamination or dose to the facility workers.

Gaseous effluents resulting from the production process are summarized in Table 19.4.2-1. These values are based on a 50-week per year operating schedule. There are no emissions of carbon monoxide, lead, ozone, or particulate matter (PM).

19.4.2.1.2.1.2 Fuel Combustion

Several combustion sources at the SHINE facility contribute to the gaseous effluents. These combustion sources are a natural gas-fired boiler that is used for the production facility building, natural gas-fired heaters in the administration building, support facility building, waste staging and shipping building, and the standby generator building. In addition to these natural gas-fired heaters, a diesel-fired standby diesel generator (SDG) is present at the facility. Each of these sources vents emissions to the outside through an associated stack. The boiler, heaters, and generator all emit CO, nitrogen oxides (NO_x), PM, SO_2, volatile organic compounds (VOCs), and carbon dioxide (CO_2), as summarized in Tables 19.4.2-2 to 19.4.2-7. Total annual emissions are presented in Table 19.4.2-8.

19.4.2.1.2.2 Evaluation of Emission Impacts on Air Quality

19.4.2.1.2.2.1 Vehicle and Other Emissions

During the operations phase, vehicular air emissions occur from the commuting workforce and from routine deliveries to/from the SHINE facility. As described in Subsection 19.4.7, the volume of traffic generated during operations is considerably lower than that expected during construction. Additionally, the lands on the developed SHINE site are either developed surfaces (buildings, paved parking/access road) or consist of either agricultural or landscaped uses. Limitation of routine vehicle uses to paved areas reduces the emissions of fugitive dust. Impacts from vehicular air emissions and fugitive dust are far less than during the construction phase. Impacts during the operations phase are therefore, SMALL.

The AERMOD modeling system was used to assess the impacts of pollutants expected to be generated by the new plant from the production unit and five natural gas-fired heaters. A SDG is only operated for limited periods of time for testing and therefore is not modeled. A March 2012 Wisconsin Department of Natural Resources (WDNR) memorandum on dispersion modeling of intermittent sources, states “In conjunction with the U.S. Environmental Protection Agency (USEPA) document cited previously, dispersion modeling for intermittent units is not performed for any of the state or federal ambient air quality standards or increments.” (WDNR, 2012a).

19.4.2.1.2.2.2 Release Point Characteristics

Emissions and stack characteristics for each emission source are based on the design parameters, assumptions, and emission factors. Exhaust characteristics for the SDG are estimated based on heat input to the source, fuel consumption, and combustion calculations assuming 25 percent excess combustion air. Exhaust gas temperatures for the SDG are based on data in the CAT C175-20 Diesel Engine Technical Data Sheet, and the calculated exhaust gas flow rates are benchmarked against exhaust flow data included in the CAT technical data sheet.

Exhaust characteristics for the production facility building natural gas-fired boiler are estimated based on heat input to the source, fuel consumption, and combustion calculations assuming 25 percent excess combustion air. Exhaust gas temperatures for the natural gas-fired boiler are based on temperature data provided by boiler vendors for other similar projects. Exhaust from the natural gas-fired boiler is vented to the atmosphere through a stack that is separate from the process stack, which is designed primarily to vent gaseous effluents from the SHINE isotope production process.

Stack characteristics for the indirect-fired heaters are based on information available from equipment vendors for packaged indirect-fired heaters. Vertical convection stack vents equipped with a rain cap are assumed for each natural gas-fired heater for all buildings except the production facility. No rain cap is assumed for the main production facility. Each stack is assumed to be 5 ft. (1.5 m) higher than the highest point of the roof of the building. Natural gas heater information sources referenced for this evaluation include those by Reznor (Reznor, 2002) and Hastings (Hastings, 2011).

Process-related and natural gas boiler exhaust flows are released through separate stacks. Release point characteristics for the process-related, boiler, and natural gas-fired heater gaseous effluents are presented in Table 19.4.2-9.

19.4.2.1.2.2.3 Gaseous Effluent Control Systems

Emission calculations included in this evaluation are intended to provide bounding values for emissions from the SHINE facility. As such, emission calculations assume that emissions are limited using standard combustion controls, but do not assume the installation of post-combustion control systems.

The SHINE facility generates gaseous effluents resulting from process operations and the ventilation of operating areas. The gaseous effluent from ventilation of operating areas includes the following control systems:

- The Zone 1 exhaust airstream passes through two stages of HEPA filtration and a single stage activated carbon bed prior to discharge from the stack.
- The Zone 2 and Zone 3 exhaust airstreams pass through two stages of HEPA filtration prior to discharge from the stack.
- Additional controls may be implemented as required by local permit conditions.

Acid gases from the thermal denitration process pass through a scrubber before being emitted to the atmosphere. All the gaseous effluents from the production process are vented to the atmosphere through the main stack on the production facility building.

The diesel generator specified for the SHINE facility is required to meet all applicable New Source Performance Standards (NSPS, 40 CFR Part 60 Subpart IIII) and National Emission Standards for Hazardous Air Pollutants (NESHAP, 40 CFR Part 63 Subpart ZZZZ). The NSPS and NESHAP standards applicable to the diesel generator depend upon several design parameters and operating variables which have not yet been established, including the year the engine is manufactured, size of the engine, displacement liters per cylinder (L/cyl), speed (revolutions per minute [rpm]), annual hours of operation, and classification of the facility as a major or area source of hazardous air pollutants. Therefore, diesel engine emissions for this evaluation are based on published emissions data for a CAT C175-20 engine, which are expected to be typical of emissions from large diesel-fired engines with no post-combustion emission control systems.

Emissions of NO_x from the natural gas-fired boiler are controlled using low NO_x burners (LNB), which are standard equipment on most new boilers manufactured in the United States. LNBs limit NO_x formation by controlling both the stoichiometric and temperature profiles of the combustion flame in each burner flame envelope. This control is achieved with design features that regulate the aerodynamic distribution and mixing of the fuel and air, yielding reduced oxygen in the primary combustion zone, reduced flame temperature, and reduced residence time at peak combustion temperatures. The combination of these techniques produces lower NO_x emissions during the combustion process. Post-combustion air quality control systems are not anticipated for the natural gas-fired boiler, as natural gas is an inherently clean fuel with minimal SO_2 and PM emissions.

Emissions from the natural gas-fired heaters are controlled using combustion controls and properly designed and tuned burners. Gas burners come in a great variety of shapes, sizes, and designs. Typical gas burners found in indirect-fired heaters are the ribbon-port type, which vary in length and in port sizes, and may employ a single ribbon or many ribbons depending on the volume of gas to be burned (Reznor, 2002). The emission calculations assume properly designed and tuned burners, with a proper balance of primary air and secondary air to ensure complete combustion. Post-combustion air quality control systems are not anticipated for the natural gas-fired heaters, as natural gas is an inherently clean fuel with minimal SO_2 and PM emissions.

19.4.2.1.2.2.4 Dispersion Modeling Assumptions and Results

19.4.2.1.2.2.4.1 Model Assumptions

Since there are no cooling towers associated with the SHINE facility, there are no estimates of fogging, icing, plume shadowing, and salt deposition from the Seasonal/Annual Cooling Tower Impact (SACTI) model.

To estimate the impacts of non-radiological pollutants from the process, boiler, and heaters, the AERMOD Modeling System is used. The AERMOD system is a state-of-the-science dispersion model system that the USEPA promulgated in 2005 to replace the Industrial Source Complex (ISC) model. The AERMOD system is composed of a terrain preprocessor (AERMAP, version 11103), a tool to develop building downwash parameters for AERMOD (BPIPPRM, version 04274), and the dispersion model (AERMOD, version 12345).

Although the SHINE facility has a standby diesel generator, the emissions from this source are not included in the dispersion modeling because the generator is considered an intermittent unit. The WDNR issued a policy statement on March 6, 2012, as discussed above, exempting intermittent operating units.

Since this modeling demonstration is an assessment of potential impacts and not for the purposes of an air permitting, 5 years of preprocessed meteorological data for Madison, Wisconsin (available from the WDNR web site) was used in place of processing 5 years of National Weather Service (NWS) data from Janesville. Comparing the location of the NWS instrumentation at the Madison airport (Dane County Regional Airport) and Janesville airport (Southern Wisconsin Regional Airport), some differences in the processed meteorological input to AERMOD can be expected, but not enough to cause an exceedance of a federal or state ambient air quality standard.

The stacks associated with the heaters in all buildings except the production building are designed to have rain caps, which restricts the vertical flow. AERMOD has two ways to model this situation: modify the source characteristics or use the non-default beta option to define the type of source. For this modeling demonstration, the former method is used so the modeling is conducted in accordance with AERMOD's regulatory default options.

For this modeling demonstration, an assumption was made, based on information contained on the SHINE facility site layout (Figure 19.2.1-1) that a fence encircles the entire property boundary (fence line), forming a continuous physical barrier restricting public access to the SHINE site. Ambient air is defined as "…that portion of the atmosphere, external to buildings, to which the general public has access" (40 CFR 50.1(e)). If plant property is accessible to the public (exclusive of the workforce), then impacts from facility emissions are required to be modeled at those locations.

AERMOD analyses were performed using a number of bounded conditions. Since the boiler and heater stacks are subject to downwash, the actual stack diameter and exit temperature are used, but the exit velocity is set to a nominally low value, such as 0.001 meter per second (m/s). This value is used on modeling the SHINE facility stacks associated with the heaters in all buildings except the production building. The stack associated with heating of the production building is modeled without a rain cap.

The modeling results assume full-time operations for the year of the natural gas-fired heating system in each building (8760 hr.). A proposed operating schedule of the heating system, limiting operations of those units to about 5600 hr. per year (with no heating from June through August and a limited schedule in the month prior to and the month after the summer months), was not modeled. Additionally, the emission rate used for the modeling assumed a 25 percent design margin on the heating load. These assumptions provide a bounding analysis on the expected impacts from the facility.

19.4.2.1.2.2.4.2 AERMOD Model Results

A Significant Impact Level (SIL) establishes the concentration below which a pollutant impact is presumed not to cause or contribute to a violation of a NAAQS or WIAAQS. If pollutant concentrations do not exceed the SIL, then no further modeling (i.e., a compliance demonstration) is required (unless the WDNR would require additional modeling). The estimated highest impacts for each pollutant and averaging time are compared to the individual SILs in Table 19.4.2-10. Based on this assessment the impacts for all pollutants and averaging times are less than the SIL except for the 1-hr. and annual NO_2 standard. The 1-hr. and annual NO_2 impacts, which do exceed the respective SILs, are about 53 percent and 26 percent of the respective NAAQS.

To assess potential impacts of the SHINE facility operation relative to the NAAQS, the concentration estimates are added with background concentrations and are compared to the NAAQS standards for each pollutant and averaging time (Table 19.4.2-11). Most background concentrations were obtained from a WDNR draft memorandum on regional background concentrations (WDNR, 2011a). A background concentration for the 1-hr. NO_2 impacts was obtained from a WDNR technical support document (WDNR, 2010) and a background concentration for the 1-hr. SO_2 impacts was obtained from a document that identifies procedures to be followed by Region 5 states in conducting modeling (Lake Michigan Air Directors Consortium, 2011).

Table 19.4.2-11 shows that none of the pollutants exceed the NAAQS for the SHINE facility alone, or in combination with background concentration. Both the 24-hr. and annual $PM_{2.5}$ values are approximately 85 percent of the NAAQS, but most of this is due to the background concentration. Additionally, neither $PM_{2.5}$ averaging period exceeds their respective SIL.

Comparing the impacts to the PSD increment shows that the impacts from the SHINE facility alone are orders of magnitude smaller than the PSD increment.

In summary, the initial AERMOD analysis with the assumptions described above for emissions from the process, boiler, and heaters shows that none of the pollutants exceed the NAAQS, and do not result in a modeled exceedance of the USEPA SILs for any pollutant and averaging time, except for 1-hr. and annual NO_2 impacts.

19.4.2.1.2.2.4.3 Potential Maximum Concentration

Since AERMOD can directly estimate concentrations that are more precise, normalized concentrations are not presented. The SILs establish the concentration below which a pollutant impact is presumed not to cause or contribute to a violation of an ambient air quality standard. The SILs are shown in Table 19.4.2-10 along with the highest concentration estimates at points within a reasonable area that could be impacted (a square area 4 km x 4 km [2.5 mi. x 2.5 mi.] in size). Highest impacts range from the fence line to about 325 ft. (100 m) from the fence line.

Pollutant impacts at points of maximum individual exposure will be less than the maximum impacts at the fence line for each averaging time. The nearest residence is about 0.33 mi (0.53 km) to the north-northwest from the proposed SHINE site. A church is about 0.35 mi (0.56 km) to the south-southeast.

For all pollutants and averaging times except for the 1-hr. and annual NO_2, the maximum concentration anywhere within a reasonable area is less than the SIL. Applying AERMOD without limitations on the operating schedule, the 1-hr. NO_2 impacts at the residence and at the church are 35.4 micrograms per cubic meter ($\mu g/m^3$) and 29.7 $\mu g/m^3$, respectively. For the annual NO_2 exposure, the impacts are 0.36 $\mu g/m^3$ and 0.21 $\mu g/m^3$ for the residence and church, respectively. As is demonstrated in Table 19.4.2-11, no impacts exceed the primary ambient air quality standards that have been established to protect public health, including the health of sensitive populations such as children, the elderly, and those with respiratory problems. Therefore, pollutant impacts within a reasonable area that could be impacted and at points of the maximum individual exposure are SMALL.

19.4.2.1.2.2.5 Plume Visibility Characteristics

The plume from the production process should not be visible. All process exhaust passes through two stages of tested high-efficiency particulate air (HEPA) filters in series. The HEPA filters remove all visible particulate from the exhaust air stream. The vapors are removed with process off-gas treatment systems and all of the exhaust air passes through a single stage activated carbon bed prior to discharge from the stack.

Plume visibility from the natural gas-fired boiler and heaters is expected to be minimal. Because natural gas is a gaseous fuel, filterable PM emissions which generally contribute to plume visibility are expected to be very low. PM emissions associated with natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted; thus increased PM emissions can result from poor air/fuel mixing or maintenance problems (USEPA, 1995). With proper burner maintenance and tuning, opacity associated with the natural gas-fired boiler and heaters is expected to be minimal.

White, blue, and black smoke can be emitted from diesel-fired engines (USEPA, 1995). Liquid particles can appear as white smoke in the exhaust during an engine cold start, idling, or low load operation. These emissions are formed in the quench layer adjacent to the engine's cylinder walls, where the temperature is not high enough to ignite the fuel. Blue smoke can be emitted when lubricating oil leaks into the combustion chamber and is partially burned. Proper maintenance is the most effective method of preventing blue smoke emissions from all types of internal combustion engines. The primary constituent of black smoke is agglomerated carbon particles or soot. Proper engine maintenance and combustion controls will minimize particulate matter emissions and limit opacity from the SDG. Opacity is expected to be less than 5 percent at all times excluding, potentially, periods of startup.

19.4.2.1.2.3 Greenhouse Gas (GHG) Emissions

Greenhouse gases trap heat in the atmosphere, absorbing and emitting radiation in the thermal infrared range. The most important of these gases are CO_2, methane, nitrous oxide, and fluorinated gases. Greenhouse gases (GHG) are reported as CO_2 equivalent (CO_2e) and refer to the global warming potential of the greenhouse gas or gases being emitted.

Activities associated with the proposed SHINE site that are expected to contribute to the greenhouse gases include:

- Construction activities at the SHINE site resulting in principally emissions of CO_2; GHG emissions associated with construction activities include the commuting of the construction workforce and operation of construction equipment at the site.
- Plant operation activities associated with the operation of plant equipment and the operations workforce.
- Decommissioning activities associated with the decommissioning workforce and decommissioning equipment.
- Life cycle activities related to the mining, processing, and transport of materials and waste storage should also be considered as part of the GHG inventory.

As noted in Subsection 19.3.2.5, SHINE will develop a comprehensive program to avoid and control GHG emissions associated with the SHINE facility. It is expected that this program will include elements such as developing a GHG emission inventory, investigating and implementing methods for avoiding or controlling the GHG emissions identified in the inventory, encouraging car pooling or other measures to minimize GHG emissions due to vehicle traffic during construction and operation of the SHINE facility, and conducting periodic audits of GHG control procedures and implementing corrective actions when necessary.

19.4.2.1.2.4 Mitigative Measures

Emission-specific strategies and measures will be developed and implemented to ensure compliance within the applicable regulatory limits defined by the National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50) and National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

Contractors, vendors, and subcontractors are required to adhere to appropriate federal and state occupational health and safety regulations. These regulations set limits to protect workers from adverse conditions, including air emissions. Implementation of controls and limits at the source of emissions on the construction site result in reduction of impacts off-site.

19.4.2.1.3 Impacts of Decommissioning

Decommissioning is the removal of a nuclear facility from service and to reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. During the decommissioning phase, activities, equipment usage and their associated emissions are expected to be similar, but less than that of the construction phase as decommissioning activities are less extensive than construction. Therefore, impacts during the decommissioning phase are SMALL.

19.4.2.1.4 Required Permits

As described in Subsection 19.1.2, several air quality permits are required to support the construction and operation of the SHINE facility. Table 19.1.2-1 indicates that an Air Pollution Control Construction Permit pursuant to the Wisconsin Administrative Code Chapter NR 406, and an Air Pollution Control Construction Permit pursuant to the Wisconsin Administrative Code Chapter NR 407 are required.

After the greenhouse gases are quantified, as noted in Subsection 19.4.2.1.2.3, a determination will be made as to whether the proposed SHINE facility will be subject to regulation.

19.4.2.2 Noise

This subsection provides an assessment of noise impacts from construction, operation and decommissioning of the SHINE facility.

19.4.2.2.1 Impacts of Construction

Typical noise levels from equipment commonly used during construction are listed on Table 19.4.2-12. On-site noise level exposure is controlled through appropriate training, personal protective equipment, periodic health and safety monitoring, and industry best practices. Practices such as maintenance of noise limiting devices on vehicles and equipment, controlling access to high noise areas, duration of emissions, and/or shielding high noise sources near their origin limit the adverse effects of noise on workers. Non-routine activities with potential adverse impacts on noise levels are limited and use best industry practices that further limit adverse effects.

The City of Janesville has no published ordinance governing noise emissions from developed land uses. As a point of reference, Rock Township has published noise level limits for properties outside of the M-1 Light Industrial District, the M-2 Heavy Industrial District, and the SP Special Purpose District. The SHINE site falls within the B1 Local Commercial District zoning boundary (Town of Rock, 2006). The protective level for B1 Local Commercial zoning is 79 decibels (dBA) (Town of Rock, 2008). No distinction is made between day and night noise level limits.

As shown in Table 19.4.2-12, noise levels for construction equipment range from 80 to 88 dBA at 50 ft. (15 m) to 50 to 58 dBA at 1500 ft. (457 m). These data indicate that noise levels attenuate rapidly with distance (30 dBA over a distance of 1450 ft. [442 m]). Based on the natural attenuation of noise levels over distance, the bounding condition construction noise level is below the Rock Township standard between 50 and 500 ft. (15 and 457 m) from its source. As is evident in Figures 19.3.1-1 and 19.3.1-7, the SHINE site is relatively isolated from potential sensitive noise receptors, the closest residences, churches and recreation areas are between 1700 and 2100 ft. (518 and 640 m) from the SHINE site. Thus, the impact of noise from construction of the new site on nearby residences, churches and recreational areas is SMALL.

Traffic associated with the construction workforce traveling to and from the SHINE site also generates noise. The increase in noise relative to background conditions is most noticeable during the shift changes in the morning and late afternoon. The 451 vehicles and 14 heavy vehicles are dispersed in shifts, with the largest shift working during the day. Additionally, posted speed limits, traffic control and administrative measures, such as staggered shift hours, are employed that reduce traffic noise during the weekday business hours. Therefore, potential noise impacts to the community are intermittent and limited primarily to shift changes. The impact from noise from construction-related traffic to nearby residences and recreational areas is SMALL.

Potential indirect impacts may be anticipated to off-site areas associated with the roadway network and adjacent lands beyond the site boundary. Noise related impacts may result from an increased traffic volume and resultant increases in traffic generated noise as discussed above. Noise levels during shift changes in these off-site areas are not notable as these residences are currently located within a roadway network that is characterized by traffic volumes that exhibit traffic noise.

In summary, noise control practices at the construction site and the additional attenuation provided by the distance between the public and the site, limits noise effects to the public and workers during construction so that its impact is SMALL and temporary.

19.4.2.2.2 Impacts of Operation

External noise emission from the SHINE facility during operation is primarily limited by the walls and other physical barriers of the facility itself. Noise generated during operations relates primarily to vehicular movements associated with employees and with truck deliveries.

Traffic associated with the operation of the SHINE facility also generates noise. The increase in traffic relative to background traffic conditions is most evident during the morning and afternoon drive time when workers are going to and leaving work. Approximately 118 work-related vehicles per day are expected to access the site once the site is operational. As discussed in Subsection 19.3.7.2.3.1, existing (2010) traffic volume on US 51 is 9000 vehicles per day. The work-related trips generated by the SHINE facility are insignificant in the existing traffic flow.

Therefore, potential noise impacts to the community from noise from operations-related traffic to nearby residences and recreational areas are SMALL.

Normal operations also include stationary external equipment (a standby diesel generator, heating, ventilation, and air conditioning [HVAC] equipment) that represent a lesser component of noise emission and are more limited in operation. The standby diesel generator is operated intermittently (i.e., for periodic testing and for asset protection during a loss of offsite power), and is therefore not part of normal operations. HVAC equipment is an expected noise source that is a characteristic of normal summer operations.

Potential indirect impacts to off-site areas are associated with the roadway network and adjacent residences and lands beyond the site boundary. Noise related impacts may result from an increased traffic volume and resultant increases in traffic generated noise as discussed above. Noise levels during shift changes in these off-site areas are not notable as these residences are currently located within a roadway network that is characterized by traffic volumes that exhibit traffic noise. The intermittent increase in traffic volume associated with shift changes, and the natural noise attenuation over distance results in noise levels that attenuate to levels below the local standards for continuous noise levels. Therefore, noise impacts resulting from normal operations are SMALL.

19.4.2.2.3 Impacts of Decommissioning

Decommissioning is the removal of a nuclear facility from service and reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. During the decommissioning phase, activities, equipment usage and the noise associated with their operation are expected to be similar or less than that of the construction phase. Therefore, impacts during the decommissioning phase are SMALL.

Table 19.4.2-1 Isotope Production Process – Gaseous Effluents

Effluent	Rate
NO_X	< 6000 pounds per year (lb/yr) [(a)]
CO, lead, O_3, PM	none
Sulfuric acid (H_2SO_4)	< 50 lb/yr [(a)]
krypton-85 (Kr-85)	< 120 Curies per year (Ci/yr)
iodine-131 (I-131)	<1.5 Ci/yr
xenon-133 (Xe-133)	< 17,000 Ci/yr
tritium (H-3)	< 4400 Ci/yr

a) Based on 50 weeks operation

Table 19.4.2-2 Standby Diesel Generator – Emissions

Pollutant	Emission Rates (grams/bhp-hr)	Source[a]	Annual Emissions (T/yr)[b]	Hourly Emissions (lb/hr)	Equivalent Heat Input Emission Factor (lb/MMBtu)
CO	0.52	CAT C175-20 Diesel Engine Technical Data Sheet	0.36	7.5	0.17
NO_x	5.07	CAT C175-20 Diesel Engine Technical Data Sheet	3.52	73.3	1.68
PM	0.04	CAT C175-20 Diesel Engine Technical Data Sheet	0.026	0.55	0.013
Hydrocarbons (VOC)	0.17	CAT C175-20 Diesel Engine Technical Data Sheet	0.12	2.51	0.058
SO_2	0.015	Calculated based on maximum fuel sulfur content of 50 ppm	0.01	0.22	0.005
CO_2	497	AP-42 (10/96) Table 3.4-1	345	7187	165

a) AP-42 from USEPA, 1995
b) Assuming 96 hours operation per year

Table 19.4.2-3 Emissions from Production Facility Building - Natural Gas-Fired Boiler

Pollutant	Emission Factor	Units	Source[a]	Annual Emissions[b]	Hourly Emissions	
				(T/yr)	(lb/hr)	(lb/MMBtu)
CO	84	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	10.37	2.47	0.082
NO_x	50	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	6.22	1.48	0.049
PM_{10} (filterable)	1.9	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.25	0.06	0.0020
PM_{10} (total)	7.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.92	0.22	0.0073
VOC	5.5	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.67	0.16	0.0053
SO_2	0.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.08	0.018	0.0006
CO_2	120,000	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	14,822	3529	117.6

Design Firing Rate:	**30.0**	MMBtu/hr	Estimated based on preliminary building sizing and materials of construction plus 25% design margin
Heating Value for Natural Gas:	1,020	Btu/scf	AP-42 Table 1.4-1
Maximum Fuel Firing Rate:	**29,412**	scf/hr	Calculated (Firing Rate/Heating Value)

a) AP-42 from USEPA, 1995
b) Based on 50 weeks per year

Table 19.4.2-4 Emissions from Administration Building - Natural Gas-Fired Heater

Pollutant	Emission Factor	Units	Source(b)	Annual Emissions(c) (T/yr)	Hourly Emissions (lb/hr)	Hourly Emissions (lb/MMBtu)
CO (Residential Furnace)	40	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	0.05	0.011	0.038
NO_x (Residential Furnace)	94	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	0.11	0.027	0.093
PM_{10} (filterable)	1.9	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.002	0.0005	0.002
PM_{10} (total)	7.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.009	0.0022	0.008
VOC	5.5	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.007	0.0016	0.006
SO_2	0.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.001	0.00017	0.0006
CO_2	120,000	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	143.2	34.1	117.6

Estimated Heating Load:	**233,278**	Btu/hr	Estimated based on preliminary building size and materials of construction
Design Firing Rate:	**290,000**	Btu/hr	Heating load plus a design margin of approximately 25% to provide bounding value
Heating Value for Natural Gas:	1,020	Btu/scf	AP-42 Table 1.4-1
Firing Rate:	**284.3**	scf/hr	Calculated (Firing Rate/Heating Value)

a) Exhaust characteristics for the indirect-fired heaters were based on information available from equipment vendors for packaged indirect-fired heaters.
b) AP-42 from USEPA, 1995
c) Based on 50 weeks per year

References: Hastings, 2011; Reznor, 2002

Table 19.4.2-5 Emissions from Support Facility Building - Natural Gas-Fired Heater

Pollutant	Emission Factor	Units	Source(b)	Annual Emissions(c) (T/yr)	Hourly Emissions (lb/hr)	Hourly Emissions (lb/MMBtu)
CO (Residential Furnace)	40	$lb/10^6$ scf	AP-42 Table 1.4-1 (7/98)	0.067	0.016	0.038
NO_x (Residential Furnace)	94	$lb/10^6$ scf	AP-42 Table 1.4-1 (7/98)	0.16	0.039	0.093
PM_{10} (filterable)	1.9	$lb/10^6$ scf	AP-42 Table 1.4-2 (7/98)	0.003	0.0008	0.002
PM_{10} (total)	7.6	$lb/10^6$ scf	AP-42 Table 1.4-2 (7/98)	0.013	0.0031	0.007
VOC	5.5	$lb/10^6$ scf	AP-42 Table 1.4-2 (7/98)	0.010	0.0023	0.005
SO_2	0.6	$lb/10^6$ scf	AP-42 Table 1.4-2 (7/98)	0.001	0.00025	0.0006
CO_2	120,000	$lb/10^6$ scf	AP-42 Table 1.4-2 (7/98)	207.5	49.4	117.6

Estimated Heating Load:	**337,317**	Btu/hr	Estimated based on preliminary building size and materials of construction
Design Firing Rate:	**420,000**	Btu/hr	Heating load plus a design margin of approximately 25% to provide bounding value
Heating Value for Natural Gas:	1,020	Btu/scf	AP-42 Table 1.4-1
Firing Rate:	**411.8**	scf/hr	Calculated (Firing Rate/Heating Value)

a) Exhaust characteristics for the indirect-fired heaters were based on information available from equipment vendors for packaged indirect-fired heaters.
b) AP-42 from USEPA, 1995
c) Based on 50 weeks per year

References: Hastings, 2011; Reznor, 2002

Table 19.4.2-6 Emissions from Waste Staging & Shipping Building - Natural Gas-Fired Heater

Pollutant	Emission Factor	Units	Source(b)	Annual Emissions(c)	Hourly Emissions	
				(T/yr)	(lb/hr)	(lb/MMBtu)
CO (Residential Furnace)	40	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	0.029	0.007	0.039
NO_x (Residential Furnace)	94	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	0.071	0.017	0.094
PM_{10} (filterable)	1.9	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.001	0.0003	0.002
PM_{10} (total)	7.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.005	0.0013	0.007
VOC	5.5	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.004	0.0010	0.006
SO_2	0.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	<0.001	0.000011	0.0006
CO_2	120,000	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	89.0	21.2	117.8

Estimated Heating Load:	**141,597**	Btu/hr	Estimated based on preliminary building size and materials of construction
Design Firing Rate:	**180,000**	Btu/hr	Heating load plus a design margin of approximately 25% to provide bounding value
Heating Value for Natural Gas:	1,020	Btu/scf	AP-42 Table 1.4-1
Firing Rate:	**176.5**	scf/hr	Calculated (Firing Rate/Heating Value)

a) Exhaust characteristics for the indirect-fired heaters were based on information available from equipment vendors for packaged indirect-fired heaters.
b) AP-42 from USEPA, 1995
c) Based on 50 weeks per year

References: Hastings, 2011; Reznor, 2002

Table 19.4.2-7 Emissions from Diesel Generator Building - Natural Gas-Fired Heater

Pollutant	Emission Factor	Units	Source[(b)]	Annual Emissions[(c)] (T/yr)	Hourly Emissions (lb/hr)	Hourly Emissions (lb/MMBtu)
CO (Residential Furnace)	40	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	0.013	0.003	0.042
NO_x (Residential Furnace)	94	lb/10^6 scf	AP-42 Table 1.4-1 (7/98)	0.029	0.007	0.097
PM_{10} (filterable)	1.9	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	< 0.001	0.0001	0.001
PM_{10} (total)	7.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.002	0.0005	0.007
VOC	5.5	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	0.002	0.0004	0.006
SO_2	0.6	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	< 0.001	0.00004	0.0006
CO_2	120,000	lb/10^6 scf	AP-42 Table 1.4-2 (7/98)	35.7	8.5	118.1

Estimated Heating Load:	**57,987**	Btu/hr	Estimated based on preliminary building size and materials of construction
Design Firing Rate:	**72,000**	Btu/hr	Maximum heat input required plus 25% design margin
Heating Value for Natural Gas:	1,020	Btu/scf	AP-42 Table 1.4-1
Firing Rate:	**70.6**	scf/hr	Calculated (Firing Rate/Heating Value)

a) Exhaust characteristics for the indirect-fired heaters were based on information available from equipment vendors for packaged indirect-fired heaters.
b) AP-42 from USEPA, 1995
c) Based on 50 weeks per year

References: Hastings, 2011; Reznor, 2002

Table 19.4.2-8 Total Annual Emissions

Pollutant	Annual Emissions (T/yr)
CO	10.9
NO_x	13.1 [(a)]
PM (total)	0.98
HC (VOC)	0.81
SO_2	0.09
CO_2	15,642

a) Includes 3 T/yr (6,000 lb/yr) NO_x emissions from process stack

Table 19.4.2-9 SHINE Facility Release Point Characteristics (Sheet 1 of 2)

Production Facility Building

Stack Data	Units	Boiler	Process
Exhaust Flow	acfm	14,450	53,251
Exhaust Temperature	°F	585	104
Height	feet above grade	66	66
Diameter	feet	1.67	4.67
Exhaust Velocity	feet/sec	110.4	51.9
Stack Base Elevation	feet above mean sea level	821	821

Administration Building

Stack Data	Units	Value	Description
Height	feet above grade	21	Based on Administration Building height of 16 feet and heater exhaust height of 5 feet above roof
Exhaust Orientation		Vertical	Assumed vertical with rain cap
Diameter	inches	5.0	Typical exhaust vent outlet for 200,000 to 300,000 Btu/hr heater
Exhaust Fan Flow	acfm	180	Approximate full load exhaust gas flow rate based on natural gas combustion
Exhaust Temperature	°F	160	Assumed for indirect-fired natural gas heater
Exhaust Velocity	ft/sec	22	Calculated
Stack Base Elevation	feet AMSL	817	

Support Facility Building

Stack Data	Units	Value	Description
Height	feet above grade	26	Based on support facility building height of 21 feet and heater exhaust height of 5 feet above roof
Exhaust Orientation		Vertical	Assumed vertical with rain cap
Diameter	inches	6.0	Typical exhaust vent outlet for >300,000 Btu/hr heater
Exhaust Fan Flow	acfm	260	Approximate full load exhaust gas flow rate based on natural gas combustion
Exhaust Temperature	°F	160	Assumed for indirect-fired natural gas heater
Exhaust Velocity	ft/sec	22	Calculated
Stack Base Elevation	feet AMSL	822	

Table 19.4.2-9 SHINE Facility Release Point Characteristics (Sheet 2 of 2)

Waste Staging and Shipping Building			
Stack Data	**Units**	**Value**	**Description**
Height	feet above grade	23	Based on Administration Building height of 18 feet and heater exhaust height of 5 feet above roof
Exhaust Orientation		Vertical	Assumed vertical with rain cap
Diameter	inches	4.0	Typical exhaust vent outlet for <200,000 Btu/hr heater
Exhaust Fan Flow	acfm	120	Approximate full load exhaust gas flow rate based on natural gas combustion
Exhaust Temperature	^oF	160	Assumed for indirect-fired natural gas heater
Exhaust Velocity	ft/sec	23	Calculated
Stack Base Elevation	feet AMSL	824	

Diesel Generator Building			
Stack Data	**Units**	**Value**	**Description**
Height	feet above grade	22	Based on Diesel Generator Building height of 17 feet and heater exhaust height of 5 feet above roof
Exhaust Orientation		Vertical	Assumed vertical with rain cap
Diameter	inches	4.0	Typical exhaust vent outlet for <200,000 Btu/hr heater
Exhaust Fan Flow	acfm	60	Approximate full load exhaust gas flow rate based on natural gas combustion
Exhaust Temperature	^oF	160	Assumed for indirect-fired natural gas heater
Exhaust Velocity	ft/sec	11	Calculated
Stack Base Elevation	feet AMSL	823	

Table 19.4.2-10 Pollutant Impacts Compared to the SIL

Pollutant	Averaging Period	Maximum Predicted Impact ($\mu g/m^3$)(b)	Year	SIL ($\mu g/m^3$)
CO	1-hr.	30	2009	2000
	8-hr.	15	2007	500
NO_2	1-hr.	64.6	5-yr	7.5
	Annual	2.3	2007	1
SO_2	1-hr.	0.23	5-yr	7.9
	3-hr.	0.14	2008	25
	24-hr.	0.074	2008	5
	Annual	0.0085	2007	1
PM_{10}	24-hr.	0.92	5-yr	5
	Annual	0.09	5-yr	1
$PM_{2.5}$ (a)	24-hr.	0.75	5-yr	1.2
	Annual	0.09	5-yr	0.3

a) A recent court decision (US Court of Appeals, For the District of Columbia Circuit), January 22, 2013, Sierra Club vs. EPA (No. 10-1413) vacated the $PM_{2.5}$ SIL and remanded it to EPA. The SILs for other pollutants remain in effect.

b) Values represent the highest predicted impacts for each pollutant and averaging time.

Table 19.4.2-11 Pollutant Impacts Compared to the NAAQS

Pollutant	Averaging Period	Rank	Predicted Impact (μg/m^3)	Year[(a)]	Bkgd. Conc. (μg/m^3)	Total Conc. (μg/m^3)	NAAQS[(b)] (μg/m^3)	% of NAAQS	PSD Increment (μg/m^3)
CO	1-hr.	H2H[(c)]	28	2009	1363	1391	40,000	3	None
	8-hr.	H2H[(c)]	13	2008	1191	1204	10,000	12	None
NO_x	1-hr.	98th %	47.4	5-yr	55	102.4	188	54	None
(as NO_2)[(d)]	Annual	H1H[(c)]	2.3	2007	24.1	26.4	100	26	25
PM_{10}[(f)]	24-hr.	H6H[(e)]	0.7	5-yr	47.0	47.7	150	32	30
$PM_{2.5}$	24-hr.	98th %	0.54	5-yr	28.9	29.4	35	84	9
	Annual	H1H[(c)]	0.09	5-yr	10.2	10.3	12	86	4
SO_2[(g)]	1-hr.	99th %	0.19	5-yr	13	13.2	196	7	None
	3-hr.	H2H	0.14	2008	43.2	43.3	1300	3	512

a) 5-yr indicates an average over the 5 modeled years
b) Primary standards except SO_2 3-hr., which is a secondary standard
c) H1H is the high, first high and H2H is the high, second high concentration of ranked concentrations at all receptors
d) NO_x modeled; assume a 100% conversion rate of NO_x to NO_2
e) 6th highest value over 5 years
f) Although there is a SIL for the annual PM_{10} impacts, there is no NAAQS standard
g) 24-hr. and Annual standards revoked June 22, 2010 (75 FR 35520)

Table 19.4.2-12 Typical Noise and Emissions from Construction Equipment

Equipment Type	Noise Level in dBA[(a)] At 50 Feet	At 500 Feet	At 1500 Feet
Earthmoving			
Loaders	88	68	58
Dozer	88	68	58
Tractor	80	60	50
Grader	85	65	55
Trucks	86	66	56
Shovels	84	64	54
Materials Handling			
Concrete pumps/mixers	81	61	51
Derrick and mobile cranes	83	63	53
Stationary			
Portable Generator	84	64	54
Impact			
Paving breaker	80	60	50
Light Duty Vehicles	NA	NA	NA

a) Rock Township, Wisconsin, Noise Limits:
M-1 Light Industrial, M-2 Heavy Industrial and SP Special Purpose District: 79 dBA
All other districts: 72 dBA

Reference: California Energy Commission, 2009

19.4.3 GEOLOGIC ENVIRONMENT

Potential impacts to geologic and soil resources during the construction, operation, and decommissioning of the proposed facility include large-scale hazards and local hazards. The large-scale hazards include earthquakes, volcanic activity, landslides, subsidence, and erosional processes. Local hazards are associated with site-specific properties of the soil and bedrock and include soil disturbances due to excavation, exposure of contaminated soil during excavation, blasting of bedrock (if required for construction), volume of material excavated or used during construction, impacts to rare or unique geologic resources, and impacts to rock/mineral/energy rights.

19.4.3.1 Impacts of Large-Scale Hazards

As noted in Subsection 19.3.3, the probability of large-scale impacts due to geologic factors is low. The seismologic regime (Subsection 19.3.3.5) of the region demonstrates that the site is located in one of the lowest earthquake hazard regions of the country. The lack of earthquakes in the region is associated with a lack of tectonic and volcanic activity, as discussed in Subsections 19.3.3.2 and 19.3.3.6.2.

The geologic environment features that are associated with landslides, subsidence, and erosional processes are discussed in Subsections 19.3.3.3 and 19.3.3.4. While landslides and subsidence can occur, the risk for subsidence or landslides within Rock County is not considered high. In addition, no sinkholes have been reported in the county in recent years. The primary soils present at the SHINE site are classified as slightly erodible and the secondary soils at the site are classified as moderately erodible. No soils present at or near the site are classified as highly erodible soils.

Consequently, impacts relative to the geologic environment are SMALL.

19.4.3.2 Other Impacts on Soils and Geology

The construction of the facility will include the excavation of the Radiologically Controlled Area (RCA) to an approximate depth of approximately 39 ft. (11.9 m) below a final grade of 826.0 ft. (251.8 m). The resulting final elevation of the base of the excavation is 787 ft. (239.9 m). The maximum frost depth is 4 ft. (1.2 m) below ground surface, and all underground utilities will be designed accordingly, with a preliminary estimation of utility excavation depth of 5 ft. (1.5 m) below ground surface.

No evidence of “recognized environmental conditions” as described in ASTM E 1527-05 were found to exist at the SHINE site, nor were any samples collected during the groundwater monitoring (as described in Subsection 19.3.4.3, Table 19.3.4-9) found to contain contamination indicating the presence of contaminated soil above the groundwater.

An analysis of the geology of Rock County indicates that it is similar to the geology of much of southern Wisconsin and northern Illinois in that it comprises glacial sediments and limestone which are not unique or rare geological resources in the region (Olcott, Perry G., 1969). Historic mineral production in Rock County has included the mining of sand, gravel, and crushed and broken limestone, with no precious- or base-metal mineral resources mapped or discovered within Rock County (Olcott, Perry G., 1969). In addition, no extraction of energy resources occurs at the site.

As noted in Subsection 19.3.4.1.2.2, bedrock at the SHINE site is at a depth greater than 220 ft. (67 m) below ground surface. The deepest excavation planned is approximately 39 ft. (11.9 m) below ground surface which eliminates the need for blasting to support excavations.

Figure 19.4.1-2 provides an illustration of the SHINE facility construction grading plan. Excavation depth of the RCA is bounded at approximately 39 ft. (11.9 m) below finished grade. For estimation of excavation quantities, a depth of 5 ft. (1.5 m) below finished grade was used for the ancillary buildings. Direct impacts associated with excavation and topsoil removal for underground utilities and site grading has also been estimated. The total amount of material to be excavated at the SHINE site is 278,000 cubic yards (212,550 cubic meters). Additional assumptions made in preparing the estimate include:

- Twenty-five percent margin for bounding considerations.
- Frost depth is 4 ft. (1.2 m), and ancillary building foundations will be at a minimum depth of 5 ft. (1.5 m).
- The bearing material at the final depth of excavation is suitable for supporting the design load, eliminating the need for over-excavation.
- An allowance for a 12-inch (30.5-centimeter) thick mudmat was included at the bottom of excavations within the RCA, with the total depth of the excavation, including mudmat allowance, not to exceed approximately 39 ft. (11.9 m) below ground surface
- Excavated slopes are stable on a slope of 1.5 horizontal to 1 vertical.
- An 8-ft. (2.4 m) wide bench is included in the excavation for slope stability concerns.
- The excavation is 10 ft. (3.05 m) wider at the base of the excavation around the sides of the RCA to allow for the erection of forms and to provide a working area.
- Below 1 ft. (0.3 m) of topsoil, the underlying material is essentially homogenous.

Preliminary plans call for materials excavated during site grading and construction to be stockpiled on-site and used as backfill. Topsoil and other materials not suited for use as structural fill will be stockpiled on-site and placed as non-structural fill. A sediment and erosion control plan is required and mitigates the potential indirect impacts associated with the release of sediment or other runoff constituents to off-site areas.

Based on the above assumptions, the estimated quantity of geologic material required for the completion of this project, exclusive of concrete acquired from commercial concrete mixing plants for construction of the buildings, is:

- Backfill: 74,000 cubic yards (56,580 cubic meters) around structures in main excavation (reuse of suitable material excavated on-site);
- Topsoil: 10,000 cubic yards (7645 cubic meters), acquired from on-site sources.
- Granular road base: 7600 cubic yards (5810 cubic meters).
- Asphaltic pavement: 2200 cubic yards (1682 cubic meters).
- Gravel surfacing: 8500 cubic yards (6499 cubic meters).
- Underground utilities: 3500 cubic yards (2676 cubic meters) for backfill (reuse of suitable material excavated on-site).

- Site grading: 10,000 cubic yards (7645 cubic meters), to be acquired from material excavated on-site.

In order to reduce impacts, on-site materials will be utilized as appropriate and no off-site borrow areas are anticipated. Consequently, direct impacts to the geologic environment are SMALL and no indirect (off-site) impacts are identified.

No impacts have been identified due to large scale or local hazards which require mitigation measures beyond compliance with local building codes.

19.4.4 WATER RESOURCES

19.4.4.1 Hydrology

19.4.4.1.1 Surface Water

19.4.4.1.1.1 Facility Construction

No surface water features such as creeks, streams or ponds are present on or in the immediate area surrounding the SHINE site. As a result, there are no direct effects to surface water resources.

Federal, state and local regulations and permit procedures provide minimum requirements for stormwater management during construction activities to prohibit adverse impacts on surface water, or stormwater. A sediment and erosion control plan is required and mitigates the potential indirect impacts associated with the release of sediment or other runoff constituents to off-site areas. An assessment of stormwater runoff patterns in the vicinity of the SHINE site indicates that the drainage area upstream of the site is approximately 100 ac. (40.4 ha), based on City of Janesville 2-ft. (0.6-m) contour interval mapping. Due to the area being very flat (0 to 1 percent slopes), having high-permeability subsoils, and being continuously tilled for agricultural use, no dendritic flow patterns develop. In addition, because of the flat terrain, it is difficult to accurately identify the exact drainage area, and tilled rows in the fields could direct flow to other basins. Runoff from this area is diverted around the site using appropriate measures as required by state and local authorities. There are no impoundments or significant detention/retention areas on the site currently that provide detention/reduction of storm runoff.

Construction-phase dewatering is not required, because the measured groundwater level is well below the deepest excavation. Thus, there is no effect on surface water quantity or flow characteristics due to drawdown of groundwater or discharge of construction phase dewatering effluent. Consequently, indirect impacts of construction of the SHINE facility on surface water are SMALL.

19.4.4.1.1.2 Facility Operations

As is described in Section 19.2, all water used at the SHINE site is obtained from the City of Janesville municipal water supply system and all sanitary waste water is discharged directly to the City of Janesville sanitary sewer system. Additionally, the facility is designed to have zero liquid discharge from the radiologically controlled area (RCA). Consequently, there is no use or release of water from the facility to the adjacent environment that would affect surface water hydrologic systems. Direct impacts to surface water from plant operations are, therefore, SMALL.

The SHINE facility site layout is illustrated in Figure 19.2.1-1. The site plan includes a low degree of impervious areas that are associated with rooftops, paved drives, and parking lots, etc. Additionally, the impervious surfaces are not “directly connected,” and stormwater instead flows across or through pervious areas as it drains across the site. These pervious areas, including vegetated swales, provide control of stormwater quantity (volume and peak rate) as well as quality. The state requirements (Wisconsin Administrative Natural Resources Code, Chapters NR 151 and NR 216); the City of Janesville requirements (Ordinances Chapter 15, Sections 15.05 [construction erosion and sediment control]; and 15.06 [post-construction stormwater management]) for maintenance of on-site infiltration and phosphorous removal by use of best management practices (BMPs) will be met or exceeded.

SHINE has coordinated with the City of Janesville stormwater staff regarding requirements for stormwater management. As a result of that coordination, the stormwater plan for the site incorporates the use of vegetated drainage swales for control of both stormwater quantity and quality. No retention or detention "pond" is to be constructed at the site to avoid larger water surface areas (even during temporary periods of storm runoff), thereby avoiding the potential for glare from the surface that might affect aircraft at the adjacent Southwestern Wisconsin Regional Airport. The absence of permanent or occasional water, as well as food sources, also minimizes frequenting of the site by waterfowl, such as Canada geese, which could otherwise be a concern for both the airport (bird aircraft hazard) and for stormwater quality due to the introduction of fecal material, a common concern for urban stormwater management ponds in the region.

Most areas of the site that are not impervious are either landscaped with native vegetation, cool-season grasses, or continue agricultural row-crop production. Use of native vegetation rather than turf grass eliminates or greatly reduces irrigation needs and maintains a low surface runoff and natural (i.e., higher than turf grass) evapotranspiration condition. All of these practices result in minimal impact to surface water downstream of the site, or even a reduction in surface runoff, compared to the current row-crop agricultural use which involves annual tillage practices.

During operation, dewatering is not required because the measured groundwater level is well below the deepest basement. Thus, there is no effect on surface water quantity or flow characteristics due to drawdown of groundwater or discharge of operation phase dewatering effluent.

Indirect impacts of site runoff on surface waters are, therefore, SMALL.

19.4.4.1.1.3 Facility Decommissioning

As described above, no surface water features are present on or in the immediate area surrounding the SHINE site. As a result, there are no direct effects from decommissioning to surface water resources.

Federal, state and local regulations and permit procedures provide minimum requirements for stormwater management during decommissioning activities to prohibit adverse impacts on surface water, or stormwater. A stormwater pollution prevention plan, including a sediment and erosion control plan, is required and mitigates the potential indirect impacts associated with the release of sediment or other runoff constituents to off-site areas. There are no impoundments or significant detention/retention areas on the site currently, or as a component of the site plan, that provide retention of storm runoff.

During decommissioning, dewatering is not required because the measured groundwater level is well below the deepest basement. Thus, there is no effect on surface water quantity or flow characteristics due to drawdown of groundwater or discharge of decommissioning phase dewatering effluent. Consequently, indirect impacts of decommissioning of the SHINE facility on surface water are SMALL.

19.4.4.1.2 Groundwater

19.4.4.1.2.1 Construction, Operations and Decommissioning

The construction of the facility includes the excavation of the RCA to an approximate depth no greater than approximately 39 ft. (11.9 m) below final grade of 827.0 ft. (252.1 m) (Section 19.4.3.2). The resulting final elevation of the base of the excavation is 788 ft. (240 m), more than 20 ft. (6 m) higher than the measured high groundwater elevation of 765.92 ft. (233.45 m). All elevations are referenced to North American Vertical Datum 88 (NAVD 88). Consequently, there is no direct impact to groundwater flow. All water used by the SHINE facility is obtained from the City of Janesville municipal water supply system and all sanitary wastes are discharged directly to the City of Janesville sanitary sewer system. No groundwater withdrawals and no groundwater returns are required during the construction, operation, or decommissioning of the facility, with no direct or indirect impacts to groundwater.

Consequently, direct and indirect impacts to groundwater are SMALL.

19.4.4.2 Water Use

19.4.4.2.1 Surface Water

All water used at the SHINE site during construction, operation, and decommissioning is obtained from the City of Janesville municipal water supply system and all waste water discharges go directly to the City of Janesville sanitary sewer system. Additionally, the facility is designed such that there is no liquid discharge from the RCA. Consequently, there is no use or release of water from the facility to the adjacent environment that would affect surface water hydrologic systems. Direct impacts to surface water from plant operations are, therefore, SMALL.

19.4.4.2.2 Groundwater

Construction, operation, and decommissioning activities do not involve the use of groundwater. Any water utilized on-site is obtained from the City of Janesville Public Water Utility. Consequently, direct impacts of water use on groundwater are SMALL.

The average estimated water usage by the SHINE facility during operations is 6070 gallons (22,977 liters) per day and a consumptive water use of 1560 gallons (5905 liters) per week. As noted in Subsection 19.3.4.2.2, the Janesville Water Utility provides water supply for both public drinking water and for fire protection, utilizing eight wells. The water supply system for the City of Janesville includes two water storage reservoirs and one water tower. According to the City of Janesville, the total pumping capacity of its eight groundwater wells is 29 million gallons per day (Mgd) (109.8 million liters per day [Mld]). Average water usage is about 11 Mgd (41.6 Mld) with a maximum recorded daily demand of 25.8 Mgd (97.7 Mld). Accordingly, the excess capacity of the Janesville water supply system is approximately 3.2 Mgd (12.1 Mld). Because there is excess capacity within the Janesville water supply system, potential indirect effects from the demand from the SHINE facility are also SMALL.

19.4.4.3 Water Quality

Potential surface water and groundwater quality impacts of site construction and operation are discussed in this section.

19.4.4.3.1 Surface Water

19.4.4.3.1.1 Facility Construction and Decommissioning

No surface water features are present on or in the immediate area surrounding the SHINE site. As a result, there are no direct effects to water quality.

Potential indirect surface water quality impacts from facility construction and decommissioning are similar to those of construction of any typical industrial or commercial facility in the area. Erosion and sediment control for ground disturbing activities will meet or exceed the regulatory requirements, including Clean Water Act National Pollutant Discharge Elimination System (NPDES) regulations and Wisconsin regulations (NR 151.11).

In addition to soil erosion and sedimentation, potential release of other potential construction activity pollutants (petroleum products, adhesives, paint, etc.), is minimized by SHINE's waste management and minimization program (Subsection 19.4.8.1.2.3 and 19.2.5.6). Additionally, Federal and state regulations and permit requirements address management and control of all potential pollutants at the facility through the use of structural and non-structural BMPs such that release of such materials to off-site waters is minimized.

Construction- and decommissioning-phase dewatering is not required because the measured groundwater level is well below the deepest excavation. Thus, there is no effect on surface water quality due to drawdown of groundwater or discharge of construction phase and decommissioning phase dewatering effluent. Therefore, indirect impacts to water quality from construction and decommissioning are SMALL.

19.4.4.3.1.2 Facility Operation

As described in Subsection 19.4.1.1, meeting the requirements of state and local stormwater management requirements minimizes potential impacts associated with site development. One of the most significant indicators of urban stormwater quality is imperviousness. The site has a low percentage of imperviousness (Figure 19.2.1-1) and the impervious areas discharge to vegetated pervious areas where treatment of runoff occurs, including infiltration, filtering, and biological uptake of pollutants. According to state permitting requirement at NR 151.12, SHINE must complete a detailed simulation of hydrology and pollutant discharges with and without use of stormwater BMPs to show 80 percent removal of total suspended solids by the BMPs to be implemented. As appropriate and as required by permit, the SHINE site design will maintain a minimum site infiltration amount, defined as either: (1) at least 60 percent of the pre-development infiltration based on average annual rainfall, or (2) at least 10 percent of the 2-year, 24-hour duration storm runoff.

Approximately 53.75 ac. (21.75 ha) of the total site may remain in row-crop agricultural use where applications of chemicals in accordance with best agricultural practices would continue. Alternatively, all or a portion of the existing agricultural use area of the site may be converted to native vegetation, reducing chemical applications and other associated existing agricultural practices that have a higher potential for affecting surface water quality.

Additionally, extensive use of native landscaping or cool-season grasses at the site minimizes the need for applications of herbicides, pesticides, and fertilizer at the site. Small areas of turf grass are maintained, and applications of any of these chemicals or fertilizers are performed in a manner consistent with product label instructions to minimize potential impacts. The oil stored on-site, which assumes a bounding value of an approximately 30,000-gallon (113,562 L) underground storage tank containing fuel oil for the standby generator, requires a Spill Prevention, Control, and Countermeasure (SPCC) Plan in accordance with 40 CFR Part 112. The SPCC Plan details requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines. The implementation of the SPCC Plan prevents releases from the aboveground oil storage from impacting surface waters.

During operation, dewatering is not required because the measured groundwater level is well below the deepest basement. Thus, there is no effect on surface water quality due to drawdown of groundwater or discharge of operation phase dewatering effluent. Therefore, impacts to water quality from operation of the SHINE facility are SMALL.

19.4.4.3.2 Groundwater

19.4.4.3.2.1 Construction, Operation, and Decommissioning

Possible indirect impacts on groundwater quality can occur during construction, operation or decommissioning if spills from vehicles, equipment, or storage areas penetrate hard surfaces (asphalt or concrete) or are accidentally released to pervious surfaces and migrate to groundwater prior to detection and remediation of the release. All equipment and material storage areas are in compliance with appropriate regulations requiring secondary containment of stored liquids and materials. Oil storage associated with the operation of the facility includes an approximately 30,000-gallon (113,562 L) underground storage tank containing fuel oil for the standby diesel generator. Fuel storage associated with the construction/decommissioning is within secondary containment and the implementation of the SPCC Plan prevents releases from migrating through the subsurface and impacting groundwater.

Measured groundwater levels are below the deepest excavation during construction and decommissioning, and below the base of the lowest basement, which prevents any direct impacts to groundwater.

Because of the depth of groundwater below the SHINE site, and the use of appropriate management and control measures as stated above, direct and indirect impacts to groundwater quality are SMALL.

19.4.4.4 Monitoring

The facility is eligible for a WPDES stormwater discharge permit exclusion under Wisconsin Administrative Code NR 216.21(3). The stormwater discharge permit exclusion does not include any stormwater monitoring requirements. Because of the absence of direct impacts to surface water, the low potential for indirect impacts, and the use of management measures and controls to prevent releases to surface water, no surface water monitoring activities are planned for the site.

Because of the absence of direct impacts to groundwater, the low potential for indirect impacts, and the use of management measures and controls to prevent releases to groundwater, no non-radiological groundwater monitoring activities are planned for the site.

19.4.5 ECOLOGICAL RESOURCES

This subsection addresses the impacts of construction and operation on the ecological resources on and within the vicinity of the SHINE site. The impacts discussed below are based on the characterization and description of terrestrial and aquatic ecosystems within the SHINE site and near site region from Subsection 19.3.5. The region surrounding the SHINE site is defined in Subsection 19.3.1.1.2 as the area within a 5 mi (8-km) radius of the site centerpoint and is located entirely within Rock County, Wisconsin.

The ecological resources described in Subsection 19.3.5 are based on recorded information provided by resource agencies (WDNR and U.S. Fish and Wildlife Service [USFWS]) and supplemental quarterly field surveys conducted in 2011 and 2012. Although the region is defined as the area within a 5 mi (8-km) radius of the site centerpoint, protected species information was provided by the USFWS and WDNR within a 6 mi (9.7 km) radius of the site.

Impacts include effects from activities associated with construction and operation, including excavation, grading, placement of fill material, temporary staging and construction laydown, construction of permanent features, and potential operational disturbances. This evaluation indicates the magnitude of potential impacts and whether mitigation measures are required.

As described in Subsection 19.3.5, the SHINE site consists of a 91.27-ac. (36.94 ha) parcel that has been farmed for the past several decades and is routinely disturbed by the disking, plowing, herbicide application and harvesting activities associated with row crop production. Ecological resources at the SHINE site, therefore, are limited by the active agricultural practices on the site and by a complete lack of surface water resources. Because baseline conditions consist solely of agricultural land lacking native terrestrial or aquatic habitat, post construction ecological monitoring and maintenance plans are not deemed necessary.

19.4.5.1 Impacts from Construction

This subsection describes the potential construction-related ecological impacts to the SHINE site and near off-site areas based on the SHINE facility site layout (see Figure 19.2.1-1). Activities such as earthmoving, excavation, erection, batch plant operation, and construction-related traffic generate potential disturbances to ecological resources during the construction phase of the SHINE project. Direct and indirect impacts associated with construction-related disturbance to the site and near-site areas is limited to the agricultural lands on-site. Figure 19.2.1-1 depicts the proposed buildings for site construction. Given the agricultural nature of the site, land clearing is not necessary. Furthermore, the project does not involve clearing along stream banks, dredging, disposal of dredged material, or waste disposal areas.

On the 91.27-ac. (36.94 ha) SHINE site, direct impacts from construction permanently converts 25.67 ac. (10.39 ha) of agricultural lands to industrial facilities. Although the entire site is in agricultural production, 0.18 ac. (0.07 ha) of permanent impacts are technically mapped as Developed, Open Space (Table 19.4.5-1). Permanent conversion to industrial facilities include the construction of facility buildings, employee parking lot, facility access road/driveway, stormwater detention area, access road drainage ditches, and US 51 drainage ditches. Construction impacts also include the temporary impact of 14.54 ac. (5.88 ha) of agricultural lands used for the construction parking area, construction material staging or lay down area, and temporary disturbance from water and sewer line installation. Temporary impact areas are either returned to agriculture or restored with either cool season grasses or native prairie. Construction impacts are summarized in Table 19.4.5-1.

19.4.5.1.1 Places and Entities of Special Interest

There are no places or entities of special interest on-site, including wetlands. Habitats of special interest off-site include wetlands and endangered resources identified by the WDNR near the SHINE site. As described in Subsection 19.3.5.6, mapped wetland land cover within a 5-mi. (8-km) radius includes just 722 ac. (292 ha) of woody wetlands and 787 ac. (318 ha) of emergent herbaceous wetlands (see Table 19.3.1-1). None of these wetland resources are impacted by construction at the SHINE site.

As part of a WDNR endangered resources review letter, six habitats of special interest were identified near (within 6 mi. [9.6 km]) the SHINE site (WDNR, 2012b) including dry prairie, dry-mesic prairie, mesic prairie, Southern dry-mesic forest, Southern mesic forest, and wet prairie (see Subsection 19.3.5.4.1). These habitats are not located on the SHINE site and none of these habitats near the site are either directly or indirectly impacted by construction. Happy Hollow County Park (southwest of the site) was also identified by WDNR near the SHINE site but is not impacted by construction.

As discussed in Subsection 19.3.5.4.3, Rock County is located along a principal route of the Mississippi Flyway and, therefore, the natural habitats along the Rock River are particularly useful to migrating birds for resting, feeding and foraging. As stated in Subsection 19.3.5.5, the Rock River is 1.9 mi. (3.1 km) southwest of the SHINE site. Although the site may be used occasionally for resting or foraging by migratory birds, habitat on-site and in adjacent lands are dominated by agricultural and developed uses that are not considered high value or important ecological systems. Although the project permanently converts 25.67 ac. (10.39 ha) of agricultural lands to industrial facilities, this direct impact is not significant when compared to the vast amount of agricultural land remaining in the region (see Table 19.4.5-1).

In summary, impacts to places and entities of special interest from construction are SMALL because such ecological resources are not present on-site and because the identified off-site resources are distant from the site and are not impacted by construction on the SHINE site. Specific mitigation measures and management controls are not needed.

19.4.5.1.2 Aquatic Communities and Wetlands

There are no streams, ponds, wetlands, or other aquatic communities present on the SHINE site. Because the site lacks wetlands and aquatic resources, and because dewatering of groundwater in excavations is not anticipated, any potential construction-related impacts to wetlands and aquatic resources are limited to indirect off-site impacts associated with runoff and siltation. As stated in Subsection 19.3.5.5, the nearest water feature is a small intermittent stream 1.6 mi. (2.6 km) south of the site and the Rock River is 1.9 mi. (3.1 km) southwest of the site. However, this intermittent stream receives drainage from lands east of the SHINE site and does not receive runoff from the site. Runoff from the site flows southwest toward the Rock River. However, because of the high infiltration rate of the soils on the SHINE site, no organized stream channel and associated aquatic habitats are present.

BMPs are used in accordance with the SWPPP, as required by the WDNR, to prevent sediment runoff and subsequent siltation in receiving streams during construction. Because of the absence of on-site aquatic communities and wetlands, the distance to off-site streams, the high infiltration rate of the soils near the SHINE site, and the implementation of BMPs on-site, direct and indirect impacts to aquatic communities and wetlands from construction are SMALL. Specific mitigation measures and management controls are not needed.

19.4.5.1.3 Terrestrial Communities

As summarized in Table 19.4.5-1, direct construction impacts permanently convert 25.67 ac. (10.39 ha) of agricultural lands to industrial facilities including the construction of facility buildings, employee parking lot, facility access road/driveway, vegetated stormwater drainage swales, access road drainage ditches and US 51 drainage ditches. Construction impacts also include the direct temporary impact of 14.54 ac. (5.88 ha) of agricultural lands used for the construction parking area, construction material staging or lay down area, and temporary disturbance from water and sewer line installation. Temporary impact areas are either returned to agriculture or restored with either cool season grasses or native prairie.

The terrestrial communities on the SHINE site and near site areas are described in Subsection 19.3.5.7. Wildlife potentially affected by construction includes bird, mammal and/or herpetofauna species that occasionally use the site as a travel corridor or for foraging or resting. Given the routine agricultural disturbance and lack of water resources on-site, wildlife occurrence on the SHINE site is relatively infrequent. Mammals were not commonly observed on-site. Their use of the site is sporadic given the lack of cover, shelter, and water supply. Furthermore, there were no amphibians or reptiles observed on the SHINE site. With the dominance of agriculture on the SHINE site and lack of other wildlife habitat, wildlife use on the SHINE site is minimal.

The minor loss of agricultural lands to industrial facilities is not significant when compared to the 25,236 ac. (10,213 ha) of agricultural land remaining within a 5-mi. (8-km) radius of the site (see Table 19.4.5-1). Furthermore, lands on-site not utilized for development of industrial facilities are returned to agriculture or restored using cool season grasses or native prairie species. As such, impacts to wildlife and terrestrial communities from construction are SMALL. Specific mitigation measures and management controls are not needed.

White-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), and Canada goose are identified in Subsection 19.3.5 as recreationally valuable game species observed on-site. Their use of the site, however, is infrequent given the lack of cover, shelter, and water supply. As such, impacts to recreationally important species from construction are SMALL and specific mitigation measures and management controls are not necessary.

Avian collisions with man-made structures are the result of numerous factors related to species characteristics such as flight behavior, age, habitat use, seasonal and diurnal habitats; and environmental characteristics such as weather, topography, land use, and orientation of the structures. The number of bird collisions with construction equipment, such as cranes, or new structures has not been quantitatively assessed. However, based on the findings of NUREG-1437 which demonstrated that the effects of avian collisions with existing structures at nuclear power plants is SMALL, the impacts of such collisions during the construction phase are considered SMALL and specific mitigation measures and management controls are not needed.

Wildlife species have the potential to be affected by the use of artificial lighting during nighttime construction activities. For example, frogs have been found to inhibit their mating calls when exposed to excessive light at night, and the feeding behavior of some bat species may be altered by artificial lighting (Chepesiuk, Ron, 2009). Amphibian and bat species, however, are generally lacking from the SHINE site due to the lack of appropriate habitat.

In addition, artificial lighting could create or exacerbate an avian-collision hazard if tall cranes are illuminated for work during nighttime construction. According to Ogden, a large proportion of migrating birds affected by human-built structures are songbirds, apparently because of their propensity to migrate at night, their low flight altitudes, and their tendency to be trapped and disoriented by artificial light, making them vulnerable to collision with obstructions (Ogden, L.J.E., 1996). For any nighttime construction at the SHINE site, BMPs such as light source shielding and appropriate directional lighting are used to mitigate the hazards to wildlife associated with artificial nighttime illumination. Based on the general lack of appropriate habitat at the SHINE site for amphibians, bats, and most bird species, and the BMPs to mitigate effects to wildlife, the direct and indirect impacts of artificial illumination at nighttime during the construction phase are SMALL thus specific mitigation measures and management controls are not needed.

19.4.5.1.4 Invasive Species

Although several “restricted” or “prohibited” weedy invasive species were observed in various land cover types off-site, as discussed in Subsection 19.3.5.8, no invasive species listed by the WDNR were observed on the SHINE site. Disturbance associated with construction activities such as earthmoving and excavation, however, can create conditions for opportunistic invasive species to become established. Temporary impact areas and other areas not permanently converted to industrial uses are either returned to agriculture or restored with either cool season grasses or native prairie species. Invasive species are controlled in areas restored to agriculture as has been done in agricultural fields on-site for the past several decades. If restored to cool-season lawn or native prairie, invasive species are controlled through mowing or similar maintenance activities. Thus, the invasive species impacts from construction are considered SMALL and monitoring or maintenance plans are not anticipated at this time.

19.4.5.1.5 Protected Species

Consultation letters from the WDNR and USFWS were acquired to provide information regarding ecological resources near (within 6 mi. [9.6 km]) the SHINE site (WDNR, 2012b; USFWS, 2012). This consultation process was used to obtain agency input regarding threatened and endangered species, sensitive habitats, and other ecological characteristics for the site and near-site areas. A list of threatened/endangered species or species of special concern identified within 6 mi. (9.6 km) of the SHINE site is provided in Table 19.3.5-7. Terrestrial and aquatic listed species include five fish species, five mussel species, one turtle species, and 27 plant species as identified in Subsection 19.3.5.11. WDNR identified the Blanding’s turtle (*Emydoidea blandingii*) as state threatened and potentially occurring near the site. Blanding’s turtles were not observed during field reconnaissance. Given the absence of wetlands and open water habitat on the site or its immediate near-site environs, Blanding’s turtles are not expected to occur on-site. Agency consultation did not identify any state or federally listed species on the SHINE site. Furthermore, no designated critical habitat was identified on-site or within 6 mi. (9.6 km) of the SHINE site.

The listed fish, mussel and turtle species inhabit aquatic areas such as rivers, streams, ponds, and/or wetlands which are absent from the site. BMPs are used in accordance with the SWPPP, as required by the WDNR, to prevent sediment runoff and subsequent siltation in receiving streams during construction. As stated in Subsection 19.3.5.5, potential receiving streams such as the Rock River are distant from the SHINE site. The use of proper BMPs combined with the distance to the nearest receiving waters and the high infiltration rate of the soils near the SHINE site minimizes impacts to protected species during construction. As such, construction-related impacts to the nearest receiving waters would be negligible and essentially would eliminate the potential for impacts to protected aquatic species.

The listed plant species inhabit forests or woodlands, riparian areas, and prairies. These habitat types are absent from the agricultural SHINE site and none of the listed plant species were observed during field reconnaissance surveys on-site. In addition, protected plants were not observed in riparian areas of nearby streams. Thus, construction would not impact protected woodland or prairie plants on or near the site. As discussed in Subsection 19.3.5.5, receiving streams and their associated riparian zones are distant from the SHINE site. Because of the absence of on-site aquatic communities and wetlands, the distance to off-site streams, the high infiltration rate of the soils near the SHINE site, and the implementation of BMPs on-site, direct and indirect impacts to any protected plant species associated with riparian areas from construction are SMALL. As such, construction-related impacts to protected species on the SHINE site or in near off-site areas are SMALL. Specific mitigation measures and management controls are not needed.

19.4.5.2 Impacts from Operations

This subsection provides a description of the potential impacts of operation of the SHINE facility on terrestrial and aquatic ecosystems.

19.4.5.2.1 Places and Entities of Special Interest

Places and entities of special interest, as described in Subsection 19.3.5.4, include a description of communities and habitats of special interest, other sensitive or susceptible areas, and important ecological systems. Communities and habitats of special interest near the SHINE site (within 6 mi. [9.6 km]) include wetlands, six endangered resources (habitats) identified by the WDNR, and state designated natural areas of Rock County. Other sensitive or susceptible areas near the SHINE site include Happy Hollow County Park (southwest of the site). Important ecological systems near the SHINE site include the Mississippi Flyway.

Due to the complete conversion of the lands of the SHINE site and its immediate environs to cultivated fields or other developed uses, none of the described places and entities of special interest are present either on-site or in adjacent off-site areas. Habitats of the SHINE site and adjacent lands are dominated by agricultural and developed uses and are not considered to be high value or important ecological systems.

Although air emissions from natural gas heating facilities are expected, such emissions are not expected to impact agricultural lands on-site or communities and habitats of special interest off site. Additionally, the SHINE facility does not utilize cooling towers. Consequently, there are no operational impacts associated with drift (i.e., gaseous or particulate emissions to the air from cooling towers). Herbicide application for lawn maintenance is minimal and is only used on the SHINE site, thus operational impacts to off-site areas identified as places and entities of special interest are minimized. The operation of the SHINE facility results in a localized minor increase in noise but noise levels are similar to that of the Southern Wisconsin Regional Airport that is immediately adjacent to the SHINE site. Thus, operation impacts to the off-site areas identified as places and entities of special interest are SMALL. Mitigation measures and management controls are not needed.

19.4.5.2.2 Aquatic Communities and Wetlands

Aquatic resources and wetlands near the SHINE site are described in Subsections 19.3.5.5 and 19.3.5.6, respectively. Aquatic resources near the SHINE site include the Rock River and an unnamed stream which is a tributary of the Rock River. In accordance with Subsection 19.3.5.5, the Rock River is 1.9 mi. (3.1 km) from the SHINE site. There are no aquatic resources or water bodies present on the SHINE site and there are no jurisdictional wetlands identified on the SHINE site.

The SHINE facility does not withdraw water from any surface water body or from groundwater. Rather, water is provided by the Janesville Public Water Supply. Thus, there are no operational impacts associated with impingement or entrainment of aquatic biota. Furthermore, the SHINE facility does not discharge directly into the Rock River or any other nearby water body thus avoiding any pollutant or thermal affects to aquatic resources. In addition, a vegetated on-site detention swale is used to control stormwater runoff which, when combined with the distance to the nearest off-site water bodies minimizes runoff and siltation to off-site receiving streams. Thus, operational impacts on aquatic communities or wetlands are SMALL. Specific mitigation measures and management controls are not needed.

19.4.5.2.3 Terrestrial Communities

Terrestrial plant communities are characterized in Subsection 19.3.5.7.1 for the SHINE site and areas in proximity of the SHINE site. The terrestrial communities of the site and areas in proximity to the site are mainly agricultural areas cultivated for crops, hay, and pasture. No federal or state-listed threatened, endangered or special concern plant species have been observed on or in the proximity of the SHINE site. Herbicide application is occasionally used around buildings and driveways as part of lawn maintenance activities to control weedy species. Thus, operational impacts to plant communities are SMALL.

Wildlife communities for the SHINE site and near site areas are described in Subsection 19.3.5.7.2. With the dominance of agriculture on the SHINE site and lack of other wildlife habitat, wildlife use is on the SHINE site is minimal. Additionally, there are no known occurrences of threatened or endangered species on the SHINE site. Thus, operational impacts to wildlife are SMALL.

The SHINE facility and associated buildings do not result in significant bird mortality from bird collisions, though infrequent bird collisions with buildings resulting in mortality can occur. As is discussed in Subsection 19.4.1 most buildings on the SHINE site have a relatively low profile. Consequently, effects on bird populations from collisions with buildings are minimized. Therefore, the operational impacts to bird species and populations from collisions are SMALL. Specific mitigation measures and management controls are not needed.

The operation of the SHINE facility results in a localized minor increase in noise (Subsection 19.4.2). But noise levels are localized to the SHINE site and not elevated above background noise emissions from US 51 immediately adjacent to the SHINE site. Thus, operation impacts to wildlife from noise are SMALL. Specific measures and controls are not needed.

19.4.5.2.4 Invasive Species

There were nine “restricted” or “prohibited” weedy invasive species observed off-site in various land cover types including developed lands, agricultural lands, and riparian corridors. Information on these species can be found in Subsection 19.3.5.8. No invasive species listed by the WDNR (neither restricted nor prohibited) were observed on the SHINE site. Additionally, there are no existing plans to implement invasive species management/control activities at the facility. Thus, operational impacts associated with invasive species are SMALL. Specific measures and controls are not needed.

19.4.5.2.5 Protected Species

A list of threatened/endangered species or species of special concern identified near the SHINE site is provided in Table 19.3.5-7. Terrestrial and aquatic listed species include five fish species, five mussel species, one turtle species, and 27 plant species. WDNR identified the Blanding’s turtle (*Emydoidea blandingii*) as state threatened and potentially occurring near the site. Blanding’s turtles were not observed during field reconnaissance. Given the absence of wetlands and open water habitat on the site or its immediate near-site environs, Blanding’s turtles are not expected to occur on-site. Agency consultation did not identify any state or federally listed mammal, bird, or insect species within 6 mi. (9.6 km) of the SHINE site. Furthermore, no designated critical habitat was identified on-site or within 6 mi. (9.6 km) of the SHINE site.

The listed fish, mussel and turtle species inhabit aquatic areas such as rivers, streams, ponds, and/or wetlands. Because these habitats are absent from the site, these species are not expected to occur on the SHINE site. Furthermore, the lack of intake and discharge structures on the Rock River or any other nearby water body avoids operational impacts to the aquatic habitats of protected species.

The listed plant species inhabit the three general habitat types of forests/woodlands, riparian areas, and prairies. There is no forested, riparian, or prairie habitat on the SHINE site nor were any of the listed plant species observed during any of the vegetation surveys within the site or near the site. Furthermore, the entire SHINE site is composed of agricultural land and does not include the preferred habitat of the listed species. In accordance with Subsection 19.3.5.5, the nearest receiving stream and associated riparian areas are more than a mile from the SHINE site. Although protected plant species were not observed in nearby riparian areas during field reconnaissance, these are areas where protected plant species could become established. The use of appropriate stormwater controls comlow enrichedbined with the distance to the nearest receiving stream minimizes impacts to any protected plant species that could potentially be associated with near site riparian areas. As such, operational impacts to protected species on the SHINE site or in near off-site areas are SMALL. Specific mitigation measures and management controls are not needed.

19.4.5.3 Impacts from Decommissioning

Construction of the SHINE facility is expected to begin in 2015. Following the cessation of operations the facility will be decommissioned. Decommissioning activities, however, are similar to construction activities, and involve heavy equipment to dismantle buildings and remove roadway and parking facilities. As such, impacts from decommissioning are anticipated to be similar to the impacts associated with construction and SMALL.

Table 19.4.5-1 Summary of Impacts to 2006 Land Use/Land Cover[a]

NLCD 2006 Land Cover Class	Permanent Site Impacts		Temporary Site Impacts		Total Land Cover Within the Region[c]		
	ac.	ha	ac.	ha	ac.	ha	Percent
Open Water					796	322	1.6
Developed, Open Space	0.18	0.07			3043	1231	6.1
Developed, Low Intensity					5858	2371	11.7
Developed, Medium Intensity					1968	796	3.9
Developed, High Intensity					992	401	2.0
Barren					43	17	0.1
Deciduous Forest					3298	1335	6.6
Evergreen Forest					68	28	0.1
Mixed Forest					1	0	0.0
Shrub/Scrub					505	204	1.0
Grassland					1049	425	2.1
Pasture/Hay					5896	2386	11.7
Cultivated Crops	25.67	10.39	14.54	5.88	25,236	10,213	50.2
Woody Wetlands					722	292	1.4
Emergent Herbaceous Wetland					787	318	1.6
Total[b]	**28.85**	**10.46**	**14.54**	**5.88**	**50,262**	**20,339**	**100.0**

a) 2006 Land Use/Land Cover is the most recent data available

b) Total may add up to more or less than 100 percent due to rounding.

c) Reference: Fry et al., 2011

19.4.6 HISTORIC AND CULTURAL RESOURCES

19.4.6.1 Impacts to Historic Properties

As is described in Subsection 19.3.6.3, no on-site historic properties are associated with the SHINE site. No archaeological sites or evidence of cultural resources were identified within the survey area. The Wisconsin Historical Society (WHS) has also reviewed the findings of the Phase I archaeological survey and has indicated that no further consultation with the State Historic Preservation Office (SHPO) regarding the SHINE facility is required (WHS, 2012).

As discussed in Subsection 19.3.6.4, SHINE initiated consultation with 13 federally recognized tribes regarding the proposed development. A single response letter was received from the Winnebago Tribe of Nebraska who indicated that they have cultural properties of interest in the project area, but had no concerns regarding the project. However, they did indicate the desire to be contacted in the event burial sites or other cultural materials were discovered during construction. Follow-up calls were made to representatives of the remaining 12 tribes; however, no return calls to SHINE were received. Prior to construction, SHINE will develop a Cultural Resource Management Plan that will contain procedures governing notification and management of cultural resources during both construction and operations.

The nearest listed National Register of Historic Properties (NRHP) property is the Hugunin House located approximately 1.1 mi. (1.7 km) from the SHINE site (see Figure 19.3.6-1). No direct impacts occur to this property by either construction or operational activities. Additionally, given the distance of the listed property and the low profile of the proposed structures on the SHINE site, no visual or other indirect impacts occur. Therefore, potential impacts to historic and archaeological resources are SMALL.

Due to the absence of historic cemeteries and prehistoric mounds within the boundaries of the SHINE site, the potential for the presence of human burials or human remains is SMALL. However, if human burials or human remains are identified at any time, work will immediately stop with no further disturbance of the human remains. If human remains are discovered, the construction personnel will contact a representative of SHINE. The representative of SHINE will contact the appropriate local law enforcement and the WHS and communicate that human remains have been discovered. If the human remains are determined to be archaeological in nature, the WHS in conjunction with SHINE will determine what further actions will be taken.

Other past, present and reasonably foreseeable Federal and non-Federal projects identified in the immediate area around the SHINE site include the planned development of lands immediately north of the site as part of the Janesville Tax Increment Financing District No. 35 Project Plan (City of Janesville, 2012a). However, because no historic properties are impacted by the SHINE site, no additional cumulative impacts historic and cultural resources would occur. Consequently, potential cumulative impacts of the SHINE project are SMALL.

19.4.7 SOCIOECONOMICS

This subsection describes potential impacts to the socioeconomic environment, including transportation system impacts associated with the construction, operation and decommissioning of the SHINE facility. The evaluation of potential socioeconomics impacts addresses potential changes in the regional population, economy, housing availability, and public services. The evaluation of transportation system impacts addresses routes and modes that are involved with transporting materials, workers, and equipment to the SHINE site.

19.4.7.1 Socioeconomics Impacts

This subsection evaluates impacts to the population, housing, public services (i.e. water supply), public education, and tax-revenues in the region of influence (ROI), Rock County, that result from constructing, operating, and decommissioning the SHINE facility. Potential impacts of constructing the facility are attributable to the size of the construction workforce, the expenditures needed to support the construction program, and the tax payments made to political jurisdictions. Because direct impacts are those that occur on-site, the only direct impacts are associated with the presence of the workforce at the SHINE site. All other socioeconomic impacts are considered to be indirect, as they occur off-site. The analysis presented in this subsection is based on the bounding parameters for the projected workforces for construction, operation, and decommissioning. As noted in Table 19.4.7-1, the peak on-site construction phase (contractor) workforce is 420 workers, and the maximum on-site operational phase workforce is 150 workers. This analysis assumes a 24-month schedule of construction-related activities. Decommissioning is estimated to start in the year 2046, and will involve a peak month on-site workforce of 261 workers.

19.4.7.1.1 Population Impacts

The ROI population is 160,331 (USCB, 2010a). Growth projections show that the population in 2015 is 165,354, and the population in 2045 is 191,703 (see Table 19.3.7-4). The analysis of population impacts considers the population growth potential due to the SHINE workforce requirements for construction, operational and decommissioning phases.

As shown in Table 19.4.7-1, a large construction trade workforce is available in the ROI for the major labor categories (those for which a peak labor force need of at least 20 workers is projected). Therefore, the potential for large numbers of trade workers moving into the ROI is lessened by the extent to which the estimated local labor force meets construction workforce needs. Because the ROI labor force in the construction trades is demonstrated to be abundant relative to construction workforce requirements (except for boilermakers and iron workers for whom data are not available from the Bureau of Labor Statistics [BLS]), it is estimated that approximately 60 percent of the required construction workforce for these trades come from within the ROI. It is conservatively assumed that 20 percent of the required boilermakers and iron workers are available from within the ROI. Similarly, based on the large ROI labor force in the major occupation categories, it is expected that approximately 60 percent of the required operations workforce comes from within the ROI. Furthermore, due to the more specialized nature of some trades required for the decommissioning workforce, it is expected that just over 50 percent of that workforce comes from within the ROI (estimates based on current ROI labor force levels).

The estimated numbers of construction workers, operational workers and decommissioning workers that are available locally, and the estimated labor force deficiencies by occupation are shown in Table 19.4.7-1. These estimates show that 248 out of the peak requirement of 420 construction workers are present within the ROI labor force. Therefore, 172 construction workers come either from the labor force of the surrounding 50-mi. (80 km) radius or relocate from outside the 50-mi. (80-km) radius. The 172 construction workers estimated to be not available within the ROI labor force equates to 41 percent of the peak month construction workforce. Based on analysis of the overall Rock County labor force as shown in Table 19.3.7-1, it is estimated that 17 percent of the existing labor force commutes to Rock County from other counties. Consistent with this estimate, it is assumed that 17 percent of the 172 construction workers to be added to the ROI labor force reside in counties outside of Rock County and commute to the ROI. The remainder, 143 construction workers and their families, are assumed to relocate to reside within the ROI. The average household size in the ROI is 2.5 persons per household (USCB, 2010a). Therefore, 143 workers relocating to the various communities within the ROI increases the population in the ROI by approximately 358 people. This estimated population increase constitutes 0.22 percent of the ROI's population of 160,331. Therefore, the impact of the construction of the SHINE facility on population is SMALL.

Table 19.4.7-1 shows the estimate that 88 out of the required 150 permanent operations workers are available in the ROI. It is assumed that 17 percent of the additional required 62 operations workers commute to Rock County from adjacent counties, and that the other 51 workers and their families relocate to reside in the ROI. Using the ROI average of 2.5 persons per household, the total population increase in the various communities within the ROI due to operational workforce requirements is 128 people. This estimated population increase constitutes 0.08 percent of the projected 2015 population of the ROI. Therefore, the impact of the operation of the SHINE facility on population is SMALL.

An estimated 132 of the required 261 decommissioning workers are available in the ROI (see Table 19.4.7-1). It is assumed that 17 percent of the additional required 129 decommissioning workers commute to Rock County from adjacent counties, and that the other 107 decommissioning workers and their families relocate to the ROI. Based on the ROI average of 2.5 persons per household, the ROI population increases by 268 due to the decommissioning workforce. This estimated population increase constitutes 0.14 percent of the projected population of the various communities within the ROI at the end of the 30-year license period. Therefore, the impact of decommissioning of the SHINE facility on population is SMALL.

19.4.7.1.2 Housing Impacts

Subsection 19.3.7.2.2 and Table 19.3.7-12 provide a summary of the 2010 USCB data concerning availability of housing in the ROI that is used as a basis for estimating the number of housing units that may be available to accommodate housing demands resulting from construction, operation and decommissioning. NUREG-1437 presents criteria for the assessment of housing impacts based on the discernible changes in housing availability, prices, and changes in housing construction or conversions. These criteria are:

- SMALL: Small and not easily discernible change in housing availability; increases in rental rates or housing values equal or slightly exceed the statewide inflation rate; and no extraordinary construction or conversion of housing.

- MODERATE: Discernible but short-lived change in housing availability; rental rates or housing values increase slightly faster than state inflation rate with rates realigning as new housing added; and minor and temporary conversions of non-living space to living space.
- LARGE: Very limited housing availability; rental rates or housing values increase well above normal inflation rate for state; and substantial conversions of housing units and overbuilding of new housing units.

In 2010, there were 5986 vacant housing units in the ROI (see Table 19.3.7-12). This amount of housing available within the ROI at the time the portion of the construction workforce that is non-resident moves into the area is substantially greater than the total estimated demand for housing due to construction of the SHINE facility. For purposes of analysis, the estimates of 143 workers relocating to the ROI for construction phase peak, 51 workers relocating to the ROI to meet operational workforce needs, and 107 workers relocating to the ROI to meet decommissioning workforce needs equates to a total of 301 additional households in the ROI. The 5986 vacant housing units in Rock County in 2010 equal approximately 20 times the total estimated demand for housing. There is clearly an adequate supply of vacant housing to accommodate the requirements of new families for temporary or permanent housing. Further, the decommissioning workforce, which represents approximately one-third of the estimated housing demand, does not relocate to the ROI until the end of the 30-year licensing period.

The potential impacts on housing are SMALL due to the large number of available vacant housing units in the ROI and the relatively small requirements for the construction, operations and decommissioning workforce.

19.4.7.1.3 Public Services Impacts

Public services impacts analysis as directed by Final ISG Augmenting NUREG-1537 concerns water supply facilities. NUREG-1437 presents criteria for the assessment of public services impacts based on the ability to respond to the level of demand and need for additional capacity. These criteria are:

- SMALL: Little or no change occurs in ability to respond to level of demand and therefore there is no need to add capital facilities.
- MODERATE: There is overtaxing of facilities during peak demand.
- LARGE: Existing service levels are substantially degraded and additional capacity is needed.

Construction of the SHINE facility requires quantities of potable water to support the needs of the construction work force. During construction and operations, the Janesville Water Utility supplies water to the SHINE site, including potable water uses, fire protection uses, and typical construction uses (e.g. dust suppression and concrete mixing). The average per capita water usage in the United States is 90 gallons per day (gpd) (340.7 liters per day [lpd]) per person including personal use, bathing, laundry and other household uses (USGS, 2012). At a conservatively assumed 30 gpd (113.6 lpd) for each construction worker who is on-site for 8 to 12 hours per day, an on-site workforce of 420 needs 12,600 gpd (47,696 lpd) for potable and sanitary use. As discussed in Subsection 19.3.7.2.5.1, the Janesville Water Utility has excess water capacity of 18 Mgd (68.1 Mld). Therefore, impacts on public water supply by the on-site construction workforce are SMALL.

The impact to the local water supply systems from SHINE-related population growth can be estimated by multiplying the amount of water that is required per capita by the estimated number of individuals who relocate to the ROI. Subsection 19.3.7.2.5.1 describes the public water supply systems in the area, permitted capacities, and current demands. The average per capita water usage in the United States is 90 gpd (340.7 lpd) per person including personal use, bathing, laundry and other household uses (USGS, 2012). The estimated total construction and operation-related population increase within the ROI of 486 people (construction and operations workforces and their families) increases consumption by 43,740 gpd (165,574 lpd). The excess public water supply capacity in Janesville is 18 Mgd (68.1 Mld). Therefore, impacts to the municipal water supplier due to the estimated population increase are SMALL.

Public wastewater treatment facilities are directly related to public water supply facilities. The impact to the local wastewater treatment systems from SHINE-related population increases can be determined by calculating the amount of water that is used and disposed of by these individuals. The average person in the United States uses 90 gpd (340.7 lpd) (USGS, 2012). All wastewater from the SHINE facility is disposed of and treated by the City of Janesville wastewater treatment facilities. The total construction and operation-related population increase of 486 people requires 43,740 gpd (165,574 lpd) of additional wastewater treatment demand. The excess treatment capacity in the City of Janesville is 12 Mgd (45.4 Mld). Therefore, based on this excess treatment capacity, impacts to wastewater treatment facilities are SMALL.

19.4.7.1.4 Public Education Impacts

Schools and student populations are discussed in Subsection 19.3.7.2.5.2. For the ROI, the numbers and types of schools and the numbers of students by district are summarized in Table 19.3.7-17. NUREG-1437 presents criteria for the assessment of public education impacts based on changes in student enrollment and the number of teaching staff and classrooms. These criteria are:

- SMALL: Project-related enrollment increase is less than or equal to 3 percent, there is no change in the school system’s ability to provide educational services, and no additional teaching staff or classroom space is needed.
- MODERATE: Student enrollment increases between 4 and 8 percent, and there is an increase in the number of teachers or classrooms.
- LARGE: Student enrollment increases by more than 8 percent and current institutions are not adequate to accommodate the influx of students.

The Janesville School District (JSD) is the largest school district in the ROI by measure of student enrollment, and the public schools in the ROI that are in closest proximity to the SHINE site are units of the JSD. According to its current Strategic Plan, the JSD is officially seeking to grow its student enrollment. More specifically, it is the JSD Board of Education’s goal to increase the net open enrollment gain/loss by 15 percent in the 2011-12 school year (JSD, 2011a.).

The student to teacher ratio is a common evaluation factor with regards to the capacity of a school, or school district, to accommodate student enrollment growth. In the JSD, the reported ratio is 12.8 students per licensed teacher full time equivalency which compares to the WI statewide ratio of 13.3 students per teacher full time equivalency (DPI, 2012a). The JSD's school enrollment for the 2011-2012 school year was 10,325 (DPI, 2012b). The district could increase its student enrollment by 412 students without adding any licensed teachers and still not exceed the statewide ratio. A 3 percent increase in student enrollment would equate to an additional 310 students.

The student age cohort (age 5 to 18) accounts for 20 percent of the ROI total population (USCB, 2010a and USCB, 2010b). The combination of estimated population increase due to construction workforce and operational workforce requirements results in a net construction and operations related population increase of 486 which contributes 97 school-aged children within the ROI. If all students are added in the JSD, enrollment would neither exceed 3 percent nor cause the JSD to exceed the statewide student to teacher ratio. No professional staff or classroom additions are needed. Beginning in 2046, an estimated population increase of 268 associated with decommissioning workforce demand contributes 54 school-aged children, assuming the student aged population remains 20 percent of the total population. No professional staff or classroom additions would be needed based on that level of increased enrollment. Therefore, the level of impact to the local public education system is SMALL.

19.4.7.1.5 Tax Revenue Related Impacts

The U.S. Nuclear Regulatory Commission (NRC) defined the magnitude of license renewal-related tax impacts based on previous case-study analysis as described in NUREG-1437 as:

- SMALL if the payments are less than 10 percent of revenue of the taxing jurisdiction.
- MODERATE if the payments are between 10 and 20 percent of revenue of the taxing jurisdiction.
- LARGE if the payments are greater than 20 percent of revenue of the taxing jurisdiction.

Additionally, the NRC determined that if a facility's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes are LARGE. This is especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development in the past.

Tax revenues associated with the construction, operation and decommissioning of the SHINE facility include payroll taxes on wages and salaries of the construction and operations work forces, sales and use taxes on purchases made by SHINE and the construction, operations and decommissioning workforces, and property taxes on owned real property and improvements. Increased tax collections are a benefit to the state, county and municipal-level jurisdictions as well as school districts.

19.4.7.1.6 Personal and Corporate Income Taxes

Workforce payroll taxes (federal and state) are generated by construction, operations and decommissioning activities and purchases as well as taxes generated by workforce expenditures. State tax payments are distributed throughout the ROI and extend beyond the ROI, based on the expectation that some construction, operations and decommissioning employees reside outside of Rock County. The relocation of workers to Rock County and surrounding counties, including some expected to relocate to Wisconsin from other states, results in an increase in payroll taxes paid to Wisconsin.

19.4.7.1.7 Sales Taxes

Workers commuting to the SHINE site from within and outside of the ROI contribute sales tax revenues to the State of Wisconsin and to Rock County and any other counties where they live. The vast majority of sales tax revenues from the ROI are collected by the State, as Rock County's sales tax rate is very low. But the ROI does experience an increase in the amount of sales taxes collected, reflecting the concentration of re-located workers. Sales tax revenues also result from direct purchases by SHINE for materials, equipment and services supporting the construction project, long term operations, and decommissioning. The distribution of these tax revenues is determined by the business locations of the material and service providers and likely reflects a broad area including the ROI and beyond to multiple states. The amount of sales taxes collected over a potential 30-year operating period that are attributable to the SHINE facility is significant, but is relatively minor when compared to the total amount of taxes collected in the ROI.

19.4.7.1.8 Property Taxes

The SHINE facility is located in the City of Janesville in Rock County. As such, property taxes are paid to Janesville and Rock County as well as the JSD. These jurisdictions all provide public services that benefit SHINE's business and employees. It is SHINE's intent to enter into a Tax Increment Financing (TIF) agreement with the City of Janesville. The TIF agreement allows SHINE to make payments in lieu of taxes to Janesville for a period of 10 years at the outset of the license period. These payments, estimated to total $600,000 per year, will be directed to offset infrastructure expenses associated with the SHINE development. During the ten year TIF time period, SHINE pays property taxes based on the assessed value of the property prior to improvements, estimated to be $35,000 per year. Following the 10-year TIF time period, property taxes paid by SHINE are based on the assessed value of real property and improvements, using the property tax rates in place at that time.

Comparison of the estimated annual SHINE property tax payment (after expiration of the 10-year TIF time period) with the individual property tax revenues of Janesville and Rock County (using 2010 data available from Wisconsin Department of Revenue [DOR]) and the Janesville School District Board of Education shows that the annual portion of total property tax revenues paid by SHINE equates to approximately 0.30 percent of total Rock County general property tax revenues, 0.66 percent of total Janesville general property tax revenues, and 0.99 percent of total Janesville School District general property tax revenues (DOR, 2012 and JSD, 2011b). The effect of property taxes paid by the construction, operations and decommissioning workforces is dispersed across the ROI and beyond. Construction workers commuting to the SHINE site from their homes continue to pay existing property taxes. Workers relocating to the ROI also contribute to increased property tax revenues.

19.4.7.1.9 Summary of Tax Impacts

Overall tax revenues generated by construction, operation and decommissioning of SHINE will be significant in absolute dollars across the lifetime of the facility, even with consideration of the TIF agreement that allows payment in lieu of taxes for 10 years. However, the overall tax revenues are relatively small in comparison to the established tax base of Janesville and

Rock County. The maximum increase in property tax revenues after expiration of the TIF agreement is expected to be substantially less than 10 percent of the total tax revenue at the city and county levels. Therefore, total tax revenues from SHINE result in SMALL positive impacts at the community level.

19.4.7.1.10 Other Socioeconomics Related Impacts

Socioeconomics related impacts in addition to those specifically described above include the potential for supportive business expansion and associated land use changes in the Janesville community as a result of the investments from SHINE. Land use changes due to housing needs are not expected due to the large number of existing vacant housing units. Potential land use changes include those to provide for expansion of existing small businesses or locations for new small businesses that might support SHINE and SHINE employees. If realized, such business expansions and/or new business developments are likely to occur in the southern area of the City of Janesville near the SHINE site in locations where conditions are appropriate for business development, including within the TIF district to the north of the SHINE site. Any such land use changes are subject to local zoning regulations and associated impacts on socioeconomic conditions are expected to be SMALL.

19.4.7.1.11 Mitigation Measures to Minimize Socioeconomic Impacts

As described in the subsections above, the socioeconomic impacts on the ROI resulting from construction, operation, and decommissioning of the SHINE facility are SMALL and no mitigation measures are required to minimize socioeconomic impacts.

19.4.7.2 Transportation

Construction-related and operations-related effects on the transportation network are provided in this subsection. The effects on the local transportation infrastructure as a result of construction and operations are measured against the existing traffic conditions and the future no-build traffic conditions in Table 19.4.7-2. All goods and services to support the SHINE facility will reach the site using existing roadway networks.

19.4.7.2.1 Construction/Modification of Transportation Infrastructure

A traffic analysis was performed to assess the construction-period traffic conditions and the post-development operations-related traffic conditions at the SHINE site. The construction entrance to the site is located along US 51. The peak construction traffic volume is estimated to be 14 heavy vehicles (dump truck/deliveries) and 451 vehicles (pick-up trucks and cars) per day in 2015. A summary of the effect of construction traffic volumes on the transportation infrastructure is provided in Table 19.4.7-2. The level of construction-related traffic does not affect the level of service anywhere in the transportation infrastructure and no modifications to the infrastructure are necessary. Based on this projected level of construction traffic to and from the site, the level of impact to the transportation infrastructure is SMALL.

The traffic analysis also assesses the traffic associated with the operations of the SHINE facility after construction is complete, which is assumed to be in 2016. The entrance to the site is located along US 51 with 75 percent of site-related traffic assumed to be coming from and going to the north and 25 percent to/from the south. The traffic volume generated by employees working at the facility is estimated to be 118 vehicles per day. A summary of the effect of these operations volumes on the transportation infrastructure is provided in Table 19.4.7-2. The operation of the facility results in a slight degradation in the level of service (from a level of service [LOS] C to an LOS D) at the intersection of US 51 and State Highway 11 (SH 11) during the morning peak hour resulting in an increased delay at the intersection. This can be easily mitigated by optimizing the signal timing at the intersection to accommodate a greater turning movement from westbound SH 11 to southbound US 51 as demonstrated in Table 19.4.7-3. Additionally, the nearby Southern Wisconsin Regional Airport does not need to modify current infrastructure in order to accommodate additional air traffic caused by shipments to and from the SHINE facility. Consequently, there are no impacts to airport facilities. Because traffic conditions during construction are not degraded, and the minor reduction in LOS at SH 11, the transportation impacts are considered to be SMALL and mitigable.

19.4.7.2.2 Transportation Routes for Conveying Materials and Personnel to the Site

The construction and operation of the SHINE facility does not alter any existing transportation routes for conveying materials and/or personnel to the site. Therefore, the impacts to transportation routes are considered to be SMALL.

19.4.7.2.3 Traffic Patterns Impacts

The construction and operation of the SHINE facility does not alter any existing traffic patterns to and from the site. Therefore, the impacts to traffic patterns are considered to be SMALL.

19.4.7.2.4 Mitigation Measures to Minimize Transportation Impacts

As mentioned above, the operation of the SHINE facility results in a slight degradation in the LOS at the signalized intersection of US 51 and SH 11. Specifically, the westbound SH 11 to southbound US 51 left-turning movement is affected during the morning peak hour. This condition can be easily mitigated by optimizing the signal timing for this turning movement. A summary of the effect of this mitigated condition is provided in Table 19.4.7-3. By optimizing signal timing for this movement at the intersection, the level of service for the intersection can be improved to its existing level. There are no other transportation infrastructure mitigation requirements in the vicinity of the SHINE site.

Table 19.4.7-1 Projected ROI Labor Availability and On-site Labor Requirements at Peak Month of Construction, Operations and Decommissioning Schedules

Occupation	SHINE Peak Need[(a)]	Estimate of Labor Force by Occupation in Rock County[(b)]	Available Labor Force in Rock County[(c)] Estimated Available	Available Labor Force in Rock County[(c)] Needed for SHINE	Rock County Labor Force Deficiency[(d)]
Construction Phase					
Boilermaker	24	ND	5	5	19
Carpenter	45	360	72	45	0
Electrician	55	190	38	38	17
Ironworker	50	ND	10	10	40
Laborer	70	340	68	68	2
Equipment Operator/Eng.	26	130	26	26	0
Plumber/Pipefitter	70	70	14	14	56
Sheet Metal Worker	30	80[(e)]	16	16	14
Construction Supervisor	20	160	32	20	0
Other	30	ND	6	6	24
TOTAL	**420**			**248**	**172**
TOTAL, Percent				59	41
Operational Phase					
Operation Support	40	340	34	34	6
Productions/Operations	37	110	11	11	26
Tech Support	40	2590[(f)]	259	40	0
Other	33	ND	3	3	30
TOTAL	**150**			**88**	**62**
TOTAL, Percent				59	41
Decommissioning Phase					
Carpenter	20	360	72	20	0
Ironworker	20	ND	4	4	16
Laborer	100	340	68	68	32
Equipment Operator/Eng.	20	130	26	20	0
Plumber/Pipefitter	30	70	14	14	16
Radiation Technicians	30	ND	6	6	24
Other	41	ND	0	NA	41
Total	**261**			**132**	**129**
Total, Percent				51	49

a) Peak month estimated need of labor categories where need is greater than or equal to 20

b) Rock County labor force estimate from BLS, 2011 unless otherwise noted

c) Left column: Estimated available construction and decommissioning labor force based on 20 percent of BLS estimated labor force; Available operational labor force based on 10 percent of BLS estimated labor force. Right column: Total reflects the total estimated labor force available to meet the SHINE Peak Need.

d) Rock County labor force deficiency determined by subtracting estimated Available Labor Force from SHINE Peak Need

e) Labor force estimates from BLS, 2009; no data available for 2011

f) Tech support subcategories include: maintenance (machinery maintenance workers and general maintenance and repair workers), engineers (industrial engineers and mechanical drafters), and craftspeople (janitors and cleaners, landscaping and groundskeepers, electricians, plumbers and pipefitters, industrial machinery mechanics, and machinists)

ND = No data, NA = Not available

References: BLS, 2009; BLS, 2011.

Table 19.4.7-2 Summary of Traffic Impacts during Construction and Operations

Existing Level of Service Summary – Weekday Peak-Hour

Intersections	Existing Conditions - AM		Existing Conditions - PM	
	LOS	Delay	LOS	Delay
SH 11 at County Highway G	C	23.3 sec.	C	22.4 sec.
US 51 at Highway 11	C	27.6 sec.	C	25.6 sec.
US 51 at Town Line Rd	B	10.2 sec.	B	10.4 sec.

Future (2015) No-Build Level of Service Summary – Weekday Peak-Hour

Intersections	Future No-Build - AM		Future No-Build - PM	
	LOS	Delay	LOS	Delay
SH 11 at County Highway G	C	24.1 sec.	C	22.8 sec.
US 51 at Highway 11	C	29.3 sec.	C	26.3 sec.
US 51 at Town Line Rd	B	10.5 sec.	B	10.6 sec.

Future (2015) Construction Level of Service Summary – Weekday Peak-Hour

Intersections	Future Construction Phase - AM		Future Construction Phase - PM	
	LOS	Delay	LOS	Delay
SH 11 at County Highway G	C	24.0 sec.	C	22.9 sec.
US 51 at Highway 11	C	31.7 sec.	C	26.3 sec.
US 51 at Town Line Rd	B	10.5 sec.	B	10.6 sec.
US 51 at SHINE site	A	0.4 sec.	A	0.9 sec.

Future (2016) Operations Level of Service Summary – Weekday Peak-Hour

Intersections	Future Operations Phase - AM		Future Operations Phase - PM	
	LOS	Delay	LOS	Delay
SH 11 at County Highway G	C	24.3 sec.	C	23.3 sec.
US 51 at Highway 11	D[a]	42.9 sec.	C	26.5 sec.
US 51 at Town Line Rd	B	10.5 sec.	B	10.7 sec.
US 51 at SHINE site	A	1.1 sec.	A	1.5 sec.

a) LOS degraded during operations only due to greater volume during peak hour. Total construction traffic volumne higher, but not at peak hour

Table 19.4.7-3 Summary of the Effects of Mitigative Measures on Traffic Conditions during Operations

Future (2016) Build-Out Mitigated Level of Service Summary – Weekday Peak-Hour

Intersection	Future Operations Phase (Mitigated) - AM		Future Operations Phase (Mitigated) - PM	
	LOS	Delay	LOS	Delay
SH 11 at County Highway G	C	20.5 sec.	C	23.3 sec.
US 51 at Highway 11[(a)]	C	27.9 sec.	C	26.5 sec.
US 51 at Town Line Rd	B	10.5 sec.	B	10.7 sec.
US 51 at Project Site	A	1.1 sec.	A	1.5 sec.

a) Mitigation consists of signal improvements only

19.4.8 HUMAN HEALTH

19.4.8.1 Nonradiological Impacts

The following subsections discuss the potential nonradiological public and occupational hazards as they pertain to the operation of the SHINE facility. Regulations for generating, managing, handling, storing, treating, protecting, and disposing of wastes during construction, operation, and decommissioning are contained in federal regulations issued and overseen by the NRC and USEPA, and in WDNR. These regulations include compliance with provisions of the Clean Air Act, Clean Water Act, Atomic Energy Act, and Resource Conservation and Recovery Act (RCRA), among others. Specifically for Wisconsin, the potentially applicable Environmental Management Regulations are provided in statutes (including Chapters 166, 254, 280, 281, 283, 285, 287, 291, 292 and 299) and the Wisconsin Administrative Code (NR series).

Nonradiological hazards are associated with emissions, discharges, and waste from processes within the facility as well as accidental spills/releases. Nonradioactive wastes generated by construction, operation, and decommissioning of the new plant, including solid wastes, liquid wastes, discharges and air emissions, are managed in accordance with applicable federal, state and local laws and regulations, and applicable permit requirements.

19.4.8.1.1 Nonradioactive Chemical Sources

During construction nonradioactive chemical sources are expected to be on-site in liquid, gaseous and solid forms including fuels, oils, solvents, and other materials necessary for site preparation and construction. During operation, in addition to radioactive chemical sources, production processes include nonradioactive chemical sources in liquid, gaseous and solid forms. For a given industrial facility, pollutants may be present in wastewater and air emissions associated with the production facility. Solid wastes are also generated. The great majority of chemicals in the SHINE facility are either reused or shipped off-site as radioactive waste. Consequently, the focus of the following subsections are impacts of air emissions and solid waste.

The bounding inventory of major chemicals (i.e., those in excess of 1000 pounds [454 kilograms]) used during operations at the SHINE facility are provided in Table 19.4.8-1. Additionally, Table 19.4.8-2 provides information regarding the characteristics of storage of these chemicals by chemical group and maximum inventory.

19.4.8.1.2 Nonradioactive Liquid, Gaseous, and Solid Waste Management and Control Systems

19.4.8.1.2.1 Liquid Wastes

The great majority of chemical processes at the SHINE facility are conducted inside of the RCA. Any wastes created by these processes are disposed of as radioactive waste and shipped off-site. Some lab-scale chemical use occurs outside the RCA. Liquid wastes produced as a result of these activities are treated to ensure they meet the requirements of the Janesville wastewater treatment facility before being discharged to the municipal sewer. Facility sanitary wastewater is also sent to the Janesville wastewater treatment facility.

19.4.8.1.2.2 Gaseous Wastes

The SHINE facility generates gaseous effluents resulting from process operations and the ventilation of operating areas. The non-radiological contaminants associated with this discharge are described and assessed in Subsection 19.4.2.

The gaseous effluent from ventilation of operating areas includes the following control systems:

- The Zone 1 exhaust airstream passes through two stages of HEPA filtration and a single stage activated carbon bed prior to discharge from the stack
- The Zone 2 and Zone 3 exhaust airstreams pass through two stages of HEPA filtration prior to discharge from the stack
- Additional controls may be implemented as required by local permit conditions.

All the gaseous effluents from the main facility building are vented to the atmosphere through the main stack.

19.4.8.1.2.3 Solid Wastes

The following is a representative list of nonradioactive solid wastes that are anticipated to be generated by the project during construction, operation, and decommissioning:

- Wood from crates
- Packaging from receiving activities
- Spent personal protective equipment (PPE)
- Broken mechanical parts
- Metal shavings
- Piping
- Wires
- Batteries (alkaline, lithium)
- Air filters
- Expired lights and fixtures
- Paper
- Hoses
- Empty plastic containers
- Expired ink cartridges

Other nonradioactive solid wastes are anticipated to be generated in conjunction with routine operations (e.g, office and cleaning supplies, etc.). Solid waste management and control measures for the SHINE facility include waste reduction, recycling and waste minimization practices that are employed during all project phases (construction, operation, decommissioning). Management practices that are used by SHINE include the following:

a) Nonradioactive solid wastes (e.g., office waste, recyclables) are collected and stored temporarily on the SHINE site and disposed of or recycled locally.
b) Scrap metal, universal wastes (federally designated as universal waste including batteries, pesticides, mercury-containing equipment and bulbs [lamps]), used oil and antifreeze are collected and stored, and recycled or recovered at an off-site permitted recycling or recovery facility, as appropriate.

19.4.8.1.3 Nonradioactive Effluents Released

A list of chemicals released as air emissions during operation to the on-site and off-site environment are provided in Subsection 19.4.2. This subsection provides information regarding the sources, composition and quantity of the air emissions from the SHINE facility.

The SHINE facility releases small amounts of maintenance and lab chemicals to the city sewer from outside the RCA. Administrative controls ensure that these effluents meet the requirements of the Janesville wastewater treatment facility before they are released. Additionally, the facility sanitary wastewater is treated by the Janesville wastewater treatment facility.

19.4.8.1.4 Chemical Exposure to the Public

19.4.8.1.4.1 Air Emissions

Calculated chemical exposure to the public is described and discussed in Subsection 19.4.2.1 regarding air emissions from the SHINE facility. Potential air emissions effects to the public are limited to indirect impacts as they are off-site. Consequently, there are no direct impacts to the public from air emissions. To estimate the impacts of non-radiological pollutants from the boiler and heaters, the AERMOD Modeling System is used. The AERMOD system is a state-of-the-science dispersion model system that the USEPA promulgated in 2005 to replace the ISC model. Table 19.4.2-10 shows that the total concentration, with background included, is no more than 32 percent of the NAAQS for CO, NO_2, PM_{10}, and SO_2. The total concentration for $PM_{2.5}$ is 68 percent and 83 percent of the NAAQS for the 24-hr. and annual average, respectively. However, most of that is consumed by the background concentration.

No impacts exceed the primary ambient air quality standards that have been established to protect public health, including the health of sensitive populations such as children, the elderly, and those with respiratory problems. Therefore, pollutant impacts within a reasonable area that could be impacted and at points of the maximum individual exposure are SMALL.

19.4.8.1.4.2 Liquid Effluents

As described in Subsection 19.4.8.1.3 the SHINE facility does not result in point source releases to the environment, as wastewater discharges are sent to the City of Janesville for treatment. The RCA, which contains the majority of SHINE processes, is zero discharge. There are no direct or indirect impacts of liquid effluents from the SHINE facility. Therefore, the impact on human health from liquid discharges is SMALL.

19.4.8.1.5 Physical Occupational Hazards

The exposure characteristics of the workforce for non-radiological hazards will be defined when the operating strategies are finalized. Because occupational hazards occur on-site and during construction, operation and decommissioning of the SHINE facility they are considered direct impacts. No indirect impacts (off-site) are identified. Table 19.4.8.1-3 lists the general types of occupational physical hazards that may be present at the SHINE facility. Occupational physical hazards are addressed and managed to be reduced or eliminated through implementation of safety practices, training and control measures. In summary, occupational hazards are managed and minimized by compliance with Occupational Safety and Health Administration (OSHA) regulations and therefore impacts from physical occupational hazards are SMALL.

19.4.8.1.6 Chemical Exposure to the Workforce

As planned, the SHINE facility will not store or use highly hazardous chemicals in quantities above the Threshold Quantities in Appendix A to 29 CFR 1910.119 during construction. During operation, quantities of nitric acid above the Threshold Quantity will be present on-site and therefore, the requirements of 29 CFR 1910.119 Process Safety Management of Highly Hazardous Chemicals apply to the facility. The majority of process chemicals are used in liquid form and contained in tanks, pipes and hot cells, limiting workforce exposure. Because potential chemical exposure to the workforce during operation of the SHINE facility occurs on-site, they are considered direct impacts. No indirect impacts (off-site) are identified. The facility is designed and practices are applied to keep air contaminants below the limits in 29 CFR 1910.1000. In summary, occupational hazards are managed and minimized by compliance with OSHA regulations and therefore impacts from chemical occupational hazards are SMALL.

19.4.8.1.7 Environmental Monitoring Programs

Applicable regulations and attending administrative codes that prescribe monitoring requirements may include those associated with emergency management, environmental health, drinking water, water and sewage, pollution discharge, air pollution, hazardous waste management and remedial action.

The following statutes are included in Wisconsin's Environmental Management Regulations:

- Chapter 166 Emergency Management – Emergency planning and Community Right-to-Know Act planning, notification and reporting
- Chapter 254 Environmental Health – Lead, asbestos, radiation protection, recreational sanitation, animal-borne and vector-borne disease control
- Chapter 280 Pure Drinking Water – Groundwater and water wells
- Chapter 281 Water and Sewage – General water resource statute
- Chapter 283 Pollution Discharge Elimination – Water pollutant discharge systems
- Chapter 285 Air Pollution – Air pollution statute
- Chapter 291 Hazardous Waste Management – Hazardous waste statute
- Chapter 292 Remedial Action – Includes hazardous substance releases and reporting

Specifically, regulations cited Chapters 283, 285, and 291 and attending administrative codes will be operative and SHINE is committed to complying with all applicable regulations and monitoring requirements as determined by permitting process.

The SHINE facility generates gaseous effluents resulting from process operations, the ventilation of operating areas and boiler emissions from facility buildings. Specific monitoring requirements in support of required air permits will be determined through the permitting process.

19.4.8.1.8 Mitigation Measures

Mitigative measures are used to ensure protection of human health including workplace and environmental regulations. SHINE is committed to best management practices during construction, operation, and decommissioning to minimize pollutant releases to on-site and off-site areas, delivery of all facility wastewater to the Janesville wastewater treatment facility, and air emission controls, as appropriate. The facility is designed such that there is no liquid discharge from the RCA. Required permits will be obtained for effluents and emissions. Furthermore, waste reduction practices are employed including recycling and waste minimization.

19.4.8.2 Radiological Impacts

This subsection describes the public and occupational heath impacts from radioactive material due to normal operational activities at the SHINE facility.

19.4.8.2.1 Layout and Location of Radioactive Material

Figure 19.2.1-1 depicts the physical layout of the site with labeled buildings, site features, and designated areas.

Radioactive material is expected within the following buildings:

- Production facility building
  - Receiving area
  - Rejected material
  - Receipt inspection
  - Target solution preparation
  - Target solution cleanup area
  - Noble gas storage
  - Hot cells
  - Gloveboxes
  - Irradiation Unit cells
  - Health physics (hot)
  - Hot lab
  - Radioactive waste packaging
- Waste staging and shipping building

19.4.8.2.2 Characteristics of Radiation Sources and Expected Radioactive Effluents

The three common sources of radiation for operating nuclear facilities and the expected effluents released from the SHINE facility are discussed in this subsection.

19.4.8.2.2.1 Gaseous Sources of Radiation

The radioactive gaseous effluent exhaust from the vent stack is expected to contain measurable quantities of the noble gases krypton and xenon, in addition to iodine. Some particulate activity (other than iodine) and tritium could also be released in airborne effluents; however, most of the off-site exposure due to airborne effluent releases is expected to be associated with noble gas and radioactive iodine releases.

Radioactive gaseous effluents produced in the SHINE facility due to normal operations consist of off-gas from the irradiated target solution. In addition, maintenance operations on the accelerator are expected to result in the release of some tritium gas, which is used as the accelerator target. All gaseous effluents released from the SHINE facility are combined and released through a single vent stack.

19.4.8.2.2.2 Liquid Sources of Radiation

As stated in Subsection 19.2.5.3.4, the radioactive liquid waste produced due to normal operations at the SHINE facility is solidified and shipped off-site. No radioactive liquid waste is discharged from the SHINE facility. Therefore, there are no liquid sources of radiation released to the environment due to normal operations at the SHINE facility.

19.4.8.2.2.3 Fixed Sources of Radiation

There are two buildings that contain fixed sources of radiation that contribute to direct dose: the production facility building, which contains sources created during production operations within the RCA (e.g., TSV irradiation, molybdenum-99 [Mo-99] separation), and the waste staging and shipping building, which contains sources associated with staging of solidified radioactive waste prior to shipment off-site.

19.4.8.2.3 Baseline Radiation Levels

Baseline radiation levels on-site and in the vicinity of the SHINE site are discussed in Subsection 19.3.8. There are no identified abnormal sources of radiation on-site or within the vicinity of the SHINE site that would cause radiation levels to be any higher than the expected natural background radiation level. Therefore, the annual background dose at the site due to terrestrial and cosmic radiation is approximately 279 millirem per year (mrem/yr) (2.79 millisievert per year [mSv/yr]) (Subsection 19.3.8.2).

19.4.8.2.4 Calculated Annual Total Effective Dose Equivalent, Annual Average Airborne Radioactivity Concentration, and Annual Average Waterborne Radioactivity Concentration

This subsection discusses the calculated annual total effective dose equivalent (TEDE), annual average airborne radioactivity concentration, and annual average waterborne radioactivity concentration at the dose receptor corresponding to the maximally exposed individual (MEI). The MEI is located at the site boundary where the doses due to normal operations are expected to be maximized. Additionally, TEDE, annual average airborne radioactivity concentration, and annual average waterborne radioactivity concentration to the nearest full-time resident is discussed. The doses to the public calculated in the following subsections are considered direct effects of operation of the SHINE facility.

The radiation dose to the public due to transportation of radioactive waste is discussed in Subsection 19.4.10. The dose to the public due to the transportation of radioactive waste is considered an indirect effect of SHINE facility operation.

19.4.8.2.4.1 Gaseous Effluents

Sources of radioactive gaseous effluents are discussed in Subsection 19.4.8.2.2.1. The effluents, which consist of the noble gases krypton and xenon, in addition to iodine and tritium, are released to the environment through the production facility building vent stack. Prior to release to the environment, gaseous effluents are held up to allow for decay.

The methodologies used to calculate the annual average airborne radioactivity concentrations and TEDE at the location of the MEI and the nearest member of the public are discussed here.

Annual average airborne radioactivity concentrations are determined per NRC Regulatory Guide 4.20, which uses the stack release rate and annual average relative atmospheric concentrations (χ/Q) to determine the annual average airborne radionuclide concentration for each radionuclide at the location of the MEI and the nearest full-time resident. The limits on calculated radionuclide concentrations are the effluent concentration limits (ECL) in 10 CFR 20, Appendix B, Table 2. To compare the mixture of radionuclides to the limits, the ECL fractions for all radionuclide are calculated and then summed to determine the ECL fraction for the mixture. The mixture ECL fraction is then compared to 10 percent of the acceptance criterion, or 0.1.

Table 19.4.8-4 lists the calculated ECL fraction for the radionuclide mixture at the MEI and at the nearest full-time resident dose receptor locations. These ECL fractions correspond to the effluent releases of the noble gas and iodine radionuclides in Table 19.4.2-1.

The air submersion and the inhalation pathways are the primary contributors to the TEDE due to airborne radiation in the form of gaseous effluents produced by normal operations at the SHINE facility. On a radionuclide-specific basis, the annual average radioactivity concentrations at both the MEI and the nearest full-time resident are multiplied by dose conversion factors from Federal Guidance Reports No. 11 (inhalation pathway) and 12 (air submersion pathway) to yield the committed effective dose equivalent (CEDE) and effective dose equivalent (EDE), respectively. The location-specific CEDE due to inhalation of airborne effluent and EDE due to external exposure to airborne effluent are summed to produce TEDE, which is compared to the As Low As Reasonably Achievable (ALARA) annual dose limits established in 10 CFR 20.1101(d).

Dose due to the deposition and ingestion pathways are negligible compared to the dose due to airborne sources of radiation.

Annual TEDE due to gaseous effluents released from the SHINE facility at the location of the MEI and nearest full-time resident are listed in Table 19.4.8-5.

As discussed in the following Subsections 19.4.8.2.4.2 and 19.4.8.2.4.3, the doses due to liquid effluents and direct dose from fixed radiation sources are negligible compared to the airborne sources of radiation. The results contained in Table 19.4.8-5 represent the annual TEDE to the MEI and nearest full-time resident for all sources of radiation due to normal operations at the SHINE facility.

Because the results in Tables 19.4.8-4 and 19.4.8-5 are within the regulatory limits explained earlier in this subsection, the radiological impacts to members of the public due to operation of the SHINE facility are SMALL.

19.4.8.2.4.2 Liquid Effluents

As described in Subsection 19.4.8.2.2.2, the SHINE facility does not generate radioactive liquid waste as candidate material for effluent release. As a result, there are no liquid effluent pathways that contribute to waterborne radioactivity concentrations.

Because there are no discharges of radioactive liquid effluent at the SHINE site, the annual averaged waterborne radioactivity concentration is not expected to be greater than the baseline concentration.

19.4.8.2.4.3 Direct Dose

From Subsection 19.4.8.2.2.3, fixed sources of radiation inside the production facility building are due to the radioactive materials used for solution preparation, Mo-99 production operations (e.g., TSV irradiation, holding tanks), and the staging of radioactive waste. The source of radiation inside the waste staging and shipping building is solidified radioactive waste.

Both the production facility and the waste staging and shipping building are designed with appropriate shielding to meet the 10 percent of 10 CFR 20.1301 limits on the outer wall of the RCA in the production facility and at the outer wall of the waste staging and shipping building.

The direct dose to a member of the public at the boundary of the unrestricted area (the site boundary) is due to gamma radiation penetrating the walls of the production facility and the waste staging and shipping facility. The direct dose is small outside of the buildings, due to site shielding design, and the dose will decrease with increasing distance. Because the nearest site boundary is located at an appreciable distance from both fixed sources, the dose is negligible at the site boundary.

19.4.8.2.5 Annual Dose to Maximally Exposed Worker

Administrative dose limits are occupational radiation exposure limits that radiation workers at SHINE shall not exceed without prior management approval. Table 19.4.8-7 gives SHINE administrative dose limits. 10 CFR Part 20 limits are also provided for reference.

19.4.8.2.6 Radiation Exposure Mitigation Measures

Occupational and public exposures due to operations at the SHINE site are ALARA. This exposure minimization goal is met through both engineered and administrative controls. The following subsections discuss each individually.

19.4.8.2.6.1 Engineered Controls

The SHINE facility utilizes the following engineered controls to minimize radiation exposure to the public and workers:

- Radiation source identification
- Shielding around radiation sources
- Ventilation control
- Access control to radiation areas
- Contamination control

- Remote operation
- Waste minimization

19.4.8.2.6.2 Administrative Controls

To minimize radiation exposure to the public and workers, the SHINE facility utilizes administrative controls, which consist of written procedures, policies, and employee training in the following subject areas:

- General environmental activities
- General environmental hazards regarding the facility
- Waste minimization requirements
- Waste minimization goals
- Waste minimization accomplishments
- Specific environmental issues
- Responsibilities for environmental stewardship
- Employee recognition for efforts to improve environmental conditions
- Requirements for employees to consider environmental issues in day-to-day activities

19.4.8.3 Radiological Monitoring

Radiological monitoring includes effluent monitoring and environmental monitoring.

19.4.8.3.1 Radiological Effluent Monitoring

The radiological effluent monitoring program is established to identify and quantify principal radionuclides in effluents (Regulatory Position C.1 of Regulatory Guide 1.21). This can be used to verify that the SHINE facility is performing as expected and within its design parameters so that doses to individual members of the public remain within the limits established in 10 CFR 20.1301 and doses due to airborne emissions meet the ALARA requirement of 10 CFR 20.1101(d) as required by Regulatory Guide 4.20.

All effluent pathways that could be a significant release pathway for radioactive material from the SHINE facility include radiological effluent monitoring.

19.4.8.3.1.1 Gaseous Effluent Monitoring

All gaseous effluents released from the SHINE facility (i.e., TSV off-gas, PVVS exhaust, and ventilation exhaust) are combined and released through a single vent stack. The airborne effluent exhaust from the vent stack is expected to contain measurable quantities of noble gas radioactivity (i.e., xenon and krypton). There could also be radioactive iodine, radioactive particulates, and tritium in the airborne effluent exhaust. Due to the expectation of having measurable quantities of radioactivity in the airborne effluent and since malfunction of the exhaust carbon filtration system could result in a change in iodine radioactivity releases, the combined exhaust in the vent stack is continuously monitored for gross gamma radioactivity using an off-line gas monitor. There are also grab sampling provisions to routinely collect and analyze gas, particulate, iodine, and tritium samples from the combined exhaust in the vent stack in order to identify radionuclides, identify relative concentrations of radionuclides in the airborne effluent, and quantify radionuclide releases.

19.4.8.3.1.2 Liquid Effluent Monitoring

The SHINE facility releases no radioactive liquid effluent due to extensive reuse of process liquids. As such, there are no defined liquid effluent release pathways from the RCA and no requirement for radiation monitoring of liquid effluent release pathways.

19.4.8.3.2 Radiological Environmental Monitoring

The requirement to have a radiological environmental monitoring program is documented in 10 CFR 20.1302. The radiological environmental monitoring program is used to verify the effectiveness of plant measures which are used to control the release of radioactive material and to verify that measurable concentrations of radioactive materials and levels of radiation are not higher than expected based on effluent measurements and modeling of the environmental exposure pathways. Methods for establishing and conducting environmental monitoring are provided in Regulatory Guide 4.1. Regulatory Guide 4.1 refers to NUREG-1301 for detailed guidance for conducting effluent and environmental monitoring. Although Regulatory Guide 4.1 and NUREG-1301 are written for nuclear power plants, due to the similarities between airborne releases of radioactivity from nuclear power plants and those released from the SHINE facility, guidance provided in Regulatory Guide 4.1 and NUREG-1301 was considered when developing radiological environmental monitoring for the SHINE facility. Specifically, guidance provided in Figure 1 of Regulatory Guide 4.1 and Table 3.12-1 of NUREG-1301 was considered when determining which exposure pathways to sample, sample locations, types of samples, and sample frequencies for the SHINE facility.

The following radiation exposure pathways are considered for monitoring under the radiological environmental monitoring program:

- Waterborne exposure pathway.
- Direct radiation exposure pathway monitored using thermoluminescent dosimeters (TLDs).
- Airborne exposure pathway monitored using continuous air samples.
- Ingestion exposure pathway (monitored only if triggered).

19.4.8.3.2.1 Waterborne Exposure Pathway (Groundwater Sampling)

There is no liquid effluent release pathway from the RCA associated with the SHINE facility and thus surface waters of the rivers in the vicinity of the plant (e.g., the Rock River and its tributaries) are not expected to accumulate detectable levels of radioactivity. As such, surface water sampling is not included in the radiological environmental monitoring plan. Similarly marine life in the rivers is not expected to accumulate detectable levels of radioactivity and thus sampling of fish or other marine creatures for the ingestion pathway is not included in the radiological environmental monitoring plan.

Measured local water table elevations for the site identify the groundwater gradient and indicate that the groundwater flow is to the west and to the south. The nearest drinking water source is a well which is located approximately a third of a mile (0.54 km) to the northwest of the facility. There are four test wells within the property boundary (see Figure 19.3.4-4) for the SHINE facility that were used for monitoring groundwater in support of a hydrological assessment of the site. One test well is located north, one south, one east, and one west of the SHINE facility building. Although there are no defined liquid effluent release pathways and the groundwater is not expected to be contaminated due to operation of the SHINE facility, in accordance with NUREG-1301 recommendations, the test wells to the west and the south are sampled for the presence of radionuclide contaminants. Sampling is in accordance with the recommendations in Table 3.12-1 of NUREG-1301, i.e., quarterly with gamma isotopic and tritium analysis. The rationale for sampling the test wells to the west and south of the SHINE facility is provided in Table 19.4.8-6.

19.4.8.3.2.2 Direct Exposure Pathway (Thermoluminescent Dosimeters)

TLDs provide indication of direct radiation from contained radiation sources within the SHINE facility building, from radiation sources contained within the waste storage and shipping facility, from radioactivity in the airborne effluent, and from deposition of airborne radioactivity onto the ground. A description of TLD locations and the rationale for TLD locations are provided in Table 19.4.8-6. TLD locations are shown on Figure 19.4.8-1. Table 3.12-1 of NUREG-1301 recommends 40 TLD locations, i.e., an inner ring and an outer ring of TLDs with one TLD in each ring at each of the 16 meteorological sectors and the balance of TLDs to be located at special interest areas. At least one TLD is to serve as a control, i.e., located a significant distance from the facility such that it represents a background dose. Considering the size of the SHINE facility and the low power level of the SHINE subcritical irradiation units (IUs), a minimum number of TLD locations (i.e., nine) are specified. These are located in order to provide annual direct dose information at on-site locations which are expected to have significant occupancy and at property line locations in the north, south, east, and west directions (to ensure all directions are monitored). These property line locations include the direction of the theoretical MEI and the direction of the nearest occupied structure. In addition, at least one location includes a paired TLD so that data quality can be determined.

19.4.8.3.2.3 Airborne Exposure Pathway (Airborne Sampling)

Airborne effluent releases from the SHINE facility contribute to off-site doses. Effluent streams from the SHINE facility that have the potential to include radioactive iodine are treated (e.g., using silver-impregnated zeolite and/or carbon filters) to remove the iodine. Some particulate activity (other than iodine) and tritium could also be released in airborne effluents; however, most of the off-site exposure due to airborne effluent releases is associated with noble gas and radioactive iodine releases.

Environmental airborne sampling is performed to identify and quantify particulates and radioiodine in airborne effluents. Regulatory Position C.3.b of Regulatory Guide 4.1 indicates that airborne sampling should always be included in the environmental monitoring programs for nuclear power plants since the airborne effluent pathway exists at all sites. Since the SHINE facility includes airborne effluent releases and radioactivity in the airborne effluent can result in measurable off-site doses and since there is a potential for a portion of the dose to be attributable to radioactive iodine and possibly airborne particulate radioactivity releases, the radiological environmental monitoring program includes airborne sampling.

The guidance provided in Table 3.12-1 of NUREG-1301 is used to establish locations for airborne sample acquisition, sampling frequency, and type of sample analysis. Continuous air sample locations are specified in accordance with guidance provided in Table 3.12-1 of NUREG-1301. The continuous air monitors (CAM) that are used to obtain continuous air samples include a radioiodine canister for weekly I-131 analysis and a particulate sampler which is analyzed for gross beta radioactivity and for quarterly isotopic analysis. Four CAM locations are near the facility property line in the north, south, east, and west direction sectors to ensure all directions are monitored. The north and east direction sectors (from the SHINE facility vent stack) have some of the highest calculated annual ground level deposition factor (D/Q) values. There is also a CAM located a sufficient distance from the SHINE facility to provide background information for airborne activity. Table 3.12-1 of NUREG-1301 suggests an additional CAM location in the vicinity of a community having the highest calculated annual average ground-level D/Q. This CAM requirement is combined with the CAM located at the site boundary in the north direction (refer to Table 19.4.8-6). A description of air sample locations and the rationale for air sample locations are provided in Table 19.4.8-6. CAM locations are shown on Figure 19.4.8-1.

19.4.8.3.2.4 Ingestion Exposure Pathway

NUREG-1301 suggests sampling of various biological media (biota monitoring) as a means to indirectly assess doses due to particulate and iodine ingestion. This type of monitoring may include sampling of soils, broad-leafed plants, fish, meat, or milk. Nuclear power plants have long monitored this pathway and have seen neither appreciable dose nor upward tending. Considering the size of the SHINE facility and the low power level of the SHINE irradiation units, in comparison to nuclear power plants, and that particulate and iodine radionuclides are not normally expected to be present in measurable quantities within airborne effluent releases from the SHINE facility, biota monitoring is not performed.

However, in the event that the results of environmental airborne samples indicate the presence of iodine or particulates in measurable quantities or if the effluent monitor sample results indicate the presence of iodine or particulates in quantities large enough to result in a calculated dose at the property line that exceeds 10 percent of the dose constraint (i.e., 1 mrem/yr), then a sampling campaign will be undertaken.

Milk is one of the most important foods contributing to the radiation dose to people if milk animals are pastured in an area near a facility that releases radioactive material. Dairy production takes place approximately one-half mile (0.8 km) to the east of the SHINE facility and goat production takes place at approximately 0.69 mi. (1.1 km) northeast of the facility. If it is determined that biota sampling is required as a result of radioactive iodine and radioactive particulate activity measured during effluent monitoring or air sampling, then milk sampling will be performed following guidance (i.e., sampling frequency and type of sample analysis) provided in Table 3.12-1 of NUREG-1301. Cow and goat milk samples would be obtained from the dairy production site and the goat production site, respectively, on a semi-monthly basis (when animals are pastured) and on a monthly basis (at other times). An I-131 analysis and a gamma isotopic analysis would be performed on the samples. Since milk samples are considered a better indicator of radioiodine in the environment than vegetation, as long as milk samples are obtained, it is expected that vegetation sampling (e.g., broad leaf vegetables) would not be included in the exposure pathway sampling (in accordance with guidance provided in Table 3.12-1 of NUREG-1301).

Table 19.4.8-1 Summary of Major[(a)] Chemical Inventory and Quantity

Chemical	Approximate Bounding Inventory, lb.	Chemical Grouping
[Proprietary Information]	[Proprietary Information]	[Proprietary Information]
Nitric Acid	17,600	Group 4 - Acids─Organic/Mineral
Sulfuric Acid	8100	Group 4 - Acids─Organic/Mineral
Calcium Hydroxide	4800	Group 5 - Bases
Caustic (NaOH)	1500	Group 5 - Bases
n-dodecane	1600	Group 2 - Flammable Liquids
Nitrogen	20,000	- -
Ordinary Portland Cement	20,000	- -
Uranyl Sulfate	3100	- -

a) In excess of 1000 pounds

Table 19.4.8-2 Chemical Storage Area Characteristics

Chemical Group	Chemical	Approximate Bounding Inventory of Chemical Reagents, lbs.	Storage Area
Group 2 Flammable Liquids (Large Quantity)	n-dodecane	1600	Stored in accordance with NFPA 30 Requirements.
[Proprietary Information]	[Proprietary Information]	[Proprietary Information]	[Proprietary Information]
Group 4 Acids - Organic and Mineral (Large Quantity)	Nitric Acid Sulfuric Acid Total	11,600 3700 15,300	Stored in mini-bulk plastic tanks
Group 5 Bases (Large Quantity)	Calcium Hydroxide Caustic (NaOH) Total	4800 1500 6300	Stored in dedicated corrosive chemicals cabinet that is coated with corrosion resistant material.

Table 19.4.8-3 Potential Occupational Hazards

Electrical
Battery banks (type unknown)
Cable runs
Diesel generator
Electrical equipment (various)
Heaters
High voltage
Motors
Power tools
Pumps
Service outlets, fittings
Switchgear
Transformers
Distribution lines\wiring underground wiring

Hazardous Materials
Asphyxiants (inert gas)
Carcinogens (lead shielding)
Decontamination materials
Fluorides
Hydrides
Lead
Oxidizers
Poisons (herbicides, insecticides)

Thermal
Boilers (modular)
Bunsen burner/hot plates
Electrical wiring
Possible exhaust (forklifts)
Welding surfaces
Welding torch

Internal Flooding Sources
Domestic water
Fire suppression piping/process water
Light water pool

Ionizing Radiation Sources
Contamination
Neutron beams
Radioactive material
Radioactive sources
Assay equipment
Criticality events

Spontaneous Combustion
Cleaning/decontamination solvents
Diesel fuel
Grease
Nitric acid
Paint solvents

Open Flame
Bunsen burners
Welding cutting torches

Flammables
Cleaning decontamination solvents
Hydrogen gases
Flammable liquids
Natural gas
Paint/paint solvent
Propane (forklift)

Physical
Sharp edges or points
Pinch points
Confined space
Tripping

Combustibles
Paper products (filters)
Wood products (crate/packaging)
Plastics (pallets)

Chemical Reactions
Concentration
Disassociation
Exothermic
Incompatible chemical mixing
Uncontrolled chemical reactions

Pyrophoric Material
Uranium

Explosive Materials
Dust (without housekeeping)
Explosive gas (hydrogen)
Hydrogen (batteries)
Nitrates
Peroxides
Propane

Kinetic (Linear and Rotational)
Acceleration/deceleration (lifted loads)
Bearings (UREX)
Belts (fan units)
Carts/dollies
Centrifugal (UREX 3-4000 RPM)
Drills (trade shops)
Fans
Fork lifts
Grinders
Motors
Power tools
Rail cars (depends on movement option)
Saws

Potential (Pressure)
Autoclaves
Boilers
Coiled springs (overhead doors)
Gas bottles
Gas receivers
Pressure vessels
Pressurized air

Potential (Height/Mass)
Cranes/hoists
Elevated doors
Elevated work surfaces
Elevators
Lift
Loading dock
Mezzanines
Floor pits
Scaffolds and ladders
Stacked material
Stairs

Table 19.4.8-4 Annual Average Airborne Radioactivity ECL Fraction at Bounding Dose Receptors[b]

Dose Receptor	Mixture ECL Fraction	ECL Fraction Limit[a]
MEI	9.3×10^{-2}	1.0×10^{-1}
Nearest Full-Time Resident	6.8×10^{-3}	

a) Limit based on NRC Regulatory Guide 4.20, Regulatory Position C.2.a

b) Values do not include contributions from tritium

Table 19.4.8-5 Annual Total Effective Dose Equivalent to the Public at Bounding Dose Receptors[b]

Dose Receptor	Annual TEDE	Annual TEDE Limit[a]
MEI	7.9 mrem (7.9×10^{-2} mSv)	10 mrem (1.0×10^{-1} mSv)
Nearest Full-Time Resident	5.7×10^{-1} mrem (5.7×10^{-3} mSv)	

a) Limit based on 10 CFR 20.1101(d)

b) Values do not include contributions from tritium

Table 19.4.8-6 Environmental Monitoring Locations (Sheet 1 of 2)

Monitoring Type	Location	Rationale
Groundwater Sampling Locations		
Test Well SM-GW4A Sampling	Test well located directly west of the SHINE facility.	The groundwater gradient is to the west and the south and thus any groundwater contamination is likely to flow to the west and to the south.
Test Well SM-GW2A Sampling	Test well located directly south of the SHINE facility.	The groundwater gradient is to the west and the south and thus any groundwater contamination is likely to flow to the west and to the south.
TLD Locations[(a)]		
TLD #1	Control TLD at Off-site Location	Distance is sufficiently large such that it represents a background dose, i.e., there is no significant dose rate associated with SHINE facility activities or associated with airborne effluents.
TLD #2	Southeast Corner of Administration Building	Administrative Building is expected to be an on-site area with regular occupancy outside the SHINE facility. The southeast corner of the building is closest to the SHINE facility.
TLD #3	North Side of the support facility building	The support facility building is expected to be an on-site area with regular occupancy outside the SHINE facility. The north side of the support facility building is closest to the SHINE facility.
TLD #4	Operating Area Boundary Fence Directly East of the Waste Staging and Shipping Building	TLD is positioned to detect direct radiation from the Waste Staging and Shipping Building.
TLD #5	Security Station	The Security Station is expected to be normally occupied.
TLD #6	Property Line to the East of the SHINE facility Vent Stack	This location is in the direction of dairy production and the horse pasture. Also the prevailing wind is from the west as indicated by the annual wind rose so this is the location of the MEI.

Table 19.4.8-6 Environmental Monitoring Locations (Sheet 2 of 2)

Monitoring Type	Location	Rationale
TLD #7	Property Line to the West of the SHINE facility	This location ensures all directions are monitored.
TLD #8	Property Line to the North of the SHINE facility Vent Stack	This location is in the direction of Janesville.
TLD #9	Property Line to the South of the SHINE facility Vent Stack	This location is in the direction of the nearest occupied structure.
<u>Air Sampler (CAM) Locations</u>		
Air Sampler (CAM #1)	Off-site Location	Control air sampler located a sufficient distance from the SHINE facility such that airborne samples are unaffected by airborne effluent releases from the facility.
Air Sampler (CAM #2)	Close to Property Line, Directly North of the SHINE facility Vent Stack	This direction has high D/Q and is in the direction of Janesville. Since the community of Janesville is relatively close to the site boundary, this air sampler location is credited with satisfying two of the conditions for air sample location recommendations in Table 3.12-1 of NUREG-1301.
Air Sampler (CAM #3)	Close to Property Line, East of the SHINE facility Vent Stack	This direction has high D/Q and is in the direction of dairy production and the horse pasture.
Air Sampler (CAM #4)	Close to Property Line, West of the SHINE facility Vent Stack	This location ensures all directions are monitored.
Air Sampler (CAM #5)	Close to Property Line, South of the SHINE facility Vent Stack	This location is in the direction of the nearest occupied structure.

a) At least one TLD location includes a paired TLD for data quality determination

Table 19.4.8-7 Administrative Dose Limits

Type of Dose	10 CFR Part 20 Limit (rem/year)	SHINE Annual Administrative Limit (rem/year)
Adult Radiological Worker		
The more limiting of:		
Total effective dose equivalent to whole body, or	5	0.5
Sum of deep-dose equivalent and committed dose equivalent to any organ or tissue other than lens of eye	50	5
Eye dose equivalent to lens of eye	15	1.5
Shallow-dose equivalent to skin of the whole body or any extremity	50	5
Declared Pregnant Worker		
Dose to embryo/fetus during the entire pregnancy: taken as the sum of the deep-dose equivalent to the woman and the dose to the embryo/fetus from radionuclides in the embryo/fetus and the woman	0.5 rem per gestation period	0.5 rem per gestation period
Individual Members of the Public		
Total effective dose equivalent	0.1	0.1

19.4.9 WASTE MANAGEMENT

19.4.9.1 Sources and Types of Waste Created

The following subsections discuss hazardous, radioactive and mixed wastes associated with the SHINE facility. Nonradioactive wastes are discussed in Subsection 19.4.8.1.

19.4.9.1.1 Sources of Hazardous, Radioactive and Mixed Wastes

The sources of radioactive liquid, solid, and gaseous waste generated by the operation of the SHINE facility are found in Subsection 19.2.5.1.

The only hazardous (or potentially hazardous) materials are [Proprietary Information] and the zeolite beds. Although small quantities of [Proprietary Information] will be used in the sulfate to nitrate conversion process, the [Proprietary Information] sludge is expected to pass TCLP, and is not considered hazardous waste. Waste streams with a hazardous component are mixed low-level waste such as the zeolite beds and are handled as described in Subsection 19.2.5.3.1.

19.4.9.1.2 Type and Quantity of Hazardous, Radioactive, and Mixed Wastes

The type and quantity of radioactive and mixed wastes are provided in Table 19.2.5-1.

Discussion of nonradiological waste is provided in Subsection 19.4.8.1.

19.4.9.2 Description of Waste Management Systems

Waste systems designed to collect, store, and process the waste from the SHINE facility are discussed in Subsection 19.2.5.3.

19.4.9.3 Waste Disposal Plans

Waste streams with a hazardous component are mixed low-level waste and are handled as described in Subsection 19.2.5.3.1.

The radiological wastes listed in Table 19.2.5-1 are stored on-site for a period of time before they are shipped off-site. The frequency of shipment of each type of waste is provided in Table 19.2.5-1. Enough storage capacity is provided on-site to accommodate the amount of waste between shipments to the off-site repositories. How solid and liquid radwaste is handled is discussed in Subsections 19.2.5.3.1 and 19.2.5.3.2. Radioactive waste gases are discussed in Subsections 19.4.8.2.2.1 and 19.4.8.2.4.1.

The radioactive wastes will be transported to the destinations listed on Table 19.2.5-1.

19.4.9.4 Waste-Minimization Plan

The waste minimization plan to reduce the generation of waste from the SHINE facility is discussed in Subsection 19.2.5.6.

19.4.9.5 Environmental Impacts

SHINE facility wastes are managed as described in the previous subsections and are managed in accordance with applicable federal, state, and local regulations. As a result, the direct impacts to the environment due to the on-site storage and disposal of waste are SMALL. Additionally, the indirect impacts to the environment from transportation and delivery of waste to off-site waste repositories are SMALL. Cumulative impacts are discussed in Subsection 19.4.13.8.2.

19.4.10 TRANSPORTATION

19.4.10.1 Nuclear Materials Transported

Nuclear materials are transported to and from the SHINE facility located in Janesville, Wisconsin. The nuclear material transported to the SHINE facility consists of low enriched uranium (LEU) metal and tritium. The nuclear materials transported from the SHINE facility consist of generated medical isotopes Mo-99, I-131, and Xe-133, and the radioactive wastes generated during the production of the medical isotopes.

19.4.10.1.1 Transportation Mode and Projected Destinations

The LEU metal is transported by truck to the SHINE facility from the Y-12 facility located in Oak Ridge, Tennessee. The Y-12 facility is approximately 650 mi. (1046.1 km) by road from Janesville, Wisconsin.

The radioactive wastes are transported by truck to various disposal facilities. The highway distances from Janesville, Wisconsin, to the disposal facilities are as follows:

- Approximately 1450 mi. (2333.6 km) to the EnergySolutions facility in Clive, Utah.
- Approximately 1305 mi. (2100.2 km) to the Waste Control Specialists (WCS) facility in Andrews, Texas.
- Approximately 660 mi. (1062.2 km) to the Diversified Scientific Services, Inc. (DSSI) facility in Kingston, Tennessee.

The medical isotopes produced at the SHINE facility are transported by air to the various facilities for final processing and distribution to medical facilities. Transportation by truck is used as a back-up in cases where inclement weather does not permit air delivery. The highway distances from Janesville, Wisconsin, to these facilities are as follows:

- Approximately 330 mi. (531.1 km) to the Covidien facility in Hazelwood, Missouri.
- Approximately 1100 mi. (1770.3 km) to the Lantheus Medical Imaging facility in North Billerica, Massachusetts.
- Approximately 975 mi. (1569.1 km) to the Nordion facility in Kanata, Ontario, Canada.

19.4.10.1.2 Treatment and Packaging

The radioactive wastes generated at the SHINE facility are treated and packaged as discussed in Subsection 19.2.5.3. Solid waste includes used components and equipment. This material is collected, stored in the facility to allow for radioactive decay, and then size-reduced and consolidated for shipment as low specific activity (LSA) material. Higher activity waste is processed and solidified prior to shipment. Liquid waste that cannot be reused is held for radioactive decay and then solidified before shipment.

The medical isotopes are extracted from the LEU target solution at the end of each irradiation cycle. The target solution is removed from the TSV and transferred to a hot cell where isotopes are selectively extracted. Purified Mo-99, I-131, and Xe-133 are tested by quality control before being packaged for shipment to the various processing facilities.

Prior to shipment, all radioactive material is packaged to meet the U.S. Department of Transportation (DOT) and NRC requirements for the transportation of radioactive materials.

19.4.10.1.3 Incident-Free Radiological Doses

The incident-free radiological doses are determined for members of the public and the workers that are involved with the transportation of the medical isotopes and the radioactive wastes (transportation workers and handling workers).

The calculation of the incident-free radiological doses is performed using RADCAT/RADTRAN and TRAGIS computer codes. The RADCAT/RADTRAN computer code is used to calculate the doses to the workers and the members of the public using the routes defined by TRAGIS and population data from the USCB. Most of the medical isotopes will be shipped by air, and the doses associated with this transport mode are smaller than the transportation via land routes due to shorter exposure time to the workers and the smaller number of exposed members of the public during air transportation. As described below, transportation scenarios based on land routes are used to conservatively estimate the radiological doses due to medical isotope transport.

The TRAGIS computer code is used to determine the highway route distance traveled for a shipment from the SHINE facility to a destination facility. TRAGIS also provides the population density along the route, which is required for calculating the dose to members of the public. However, the version of the TRAGIS computer code used in this analysis (WebTRAGIS 5.0 Beta) did not have the capability to provide population density data. Therefore, the population density data is estimated using the following approach. The state-level mileage distributions for rural, suburban, and urban population density zones are conservatively estimated by superimposing the routes from TRAGIS on the population profile maps (year 2010) from the USCB. The maps that show the routes from TRAGIS and the associated population densities from the USCB are shown in Figures 19.4.10-1 through 19.4.10-4. The summary of the population densities along the transportation routes analyzed are provided in Tables 19.4.10-1 through 19.4.10-4.

Using the TRAGIS output, the regions that contain segments of each transportation route are classified as rural, suburban, or urban population zones. In TRAGIS, a population density less than 139 people per square mile is considered a rural population. A population density between 139 and 3326 people per square mile is considered a suburban population. A population density greater than 3326 people per square mile is considered an urban population. The ranges provided on the maps obtained from the USCB do not match these ranges. Therefore, in cases where there are multiple population zones in a region of the transportation route, the population zone with the highest population density is identified and assumed for the region.

The TRAGIS Beta release provides a population count of the total exposed population within 800 m (243.8 ft.) of the route. Adjustment factors are calculated based on the exposed population using the population count from TRAGIS and the exposed population based on the population densities from Figures 19.4.10-1 through 19.4.10-4. Tables 19.4.10-1 through 19.4.10-4 provide the exposed populations along the transportation routes and the associated adjustment factors. The analysis for determining the exposed populations along the transportation routes is performed in a conservative method to ensure the calculated dose values will bound the TRAGIS values once the computer code is updated to internally include the population density data.

The doses due to transportation of the radioactive wastes are calculated for shipments to the WCS facility in Andrews, Texas (bounded at 12 shipments/year) and the EnergySolutions facility in Clive, Utah (bounded at 22 shipments/year). The doses due to transportation of radioactive wastes to other disposal facilities, such as the DSSI facility in Kingston, Tennessee, are not calculated because they are bounded by the doses associated with transportation of radioactive wastes to the WCS and EnergySolutions facilities, primarily due to the smaller travel distance which reduces the exposure time to the workers and the members of the public.

The doses due to the transportation of the medical isotopes are calculated using scenarios based on truck shipments to the Covidien facility in Hazelwood, Missouri and the Lantheus Medical Imaging facility in North Billerica, Massachusetts. The estimated total number of shipments per year is 468, or nine shipments per week. Most of these shipments will be by air, but to estimate the effect of a combination of shipments by air and ground transportation it is assumed that approximately one quarter of the shipments (two per week) are shipped by truck. This is more truck shipments than is expected, but the use of this larger number of truck shipments conservatively accounts for the dose due to air shipments. Most of the truck shipments would be sent to the closest facility, which is Covidien, because of the short half-life of the medical isotopes. However, shipment by truck of the longer lived isotopes to other facilities may occur. Therefore it is assumed that half of the truck shipments (52 shipments/year) are to Covidien and an equal number of shipments (52 shipments/year) are to the Lantheus Medical Imaging facility. The doses due to the transportation of medical isotopes to other processing facilities, such as the Nordion facility in Kanata, Ontario, Canada, are not calculated because they are bounded by the doses associated with the transportation of medical isotopes to the Lantheus facility, primarily because the transportation route is longer and its path is through areas with a higher population density. The use of these scenarios will bound the shipment by air because the exposed population is smaller and the exposure time for the crew is shorter for each shipment. The dose due to package handling will increase for air shipments, so a conservatively large dose is calculated for the handlers in order to conservatively estimate the dose component for air shipments.

The doses associated with the transportation of the LEU metal and tritium gas are much smaller than the doses associated with the transportation of other radioactive materials and are not calculated. The doses associated with the transportation of the LEU metal are much smaller because of the infrequent shipments (less than one per year) and the low activity in each shipment. The doses associated with the transportation of the tritium gas are negligible because, as a beta emitter, the dose rate outside a container of tritium is practically zero, independent of the quantity of tritium.

The annual incident-free radiological doses due to transportation of radioactive materials from the SHINE facility are summarized in Table 19.4.10-5. These doses are calculated assuming the dose rates due to the shipping containers are equal to typical dose rates based on reported dose rates from historical shipments of medical isotopes and low-level waste. The dose to the workers due to the transportation of radioactive material from the SHINE facility is 9.63 person-rem/year. The dose to the members of the public due to the transportation of radioactive material from the SHINE facility is 0.350 person-rem/year. As indicated in Subsection 19.4.3.7, the population in the region around the facility is 160,331, and the background dose rate identified in Subsection 19.4.3.8.2 is 620 mrem/yr (6.2 mSv/yr). Therefore, the population dose in the vicinity of the SHINE facility due to background radiation is approximately 1E+05 person-rem/year. Compared to the background dose in the vicinity of the SHINE facility, the effect of incident-free transportation is SMALL.

19.4.10.2 Non-Nuclear Materials Transported

General office supplies and industrial supplies supporting the maintenance and day-to-day operations of the SHINE facility are transported to the site. Office waste is generated at the site and transported from the site by City of Janesville without being treated or packaged. These activities are typical for a general commercial facility within City of Janesville. The associated incident-free transportation activities do not have an adverse impact on the environment, workers, or the members of the public.

Table 19.4.10-1 Population Density, Exposed Population, and the Adjustment Factor for Transportation Route to Andrews, Texas

State	Zone	Distance Traveled (mi.)	Distance Traveled (km)	Population Density (persons/km^2)	Population Along Route Segment
WI	Rural	0.0	0.0	6.60E+01	0.00E+00
	Suburban	3.2	5.1	1.67E+03	1.36E+04
	Urban	12.0	19.3	3.86E+03	1.19E+05
IL	Rural	94.3	151.7	6.60E+01	1.60E+04
	Suburban	127.0	204.3	1.67E+03	5.46E+05
	Urban	86.8	139.7	3.86E+03	8.63E+05
MO	Rural	39.2	63.1	6.60E+01	6.66E+03
	Suburban	170.8	274.8	1.67E+03	7.34E+05
	Urban	80.5	129.5	3.86E+03	8.00E+05
OK	Rural	184.6	297.0	6.60E+01	3.14E+04
	Suburban	126.8	204.0	1.67E+03	5.45E+05
	Urban	32.8	52.8	3.86E+03	3.26E+05
TX	Rural	238.6	383.9	6.60E+01	4.05E+04
	Suburban	97.6	157.0	1.67E+03	4.20E+05
	Urban	10.8	17.4	3.86E+03	1.07E+05
Total		1305.0	2099.6		4.57E+06
				Population from TRAGIS	128,667
				Adjustment Factor	2.82E-02

Table 19.4.10-2 Population Density, Exposed Population, and the Adjustment Factor for Transportation Route to Clive, Utah

State	Zone	Distance Traveled (mi.)	Distance Traveled (km)	Population Density (persons/km^2)	Population Along Route Segment
WI	Rural	0.0	0.0	6.60E+01	0.00E+00
	Suburban	3.2	5.1	1.67E+03	1.36E+04
	Urban	12.0	19.3	3.86E+03	1.19E+05
IL	Rural	36.1	58.1	6.60E+01	6.14E+03
	Suburban	51.7	83.2	1.67E+03	2.22E+05
	Urban	38.3	61.6	3.86E+03	3.80E+05
IA	Rural	142.8	229.8	6.60E+01	2.43E+04
	Suburban	44.6	71.8	1.67E+03	1.92E+05
	Urban	117.5	189.1	3.86E+03	1.17E+06
NE	Rural	249.6	401.6	6.60E+01	4.24E+04
	Suburban	165.7	266.6	1.67E+03	7.12E+05
	Urban	27.8	44.7	3.86E+03	2.76E+05
WY	Rural	259.1	416.9	6.60E+01	4.40E+04
	Suburban	52.1	83.8	1.67E+03	2.24E+05
	Urban	90.4	145.5	3.86E+03	8.99E+05
UT	Rural	59.0	94.9	6.60E+01	1.00E+04
	Suburban	12.1	19.5	1.67E+03	5.21E+04
	Urban	87.9	141.4	3.86E+03	8.73E+05
Total		1449.9	2332.9		5.26E+06
				Population from TRAGIS	68,655
				Adjustment Factor	1.31E-02

Table 19.4.10-3 Population Density, Exposed Population, and the Adjustment Factor for Transportation Route to Hazelwood, Missouri

State	Zone	Distance Traveled (mi.)	Distance Traveled (km)	Population Density (persons/km^2)	Population Along Route Segment
WI	Rural	0.0	0.0	6.60E+01	0.00E+00
	Suburban	3.2	5.1	1.67E+03	1.36E+04
	Urban	12.0	19.3	3.86E+03	1.19E+05
IL	Rural	94.3	151.7	6.60E+01	1.60E+04
	Suburban	122.0	196.3	1.67E+03	5.25E+05
	Urban	85.9	138.2	3.86E+03	8.54E+05
MO	Rural	0.0	0.0	6.60E+01	0.00E+00
	Suburban	0.0	0.0	1.67E+03	0.00E+00
	Urban	11.5	18.5	3.86E+03	1.14E+05
Total		328.9	529.1		1.64E+06
				Population from TRAGIS	24,272
				Adjustment Factor	1.48E-02

Table 19.4.10-4 Population Density, Exposed Population, and the Adjustment Factor for Transportation Route to North Billerica, Massachusetts

State	Zone	Distance Traveled (mi.)	Distance Traveled (km)	Population Density (persons/km^2)	Population Along Route Segment
WI	Rural	0.0	0.0	6.60E+01	0.00E+00
	Suburban	3.2	5.1	1.67E+03	1.36E+04
	Urban	12.0	19.3	3.86E+03	1.19E+05
IL	Rural	0.0	0.0	6.60E+01	0.00E+00
	Suburban	30.5	49.1	1.67E+03	1.31E+05
	Urban	87.8	141.3	3.86E+03	8.73E+05
IN	Rural	13.3	21.4	6.60E+01	2.26E+03
	Suburban	62.8	101.0	1.67E+03	2.70E+05
	Urban	70.3	113.1	3.86E+03	6.99E+05
OH	Rural	20.4	32.8	6.60E+01	3.46E+03
	Suburban	139.2	224.0	1.67E+03	5.99E+05
	Urban	88.3	142.1	3.86E+03	8.78E+05
PA	Rural	0.0	0.0	6.60E+01	0.00E+00
	Suburban	13.3	21.4	1.67E+03	5.72E+04
	Urban	33.4	53.7	3.86E+03	3.32E+05
NY	Rural	13.3	21.4	6.60E+01	2.26E+03
	Suburban	245.0	394.2	1.67E+03	1.05E+06
	Urban	119.4	192.1	3.86E+03	1.19E+06
MA	Rural	8.9	14.3	6.60E+01	1.51E+03
	Suburban	63.8	102.7	1.67E+03	2.74E+05
	Urban	76.1	122.4	3.86E+03	7.56E+05
Total		1101.0	1771.4		7.25E+06
				Population from TRAGIS	215,374
				Adjustment Factor	2.97E-02

Table 19.4.10-5 Incident-Free Radiological Dose Summary (Person-Rem/Year)

Receptor	Destination Facility				Total
	WCS	EnergySolutions	Covidien	Lantheus	
Workers (Transportation)	1.44E-01	2.93E-01	6.92E-01	2.31E+00	3.44E+00
Workers (Handling)	1.51E-01	2.77E-01	2.88E+00	2.88E+00	6.19E+00
Members of the Public	1.48E-02	1.22E-02	3.61E-02	2.87E-01	3.5E-01

19.4.11 POSTULATED ACCIDENTS

This subsection identifies the postulated initiating events (IEs) and credible accidents for the SHINE facility that were selected to drive the design of the facility; designated herein as design basis accidents (DBAs). This subsection also describes the maximum hypothetical accident (MHA).

The major hazards associated with the SHINE facility are:

- Fissile material as either feed or in target solution.
- Irradiated fissile solution and corresponding fission products present not only within the TSV but throughout the SHINE facility.
- Neutrons produced by the accelerator.
- Radioactive waste.
- Production of hydrogen by radiolytic decomposition of irradiated fissile solution.
- Failure of tanks and/or vessels with significant quantities of hazardous chemicals.
- Exothermic reactions between chemicals leading to damage to tanks or vessels containing significant quantities of hazardous materials.
- Mishap during handling of chemicals leads to breach or spill of chemicals from tanks or vessels.
- Mishap during handling of chemicals leads to spill of chemicals outside tanks or vessels within the facility.
- Mishap during delivery of hazardous chemicals leads to spill of chemicals outside the facility.

19.4.11.1 Methodology for Identification of Design Basis Accidents

The methodology for identifying DBAs is described in Chapter 13.

The SHINE facility has been divided into two major areas: the Irradiation Facility (IF) and the Radioisotope Production Facility (RPF). The IF consists of the Irradiation Units (IUs) and supporting structures, systems, and components dedicated to the irradiation of target solution. This includes the primary cooling systems and the tritium purification system. The RPF includes the isotope extraction and purification, target solution preparation and clean-up, radioactive waste handling and chemical storage systems and areas.

According to the Final ISG Augmenting NUREG-1537, the following accident categories, as modified for the SHINE facility, are to be addressed for the IF and RPF:

- MHA.
- Insertion of excess reactivity.
- Reduction in cooling.
- Mishandling or malfunction of target solution (including inadvertent criticality in the RPF).
- Loss of normal electrical power.
- External events.
- Mishandling or malfunction of equipment.
- Large undamped power oscillations (fuel temperature/void-reactivity feedback).
- Detonation and deflagration.
- Unintended exothermic chemical reactions other than detonation.
- Facility system interaction events.

- Hazardous chemical releases.
- Facility fire (RPF).
- Unique facility IEs/DBAs.

All IEs and scenarios applicable to the IF are evaluated in Section 13a2. Those applicable to the RPF areas are covered in Section 13b.

Representative accident scenarios with bounding consequences for each of the above IEs/ scenario categories are to be evaluated quantitatively in Sections 13a2.2, 13b.2, and 13b.3, per the guidance in NUREG-1537 and the Final ISG Augmenting NUREG-1537. The most bounding DBAs with respect to consequences for both the IF and the RPF are analytically evaluated in Subsection 19.4.11.3 below.

19.4.11.2 Identified Initiating Events and Design Basis Accidents

This subsection gives a quantitative discussion of the consequences of the MHA. This subsection also briefly discusses IEs and DBAs as well as some of the controls that are being designed to prevent or mitigate the potential consequences to levels that are acceptable (i.e., within regulatory criteria). These IEs and DBAs are designed to bound the potential accident scenarios in each of the accident categories of interest.

Potential radiological consequences of DBAs are discussed qualitatively as a function of the source terms released during the postulated scenarios, and controls that mitigate the consequences. The consequences of the DBAs are bounded by the quantitative analysis performed for the MHA.

19.4.11.2.1 Maximum Hypothetical Accident

The MHA is defined to be an event that results in radiological consequences that exceed those of any accident considered to be credible. The MHA therefore bounds the radiological consequences of postulated DBA scenarios at the SHINE facility. The MHA need not be a credible scenario but a failure assumed to establish an outer limit consequence.

For the SHINE facility, the MHA is based on events unique to the facility that hypothetically could result in a release of radioactive materials. The SHINE facility is subdivided into two major process areas: the IF and the RPF. Processes in both areas of the facility are generally of low energy (i.e., subcritical, low heat generation). In addition, the facility is being designed to withstand credible external events. Therefore, an internal accident releasing the largest possible quantity of radioactive material is considered to be the initiating event that would result in the maximum bounding radiological consequence.

The IF and RPF are designed to function as two independent areas within the facility. Though the IF and RPF have processes and systems that interact with each other, they are physically separated by concrete walls. Design features such as irradiation cell shielding, redundant isolation valves, ventilation dampers, and penetration seals in both areas, ensure that an accident in one area is highly unlikely to affect the other area. In addition, both areas are separated to ensure that a radiological release in one area does not have a significant effect on the other area. Because of this physical separation, it is necessary to analyze both the IF and RPF to determine the MHA.

The MHA is used to demonstrate that the maximum consequences of an accident at the SHINE facility are within the acceptable regulatory limits of 10 CFR 20.1301. The MHA assumes a failure that results in a radioactive release with radiological consequences that bound all credible DBAs.

Because the SHINE facility is being designed to withstand external events such as tornadoes, seismic events, and man-made external events, scenarios that involve multiple irradiation units are not considered to be credible, and are not analyzed further. In addition, several internal events were eliminated as possible MHAs due to the design of facility. For example, a pipe break containing fissile inventory being transferred from a TSV dump tank to a supercell in the RPF was considered. Because all production piping is located in covered, concrete trenches that are designed to contain any rupture of inventory and drain to sumps that are geometrically designed to prevent an inadvertent criticality, this event was eliminated as a possible MHA. There is no credible internal event that will result in releases from multiple TSVs.

A potential MHA considered was a rupture or leakage of the TSV or TSV dump tank resulting in a complete release of the target solution and fission product inventory into one IU cell. This potential MHA assumes zero hours of decay time. This event occurs within the confinement of the IU cell and is assumed to release the entire inventory of one TSV into the IU cell. The calculated radionuclide inventory released from the TSV to the IU cell represents the bounding source term for any other postulated accident in the IF.

Any potential loss of TSV inventory within the IU is mitigated by several controls, namely: confinement provided by the IU cell and the RCA ventilation system zone (RVZ)1 (including the presence of bubble-tight dampers to isolate the cells upon detection of above-threshold radiation levels), radiation monitoring (to be interlocked with bubble-tight dampers), shielded pipe penetrations, and TSV off-gas system.

Another potential MHA considered was a release of the inventory stored in the noble gas removal system (NGRS) storage tanks. This event occurs within the confinement of the noble gas storage tank room, located in the RPF. The calculated radionuclide inventory released from the NGRS storage tanks represents the bounding source term for any other postulated accident in the RPF.

Controls to mitigate the consequences of the MHA in the RPF include: the NGRS room, radiation monitors, RCA ventilation system Zone 1 (RVZ1) (including the presence of bubble-tight dampers to isolate the cells upon detection of above-threshold radiation levels), radiation monitoring (to be interlocked with bubble-tight dampers), and RCA ventilation system Zone 2 (RVZ2).

The evaluation of the inventory for the considered MHAs is based on a set of limiting initial conditions that were designed to maximize the potential source terms and to bound credible scenarios. This includes assumptions regarding the total time for irradiation, failure to decay target solution prior to processing, process faults that result in additional target solution cycles, and failure of fission product removal.

The amount of radioactive material released to the environment (i.e., source term) was calculated for both MHAs based on the five factor formula:

$$ST = MAR \times DR \times ARF \times RF \times LPF. \qquad \text{(Equation 19.4.11-1)}$$

Where:

ST refers to the source term

MAR refers to the inventory of material-at-risk from the postulated scenarios.

DR represents the fraction of the inventory impacted by the scenario (in the evaluated cases assumed to be 1.0).

ARF/RF refer to the airborne release fractions and respirable fractions for the radionuclides assumed to be present in the inventory (based on published ARF/RF in NUREG-6410).

LPF refers to the leak-path factor or fraction of the material that is airborne that is assumed to be released to the environment.

For the postulated scenarios, the entire inventory of the TSV and the NGRS holding tanks are released to the IU cell and the noble gas storage cell, respectively. ARF x RF for solution spills for particulates from NUREG-6410 were selected. For halogens an ARF x RF of 0.25 was assumed, while an ARF x RF of 1.0 was assumed for noble gases.

In-plant transport of the radionuclides was based on the assumptions concerning the functioning of available plant systems. Mitigated consequences are based on the assumption that the radioactive material will be released into the IU cell and that no more than 1 percent of the airborne radioactive material will be released by the IF before the cell is isolated by the RVZ1 isolation bubble-tight dampers. Any radioactive material that is released from the noble gas storage room before it is isolated is assumed to be filtered by the HEPA and charcoal filters. For dose calculations, all releases are assumed to be at ground level. These calculations are based on the 50th percentile χ/Q. Doses are calculated using ICRP-30 dose conversion factors, and receptor locations are the closest point on the site boundary and the nearest permanent resident.

The total effective dose equivalent (TEDE) and the thyroid doses for the postulated scenarios are:

- Rupture or leakage of the TSV or TSV dump tank scenario: TEDE of 1.65E-02 rem at the site boundary and 2.30E-03 rem for the nearest residence.
- Release of the inventory stored in the NGRS storage tanks scenario: TEDE of 7.98E-02 rem at the site boundary and 1.12E-02 rem for the nearest residence.

Based on the calculated doses, the MHA for the SHINE facility is the release of the inventory stored in the NGRS storage tanks. The dose for the MHA is less than the dose criteria in 10 CFR 20.1301.

19.4.11.2.2 Insertion of Excess Reactivity

Excess reactivity insertion in the subcritical assembly system (SCAS) is identified as a potential DBA that needs to be evaluated. This DBA covers events that can lead to an insertion of positive reactivity in the SCAS. Examples include:

- Pressurization of target solution fluid.
- Excessive cool down.
- Target solution injection.
- Geometry changes.
- Reactivity insertion due to moderator lumping effects.
- Inadvertent introduction of other materials into the target solution.
- Loss of water from the target solution during irradiation.

This event is not applicable to the RPF.

The SCAS has a TSV reactivity protection system (TRPS). Anticipated protective signals of the TRPS for TSV shutdown and dump valve actuation include a combination of high neutron flux levels, high flux rate, high TSV fill rate, high TSV level, or indication of a loss of cooling to the TSV. Shutdown of the TSV will limit the amount of power and pressure increase allowed in the TSV preventing PSB breach. Any potential releases from such events are further mitigated by the off-gas system, the facility ventilation system, and the passive nature of the confinement provided by the IU cells and facility itself. As such, release of the entire contents of one TSV bounds any radiological release from such a reactivity insertion event and is therefore bounded by the MHA.

19.4.11.2.3 Reduction or Loss of Cooling

The reduction or loss of cooling event is identified as a potential DBA. This scenario, however, is bounded and covered by the MHA event, since there is little or no consequence from loss of cooling in the IF or RPF.

The design of the IF, including the intrinsic properties of the irradiated solution, are such that the reduction or loss of cooling (even without engineering features) will lead to a reduction in the neutron multiplication factor (k_{eff}), thus leading to a reduction in the amount of energy (or power) generated under this condition. Furthermore, just like for insertion of excess reactivity, the SCAS has a TRPS trip that serves as a defense-in-depth control to mitigate any potential consequences from this postulated scenario. Indication of a loss of cooling to the TSV results in TRPS shutdown of the TSV. This limits the amount of power and pressure increase allowed in the TSV, preventing PSB breach. Any potential releases from such events are further mitigated by the off-gas system, the facility ventilation system, and the passive nature of the confinement provided by the IU cells and facility itself. Finally, given the low decay heat production, the light water pool serves as a passive heat sink that prevents the temperature of the target solution from rising to any significant degree. As such, release of the entire contents of one TSV bounds any radiological release from a reduction or loss of cooling event and is therefore bounded by the MHA.

19.4.11.2.4 Mishandling or Malfunction of Target Solution

The following events are identified as potential DBAs representing the mishandling or malfunction of target solution:

- Loss of PSB in the IF.
  - Covers target solution spills and leaks (bounded by release of entire TSV contents).
  - Vessel/line failures in the RPF (to be covered under mishandling or malfunction of equipment).
- Inadvertent criticality in the IF.
  - Covers IEs associated with failure to control pH in the target solution.
  - Failure to control target solution temperature and pressure is covered under the reactivity insertion DBA.
- Inadvertent criticality in the RPF.
  - Covers IEs associated with failure to control pH or temperature in the target solution.

Loss of PSB and an inadvertent nuclear criticality are prevented and/or mitigated by the design of robust and criticality safe geometry tanks, piping, and valves, along with the design of spill pits or berms around tanks containing significant quantities of fissile material. The TSV where irradiation operations take place is designed with features and safety controls such as dump valves to limit the duration of an inadvertent criticality. Furthermore, administrative controls on the concentration of fissile material in the TSV or tanks are implemented to prevent the occurrence of an inadvertent criticality within the facility. Tanks containing significant quantities of fissile material are seismically qualified to survive site-specific design basis seismic events.

Any potential releases of radioactive material, from either a loss of PSB or an inadvertent criticality, are mitigated by the off-gas system, the facility ventilation system, and the passive nature of the confinement provided by the IU cells and the facility itself.

An inadvertent criticality is likely to generate source terms and doses that are equivalent to an insertion of excess reactivity. This is because these events would be limited to a single or small number of pulses. Thus, this event would be bounded by the MHA.

19.4.11.2.5 Loss of Normal Electrical Power

The loss of normal electrical power affects both the IF and RPF, and has been identified as a potential DBA.

A loss of normal electric power causes a shutdown of the TSV and thus reduces significantly the power and heat that could be generated. After shutdown of the TSV, decay heat levels are low enough to allow cooling to ambient, thus a loss of electric power does not cause a breach of the PSB. The loss of power also could lead to an initiating event that could result in various potential accident conditions, including the loss of ventilation and off-gas system, which in turn could lead to a deflagration event from the build-up of hydrogen on the top of the TSV cavity or in the off-gas system itself. This scenario is covered separately under detonation or deflagration due to the generation of hydrogen.

19.4.11.2.6 External Events

The following potential external events have been identified as DBAs for the SHINE facility:

- Seismic event affecting the IF and RPF.
- Tornado or high-winds affecting the IF and RPF.
- Small aircraft crash into the IF or RPF.

The facility structure, including the SCAS and critical process equipment (including tanks containing potentially significant quantities of fissile material) in the IF and RPF, are designed to survive the above external events.

19.4.11.2.7 Mishandling or Malfunction of Equipment

The potential DBAs that could be initiated by the mishandling or malfunction of equipment include:

- Failure of the off-gas system leading to release of noble gases and halogens.
- Loss of pressure boundary in PSB (covered under mishandling target solution).
- Vessel/line failures in the RPF (e.g., Mo-99 extraction feed or raffinate tanks).

The SHINE facility is designed with multiple engineering features and controls to prevent or mitigate the potential consequences from such mishandling or malfunction of equipment. Critical equipment are designed robustly with significant redundancy or fail safe features to prevent or mitigate the consequences from these events.

The consequences from these scenarios are bounded by the release of the entire contents of one TSV and are therefore bounded by the MHA. For this DBA, the worst case condition is the loss of the PSB or a spill of radioactive material from tanks in the RPF.

19.4.11.2.8 Large Undamped Power Oscillations

Large undamped power oscillations are identified as potential DBAs to be considered. The TSV is designed for subcritical operation, low power density, and large negative temperature and void coefficients, resulting in a stable TSV with only self-limiting power oscillations. The low power density and subcritical operating conditions of the TSV will prevent the occurrence of any large undamped power oscillation. The source term and potential consequences from this type of event would be, however, bounded by the excess reactivity insertion scenario (see Subsection 19.4.11.2.2).

19.4.11.2.9 Detonation and Deflagration Events (Due to Hydrogen Generation)

The potential for detonation and deflagration due to hydrogen accumulation in the PSB (including in the cavity of the TSV or off-gas system) is identified as a potential DBA. Hydrogen accumulation in the RPF is not expected to exceed the lower explosive limit (LEL) or lower flammability limit (LFL).

During operation and post TSV shutdown, the TSV solution generates hydrogen and oxygen. Analysis has shown that buildup of gas to a level that could cause a detonation or deflagration is possible. The off-gas system is engineered to prevent such an event. However, the failure of the off-gas system, combined with a buildup of hydrogen and oxygen in the TSV and an ignition source, could lead to a breach of the PSB. Many design features and controls are designed to prevent or mitigate such events, including the design of a reliable and robust off-gas system that is interlocked upon failure of the TSV off-gas blower to immediately shutdown the irradiation operations and thus limit the amount of hydrogen being produced. The off-gas system is also designed to structurally survive a wide range of deflagration events (pressure pulses). Upon a deflagration, any releases of radioactive material are confined within the IU cell and are further mitigated by the confinement capability of the IU cell and by the facility ventilation systems. The consequences from this DBA are bounded by the release of the entire contents of one TSV and are therefore bounded by the MHA.

19.4.11.2.10 Unintended Exothermic Chemical Reactions Other than Detonation

A few potential exothermic chemical reactions were identified that, under very unlikely or incredible conditions, might challenge the PSB integrity. Exothermic reactions are more likely to result in fires.

Detonations, deflagrations, or fires due to exothermic reactions other than hydrogen-related in the IF are not considered to be possible given the design of the process. There is the possibility under uncontrolled conditions that during solvent extraction a runaway tributyl phosphate (TBP)/ nitric acid reaction could occur due to a number of unexpected events, such as the inadvertent heating of a tank. The design of the solvent extraction process, including the control of the fissile material concentration (protected through administrative controls), the minimization of dissolved solids, and the concentration of nitric acid is such that the maximum temperature achieved during this operation is significantly lower than that of the minimum initiation temperature for a runaway reaction (on the order of 130^{o}C [266 ^{o}F]).

The most likely and bounding scenarios resulting from potential exothermic reactions are fires which could impact the RPF. RPF fires, bounding all exothermic chemical reactions that may take place in the area, are covered under facility fire events (see Subsection 19.4.11.2.12).

19.4.11.2.11 Facility System Interaction Events

Facility system interaction events have been identified as DBAs that could result in radiological releases from various parts of the facility or multiple areas. The IF and the RPF include the following systems: target solution preparation, TSV, TSV dump tank, TSV off-gas system, molybdenum extraction, and UREX processing systems.

System interactions have the potential to cause damage that may lead to the release of these radioactive materials. NUREG/CR-3922 defines a system interaction as "…an event in one system, train, component or structure propagates through unanticipated or inconspicuous dependencies to cause an action or inaction in other systems, trains, components or structures."

There are three categories of system interactions between systems located within the IF and the RPF that are considered in this analysis. The three types of interactions include: 1) functional interactions, 2) spatial interactions, and 3) human-intervention interactions.

At the SHINE facility, there are a number of shared system interactions that need to be considered in the context of functional system interactions. The shared systems that are considered:

- Electrical power including the uninterruptable power supply system.
- Radioisotope process facility cooling system (RPCS).
- The fire protection system.
- RCA ventilation.
- NGRS.
- PVVS.

Scenarios that are considered for system interactions include:

- Loss of off-site power (LOOP) scenarios (see Subsection 19.4.11.2.5).
- Loss of RPCS scenarios (see Subsection 19.4.11.2.3).
- Loss of RVZ1, RVZ2, and RCA ventilation system Zone 3 (RVZ3) ventilation scenarios.
- Noble gas release scenarios (see Subsection 19.4.11.2.1).
- Fire scenarios (see Subsections 19.4.11.2.9, 19.4.11.2.10, and 19.4.11.2.12).
- External events including seismic events, high wind and tornadoes and aircraft impact events (see Subsection 19.4.11.2.6).
- Chemical reaction scenarios (see Subsection 19.4.11.2.10).
- Internal flooding scenarios.
- Pipe break scenarios (see Subsection 19.4.11.2.4).

For each of the scenarios listed above, except for loss of ventilation and internal flooding, the consequences are discussed in the referenced subsections. The MHA bounds all of these scenarios as discussed in each subsection. Loss of ventilation does not initiate an accident that could result in a release of radioactive material or hazardous chemicals nor are the ventilation systems used to mitigate the consequences of an accident. Upon release of radioactive materials within the facility, the ventilation system is shut down and bubble-tight dampers are closed to isolate the impacted areas of the facility. Internal flooding as a result of the rupture of water lines in the facility or the inadvertent actuation of a fire suppression system would not result in the release of radioactive material to the environment. All water is collected and sampled for radioactive contamination. If radioactive material contamination is found, the water is treated as radioactive waste.

19.4.11.2.12 Facility Fire (RPF)

A fire in the RPF is identified as a possible DBA. Events that could lead to a fire in the RPF may be precipitated by failure of electrical or mechanical equipment or human error involving a loss of control of combustible materials or ignition sources or both. Facility fires are not expected to directly release significant amounts of radioactive material; however fires can lead to the release of radioactive material where fire damage to process equipment results in a loss of confinement through damage to system integrity, spurious equipment operation, or loss of equipment control. Fire damage to equipment typically results from direct exposure of equipment to the fire or exposure of equipment to elevated temperatures caused by the fire. Widespread fire damage to process equipment that could lead to a radiological release is most likely inside a confined enclosure such as a hot cell, glove box, or tank enclosure. Small spaces such as these provide the confinement of the products of combustion, which can lead to development of a damaging fire environment. Development of damaging fire environment in the general area of the RPF is much less likely due to the large volume of the area. Direct fire damage to important equipment which could lead to a significant radiological release is not likely because redundant control or power circuits are separated by distance to prevent such damage from a single fire, accordingly the DBA is considered to be a fire in an enclosure that may lead to the development of a damaging fire environment.

The design basis fire accident is postulated to occur in an RPF supercell where it contributes to the release of the contents of the Mo extraction feed tank. Fire damage to the tank, associated valves, or process piping could lead to a release of Mo-99 eluate into the supercell enclosure. Release of this material into the enclosure could lead to an airborne release of radiological material into the cell enclosure and ultimately migration into the RCA ventilation system. The potential release would be mitigated by closure of the bubble-tight dampers in the RCA ventilation system in response to a smoke alarm signal or detection of the radioactive material by the radiation monitoring system. Isolation of the ventilation system would prevent significant release to the environment.

Radiological release of this DBA is bounded by the MHA and contained by the facility and RCA ventilation system. Postulated fire strengths are insufficient to breach the credited facility barrier walls or components. The effects of this DBA and any associated radiological release will be contained by the facility construction and RCA ventilation system components.

19.4.11.2.13 Hazardous Chemical Releases

The consequence of chemical releases are evaluated using dispersion models and/or computer codes that conform to NUREG/CR-6410 methodologies.

Typical computer codes to model chemical releases and determine the chemical dose (or concentration) are the ALOHA and EPICode; both computer codes are widely used for supporting accident analysis and emergency response evaluations. Both codes have been used and accepted by government agencies such as DOE. Verification and validation for both codes have been performed for modeling chemical hazards for the SHINE facility. Because ALOHA can readily model only about half of these chemicals, the EPICode was selected to perform chemical dose calculations in this subsection. Both computer codes give comparable results for the hazardous chemicals that they have in common and both codes implement release and dispersion models that are consistent with the guidance in NUREG/CR-6410.

In running IPICode, no credit is taken for depletion or plate out of chemicals within the facility or during transport to the site boundary or nearest population location. All dispersion calculations performed are done assuming stable meteorological conditions (i.e., Stability Class F) and 1 m/s wind speed. These meteorological conditions are typically seen about 15 percent of the time at the site. Ambient temperature was assumed to be 75 ^{o}F, the deposition velocity is 1 m/s, and a receptor height of 1.5 m was used to simulate the height of an individual. Concentrations are plume centerline values. Releases were conservatively modeled as ground non-buoyant.

Chemical dose or concentrations were determined for the 11 chemicals at the site boundary and the nearest residence (402 and 788m, respectively). Table 19.4.11-1 summarizes the results of the source term and concentration calculations for the 11 chemicals. The material-at-risk (MAR) represents the inventory of hazardous material that is at risk from the postulated scenario. The MAR for most of the chemicals represents the amount of material in storage. In some cases, the MAR represents the total facility inventory. The 11 chemicals were selected for evaluation based on the combination of anticipated bounding facility inventory amounts and high toxicity characteristics (lowest PAC values). The acceptance limits were those identified in NUREG/CR-6410 and correspond to Protective Action Criteria (PAC) values corresponding to Acute Exposure Guideline Levels (AEGLs), Emergency Response Planning Guideline (ERPG), or Temporary Emergency Exposure Limits (TEEL) values for such chemicals.

The results from the analysis indicate that the chemical dose or concentration for the MOI and the nearest residence is below the PAC-2 and PAC-3 levels (equivalent to ERPG-2 and ERPG-3). These concentrations are very conservatively calculated, and are based on the assumption that the entire inventory of liquid hazardous chemicals will evaporate within one hour. In most circumstances including nitric acid, evaporation takes longer than one hour, thus significantly reducing the potential concentrations downwind.

Table 19.4.11-1 SHINE Hazardous (Toxic) Chemical Source Terms and Concentrations

Hazardous Chemical/ Release Mechanism	MAR (lb)	ARF/RF	Source Term* (lb)	PAC-1	PAC-2	PAC-3	Site Boundary Concentration (402 m)	Nearest Residence Concentration (788 m)
Nitric Acid (Evaporating Liquid)	6,229	1.0	6,229	0.53 ppm	24 ppm	92 ppm	3.0 ppm	0.4 ppm
Sulfuric Acid (Evaporating Liquid)	7,770	1.0	7,770	0.20 mg/m^3	8.7mg/m^3	160 mg/m^3	4.7E-07 mg/m^3	6.3E-08 mg/m^3
Calcium Hydroxide (Dispersed Solid)	3,182	0.001	3.182	15 mg/m^3	240 mg/m^3	1,500 mg/m^3	0.16 mg/m^3	0.020 mg/m^3
Caustic Soda (Dispersed Solid)	1,488	0.001	1.488	0.5 mg/m^3	5 mg/m^3	50 mg/m^3	0.073 mg/m^3	0.010 mg/m^3
[Proprietary Information] (Dispersed Solid)	4,104	0.001	4.104	[Proprietary Information]	[Proprietary Information]	[Proprietary Information]	0.20 mg/m^3	0.026 mg/m^3
Ammonium Hydroxide (Dispersed Solid)	59	0.001	0.059	61 ppm	330 ppm	2300 ppm	2.0E-03 ppm	2.6E-04 ppm
[Proprietary Information] (Dispersed Solid)	606	0.001	0.606	[Proprietary Information]	[Proprietary Information]	[Proprietary Information]	0.03 mg/m^3	3.9E-03 mg/m^3
Dodecane (Evaporating Liquid)	1,033	1.0	1,033	0.0028 ppm	0.031 ppm	7.9 ppm	4.4E-03 ppm	5.9E-04 ppm
Postassium Permanganate (Dispersed Solid)	66	0.001	0.001	8.6 mg/m^3	14 mg/m^3	78 mg/m^3	3.3E-03 mg/m^3	4.2E-04 mg/m^3
Tributyl Phosphate (Dispersed Solid)	333	0.001	0.333	0.6 mg/m^3	3.5 mg/m^3	125 mg/m^3	1.5E-03 ppm	2.0E-04 ppm
Uranyl Nitrate (Dispersed Solid) (Likely in solution at SHINE)	480	0.001	0.480	0.99 mg/m^3	5.5 mg/m^3	33 mg/m^3	0.024 mg/m^3	3.1E-03 mg/m^3

19.4.12 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton signed Executive Order 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. Executive Order 12898 directs federal executive agencies to consider environmental justice under the National Environmental Policy Act of 1969 (NEPA). This Executive Order ensures that minority and/or low-income populations do not bear a disproportionate share of adverse health or environmental consequences of the building of the SHINE production facility.

19.4.12.1 Methodology

Guidance for addressing environmental justice (EJ) is provided by the Council on Environmental Quality's *Environmental Justice Guidance under the National Environmental Policy Act;* NRC *Policy Statement on the Treatment of Environmental Justice Matters in NRC Licensing Actions;* and NRC Office Instruction No. LIC 203, Revision 2, *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues*. The NRC defines a "minority" by race and ethnicity, as classified by the USCB (NRC, 2009). Specifically, a minority is an individual whose race is: Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race (not mentioned above); Two or More Races (i.e., multiracial); or whose ethnicity is Hispanic or Latino of any race. Determination of low-income populations is based on poverty thresholds as defined by the USCB.

The geographic area of analysis is the 5-mi. (8-km) area around the SHINE site. The method to identify the locations of minority and low-income populations of the geographic area of analysis is the "block group" method recommended by the NRC. The block group is the smallest geographical unit for which the USCB tabulates data required for EJ analysis (NRC, 2004). The 2010 census data, along with geographic information system (GIS) software, are used to determine the minority characteristics of resident populations by block group. If any part of a block group is located within 5 mi. (8 km) of the SHINE site, the entire block group is included in the analysis. A total of 48 block groups meet this criteria and are evaluated as part of this analysis (Table 19.4.12-1).

The following methodology is used to identify populations that may be the subject of EJ considerations.

19.4.12.1.1 Minority Populations

NRC guidance requires analysis of individual race and ethnicity classifications as well as the aggregate of all minority populations (NRC, 2009). Based on NRC guidance, a minority population exists if either of the following two conditions exist:

- The minority population of the block group of the impacted area (block group) exceeds 50 percent of the total population of the block group.
- The minority population percentage of the block group significantly (20 percentage points) exceeds the geographic area chosen for comparative analysis (NRC, 2004).

For the 48 block groups within the geographic area of analysis (5-mi. [8-km] radius), the percentage of each block group's minority population in all of the minority classifications is calculated. If any block group has a minority percentage that exceeds 50 percent, then the block group is identified as containing a minority population. If any block group has a minority percentage exceeding the corresponding minority percentage for Rock County and the State of Wisconsin by more than 20 percentage points, then a minority population is determined to exist in that block group.

19.4.12.1.2 Low-Income Populations

NRC guidance defines low-income households as those with incomes that are less than the poverty level (NRC, 2004). A block group is considered low-income if either of the following two conditions is met:

- The low-income population of the block group of the impacted area (block group) exceeds 50 percent of the total number of households in the block group
- The low-income population percentage of the block group significantly (20 percentage points) exceeds the geographic area chosen for comparative analysis

The number of low-income households in each census block group is divided by the total households for that block group to obtain the percentage of low-income households per block group. If any block group has a low-income percentage exceeding 50 percent, then the block group is identified as containing a low-income population. If any block group has a minority percentage exceeding the corresponding percentage for Rock County and the State of Wisconsin by more than 20 percentage points, then a low-income population is determined to exist.

19.4.12.2 Assessment of Disproportionate Impacts

19.4.12.2.1 Minority Populations

Table 19.4.12-1 presents the results of the analysis for minority populations. The table displays the percentage of minority populations in each block group and the totals for the complete 5-mi. (8-km) radius. The percentages of each minority category within the county and state are also presented as the basis for determining which block groups meet the criteria.

None of the 48 census block groups within the 5-mi. (8-km) radius meet the NRC quantitative method for identifying a minority population. Generally, Hispanic or Latino, Black or African American, and Two or More Races (i.e. multiracial) classifications represent the predominant minority populations in the block groups within 5 mi. (8-km) of the SHINE site; however, no block group contains a minority population (individual or aggregate) that either exceeds 50 percent or significantly exceeds the comparative geographic areas. Overall, the percentage of minority groups in the 5-mi. (8-km) area of analysis is less than comparative figures for Rock County and Wisconsin. The aggregate minority population in the 5-mi. (8-km) study area is 11.1 percent, compared to 15.5 percent in the county and 16.7 in the state. The aggregate minority population includes all minority populations, as defined by NRC (NRC, 2009) (see Subsection 19.4.12.1).

Only a small percentage of the study area population is American Indian and Alaska native (0.3 percent) in the study area, and there is no American Indian reservation within 5 mi. (8 km) of the SHINE site (Bureau of Indian Affairs, 2012).

There is one property in the immediate vicinity of the SHINE site that appears to be a location for regular congregation of minorities. A relatively small Hispanic church congregation uses a building located on US 51 to the south of the SHINE site. The church, called *Iglesia Hispania Pentecostale*, is not located within a minority block group.

Within the 5-mi. (8-km) radius of the SHINE facility, there is an absence of populations indentified as minority that qualify as EJ populations. Therefore, the potential for a disproportionately high impact to these populations is SMALL.

19.4.12.2.2 Low-Income Populations

Table 19.4.12-1 presents the results of the analysis for low-income populations. The table displays the percentage of low-income households in each block group, the total for the 5-mi. (8-km) radius, and the percentage of low-income households within the county and state. The table also highlights the block groups that meet the NRC criteria for low-income populations. Figure 19.4.12-1 identifies these populations as occurring in the central area of Janesville.

As a whole, the percentage of low-income households in the 5-mi. (8-km) radius (12.7 percent) is slightly higher than that for the county (11.4 percent) and the state (11.2 percent). Eighteen of the 48 block groups in the 5-mi. (8-km) area have low-income populations that exceed county and state rates; however, only three of the 18 meet the NRC criteria for low-income population. The table illustrates that two of the three block groups have a higher percentage of low-income population than comparable percentages for the county and state. The three block groups are contiguous to one another and are located considerably north of the SHINE site in downtown Janesville (see Figure 19.4.12-1).

In addition to the identification of EJ populations based on census block analysis, SHINE also considered the potential for isolated low-income/minority groups near the SHINE site. A manufactured housing complex called Janesville Terrace Mobile Home Park is located to the north of the SHINE site on US south of SH 11. It is visible from the proposed construction area. There are approximately 25 manufactured housing units in the complex. It is not known whether one or more of the households are classified as low-income, though it is known that Janesville Terrace Mobile Home Park is not located within a low-income Census block group.

Potential impacts of plant construction, operations and decommissioning on low-income populations may include small increases in local traffic and associated noise due to construction and operational workforce traffic. Given the distance between low-income population block groups and the SHINE site, and that transportation routes likely to be utilized for construction and operation workforces do not adversely impact these block groups, impacts to low-income population block groups are SMALL and not disproportionate.

As is described in Subsection 19.4.7, construction and operation of the SHINE facility may also result in a small demand for housing. The potential that low-income populations may be disadvantaged in their ability to find or keep housing in competition with a non-resident workforce was considered. Factors affecting the degree of disadvantage include the amount of vacant housing available and the size of the work force relocating into the area. A potential impact mechanism to EJ populations may arise from competition from non-resident workers for a limited supply of housing.

Based on the analysis discussed in Subsection 19.4.7.1, a maximum of 420 workers is needed for the facility's construction, and 150 workers are needed permanently for its operation (see Table 19.3.7-2). As discussed in Subsection 19.4.7.1 it is estimated that approximately 60 percent of the required construction and operational workforce is drawn from the labor force that currently resides in the Region of Influence, therefore only a portion of the required construction workers and operations workers will relocate to Rock County. According to 2010 Census, there are 5986 vacant housing units in Rock County (see Table 19.3.7-12). This quantity of vacant housing far exceeds the quantity required to meet estimated non-resident worker demand without creating a competitive shortage of housing. Therefore, with regards to housing the potential impacts to low-income populations are SMALL.

19.4.12.2.3 Migrant Populations

The State of Wisconsin's Bureau of Migrant Labor Services releases an annual Migrant Population Report that documents the number of workers eligible for protection under Wisconsin Statute 103.90-103.97. The state statute provides protections for migrant workers who temporarily leave their principal, out-of-state residence and live in Wisconsin for not more than 10 months in a year to work in agriculture, horticulture or food processing. The 2011 Migrant Population Report reflects the number of workers whose presence was verified by Migrant Law Enforcement staff, though it is not intended to provide comprehensive statistics about migrant seasonal farm workers in Wisconsin. The report does not indicate any migrant workers in Rock County (State of Wisconsin Bureau of Migrant Labor Services, 2011); therefore the potential impacts to migrant populations are SMALL.

19.4.12.3 Assessment of Human Health and Environmental Impacts

19.4.12.3.1 Minority Populations

Table 19.4.12-1 shows that there are no block groups that meet the NRC criteria for a minority population. As described in Subsection 19.4.12.2, there is a Hispanic church located near to the south of the SHINE site. Plant construction may result in construction related noise; exposure to fugitive dust, exhaust emissions, and vibrations; and generation of construction-related wastes. However, it is not anticipated that construction activity will be heavy on Sundays when the most Hispanic minority persons would be expected to visit the church. Additionally, because dust control measures are used and because noise attenuates to acceptable levels near the site boundary (see Subsection 19.4.2), the potential impacts to minority populations are SMALL.

19.4.12.3.2 Low-Income Populations

As described in Subsection 19.4.12.2.2, the Janesville Terrace Mobile Home Park is located to the north of the SHINE site and may include low-income households. Plant construction may result in construction related noise, exposure to fugitive dust, exhaust emissions, vibrations, and generation of construction-related wastes. These are potential impacts that would impact the general population, but have no disproportionate impact on low-income populations. Mitigation measures include implementing best management practices for controlling fugitive dust and proper maintenance of construction equipment for controlling emissions; recycling of construction waste, to the extent possible; and, minimizing land disturbance, removing construction debris in a timely manner, and adding landscape enhancements. Additionally, noise levels attenuate to acceptable levels near the site boundary (see Subsection 19.4.2). Therefore, human health and environmental impacts on low-income populations are SMALL.

19.4.12.4 Mitigation Measures

Mitigation measures to reduce or minimize adverse impacts on EJ populations are not required; any measures as described in Subsections 19.4.12.2 and 19.4.12.3 are used to minimize potentially adverse impacts of construction affecting the general population, which are expected to be SMALL.

Table 19.4.12-1 Minority and Low-Income Population Statistics for Block Groups within a 5-Mi. Radius of the SHINE Site (Sheet 1 of 2)

			Minority Population (%)[a]							
Block Group	Census Tract	Low-Income Population (%)	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino	Aggregate
1	1	29.0	5.1	0.1	0.3	0.0	0.0	2.1	8.8	16.5
1	2	4.8	0.6	0.3	0.5	0.0	0.0	1.5	2.1	5.0
2	2	3.1	0.9	0.6	1.5	0.0	0.0	0.9	1.5	5.5
3	2	35.0	2.6	0.4	1.1	0.0	0.1	2.2	6.1	12.5
1	3	56.6	7.5	0.3	1.6	0.0	0.0	2.7	11.6	23.8
2	3	48.1	7.6	0.6	5.0	0.0	0.2	3.3	13.6	30.4
3	3	16.1	4.2	0.4	7.2	0.0	0.7	2.0	5.9	20.3
1	4	27.8	5.1	0.1	3.3	0.0	0.0	3.6	9.5	21.7
2	4	17.8	2.3	0.0	2.0	0.0	0.1	4.3	7.0	15.7
3	4	18.2	0.8	0.3	0.3	0.0	0.0	0.7	2.9	5.0
4	4	31.0	1.8	0.4	2.9	0.0	0.5	1.9	14.4	21.9
1	5	4.5	1.0	0.4	1.0	0.4	0.0	0.6	3.1	6.4
2	5	10.1	0.9	0.7	0.3	0.0	0.0	3.6	2.7	8.1
3	5	0.0	2.3	0.0	2.2	0.2	0.0	2.8	7.0	14.5
4	5	21.0	1.3	0.9	1.0	0.1	0.0	2.0	3.8	9.2
5	5	8.0	1.3	0.4	0.7	0.0	0.1	0.9	10.1	13.5
1	6	7.0	2.4	0.2	0.3	0.4	0.2	2.0	3.6	9.2
2	6	19.8	2.8	0.3	0.4	0.0	0.0	3.9	6.0	13.4
2	8	5.9	0.2	0.2	0.4	0.0	0.0	0.3	3.6	4.8
3	8	3.7	1.6	0.2	0.5	0.0	0.3	0.9	5.2	8.7
4	8	3.1	3.7	0.5	0.3	0.1	0.0	2.5	7.3	14.4
1	9	1.4	0.8	0.0	0.4	0.0	0.0	0.8	4.3	6.3
2	9	9.0	1.3	0.2	0.5	0.1	0.0	0.5	2.5	5.2
1	10	7.4	2.7	0.7	1.0	0.0	0.1	1.7	6.5	12.7
2	10	16.9	1.6	0.3	0.6	0.0	0.2	1.1	11.2	15.1
1	11	7.0	1.7	0.1	1.1	0.0	0.1	1.2	3.0	7.3
2	11	9.9	1.3	0.1	1.5	0.1	0.0	2.2	3.9	9.1
3	11	22.6	6.9	0.1	0.8	0.0	0.0	2.7	9.5	19.9
4	11	7.3	0.9	0.3	0.6	0.0	0.0	1.8	2.9	6.5
5	11	26.3	2.8	0.2	1.2	0.0	0.0	1.1	11.5	16.7
1	12.01	10.8	3.3	0.2	0.8	0.0	0.0	2.1	3.4	9.9
2	12.01	2.7	1.1	0.1	0.3	0.0	0.0	0.7	2.6	4.8
3	12.01	4.3	0.4	0.4	0.8	0.0	0.0	1.5	1.8	4.9

Table 19.4.12-1 Minority and Low-Income Population Statistics for Block Groups within a 5-Mi. Radius of the SHINE Site (Sheet 2 of 2)

Block Group	Census Tract	Low-Income Population (%)	Minority Population (%)[a]							
			Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino	Aggregate
1	13.02	0.0	2.3	0.1	1.0	0.1	0.1	0.7	2.1	6.4
2	13.02	9.5	1.5	0.1	0.7	0.0	0.0	0.6	2.8	5.6
3	13.02	6.3	3.4	0.0	0.9	0.0	0.0	0.7	2.7	7.7
4	13.02	8.6	0.5	0.0	0.0	0.0	0.3	1.0	1.1	3.0
5	13.02	3.7	1.2	0.1	0.5	0.0	0.0	1.0	2.0	4.7
1	14	4.1	1.0	0.5	1.2	0.0	0.2	0.9	1.0	4.9
2	14	19.0	3.8	0.2	0.1	0.0	0.2	0.9	10.6	15.8
3	14	13.2	3.1	0.3	1.6	0.2	0.0	1.4	10.9	17.6
4	14	5.5	1.5	0.2	0.6	0.0	0.0	1.0	4.1	7.4
2	22	0.0	1.1	0.6	0.4	0.0	0.3	2.0	2.0	6.5
1	24	9.0	3.7	0.1	1.8	0.0	0.0	1.3	3.2	10.0
2	24	11.8	3.3	0.2	0.9	0.0	0.0	0.8	5.1	10.1
3	24	20.7	2.6	0.4	0.3	0.1	0.0	2.2	3.3	9.0
1	26.01	21.8	14.1	0.1	1.2	0.0	0.2	1.9	11.0	28.3
1	26.02	14.7	3.9	0.1	1.7	0.0	0.1	0.8	4.5	11.2
Total, 5-Mi. Radius		12.7	2.7	0.3	1.1	0.0	0.1	1.6	5.4	11.1
Comparative Populations										
Rock County		11.4	4.8	0.2	1.0	0.0	0.1	1.7	7.6	15.5
State of Wisconsin		11.2	6.2	0.9	2.3	0.0	0.1	1.4	5.9	16.7

a) Shaded block groups meet the NRC qualitative method for identifying low-income populations.

References: USCB, 2010c; USCB, 2006-2010.

19.4.13 CUMULATIVE EFFECTS

This subsection discusses the cumulative impacts to the region's environment that could result from construction and operation of the SHINE facility. A cumulative impact is defined in Council on Environmental Quality (CEQ) regulations (40 CFR 1508.7) as an "impact on the environment which results from the incremental impact of 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."

To guide its assessment of the environmental impacts of a proposed action, the NRC has established a standard of significance for impacts based on guidance developed by the CEQ (40 CFR 1508.27).

To address cumulative impacts, the existing environment in the region surrounding the SHINE site was considered in conjunction with the environmental impacts as presented in Section 19.4 for constructing and operating a new facility at the SHINE site. These combined impacts are defined by the CEQ as "cumulative" in 40 CFR 1508.7 and may include individually minor but collectively significant actions taking place over a period of time.

Cumulative effects analysis encompasses a consideration of past, present, and reasonably foreseeable future (Federal, non-Federal, and private) actions that could have meaningful cumulative impacts together with the proposed action. Past construction and operational impacts of existing industrial uses and developments are part of the existing baseline conditions in the region and are therefore, intrinsically integrated as part of the cumulative effects analysis. The cumulative effects analysis therefore, focuses on the additive impacts from the existing baseline conditions, the effects of a new facility, and other identified present and reasonably foreseeable future actions.

Table 19.4.13-1 provides a listing of all projects identified as potentially contributing to cumulative impacts. To identify other actions SHINE considered:

- Information about current or planned local economic development programs or projects (e.g., commercial, industrial, and/or residential); and
- Information about current or planned infrastructure improvements (e.g., transportation, electric and water utility).

As described in NRC Memo ML100621017, actions that are not reasonably foreseeable are those that are based on mere speculation or conjecture, or those that have only been discussed on a conceptual basis. These can include projects that have not yet been approved by the proper authorities or have not yet submitted license/permit applications. Present and future projects that were considered for cumulative effects analysis but did not meet the criteria established for reasonable foreseeability were not retained. Projects and other actions retained for the cumulative effects analysis are identified in Table 19.4.13-2 and Figure 19.4.13-1.

Cumulative impacts of the new facility and other identified present and reasonably foreseeable future actions are assessed for the following resources: land use and visual resources; air quality and noise; geologic environment; water resources (hydrology, water use, water quality); ecological resources (terrestrial and aquatic communities); historic and cultural resources; the socioeconomic environment; human health; and environmental justice. According to the CEQ's Considering Cumulative Effects Under the National Environmental Policy Act (CEQ, 1997), the establishment of an appropriate geographic area of analysis is an important step in performing the cumulative effects analysis. The geographic areas for analysis were selected based on the environmental effects that may occur to each of the affected resources under consideration and are the same as those used for each resource category in Section 19.4. The sensitivity of cumulative effects is resource-based, and an appropriate context of analysis was selected for each of the resources described below.

19.4.13.1 Land Use and Visual Resources

The description of the affected environment in Subsection 19.3.1 serves as a baseline for the land use and visual resources cumulative impact assessment. The geographic area of analysis for evaluation of cumulative effects on land use and visual resources is the same as that used in Subsection 19.4.1 and includes the 91.27 ac. (36.94 ha) within the site boundary and the 5 mi. (8 km) region surrounding the site. As discussed in Subsection 19.4.1.1, construction and operation impacts from the SHINE facility on land use are SMALL. Impacts from construction and operation to visual resources are SMALL, as discussed in Subsection 19.4.1.2.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on land use and visual resources. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the utility line extensions, proposed facility, TIF District No. 35 Project Plan, an agricultural storage facility immediately south of the SHINE site, the Southern Wisconsin Regional Airport, and an Alliant Energy power generation facility. The storage facility is a recent past disturbance; however it has on-going affects to land use and visual resources. The utility line extensions, proposed facility, and TIF No. 35 Project Plan are all future actions. The airport, Glen Erin Golf Course and power generation facilities are existing facilities (“present actions”) and on-going actions.

19.4.13.1.1 Land Use Resources

The City of Janesville plans to install a water main and sanitary sewer main along the northern boundary of the SHINE site as part of the overall TIF District No. 35 development activities. Based on the SHINE facility site layout, the expected route of the water main and sewer main connects directly to the facility (Figure 19.2.1-1). Installation of the City’s water and sewer mains disturbs a 50-ft. (15-m) wide corridor (one corridor for both water and sewer) with the pipelines centered in the middle of the corridor. Similarly, installation of the water and sewer connections from the City’s mains to the SHINE facility disturbs a 50-ft. (15-m) wide corridor (one corridor for both water and sewer) with the pipelines centered in the middle of the corridor. The corridors temporarily disturb 0.62 ac. (0.25 ha) immediately adjacent to the northern boundary of the site. Lands disturbed by this corridor include undeveloped cultivated crop lands and prime farmland, which comprise the majority of the land cover within the site and region.

In 2004, the City of Janesville purchased 224 ac. (91 ha) of land located south of SH 11 and west of County Truck Highway G with the intention of creating a TIF district. The parcel is vacant industrial land in agricultural use in an industrially-zoned area on the City's southeast side. The parcel is unimproved and has been used for agricultural crop production for decades. The land has since been zoned for light industrial use and is “shovel ready” certified. Land cover in this parcel consists entirely of cultivated crops and includes prime farmland. The region surrounding the SHINE site includes over 25,000 ac. (10,000 ha) of cultivated crop land and approximately 42,000 ac. (17,000 ha) of prime farmland or farmland of statewide importance (see Subsection 19.3.1.1). Consequently, the utilization of the 224 ac. (91 ha) included in the TIF District No. 35 Project Plan would have a minimal change in the availability of these resources in the region.

Immediately adjacent to the southern border of the SHINE site are two large warehouses that support local agriculture operations and provide storage for large farming equipment. The warehouse facility has resulted in the conversion of prime farmland and the land surrounding the site. This development represents a recent ground disturbance that has impacted the overall land use and potential crop production for the region.

As described in Subsection 19.3.1.1.4, the potential relative value of the farmland for the 91.27 ac. (36.94 ha) comprising the SHINE site is 13,771 Bu. of grain corn or 3947 Bu. of soybeans, while the 10-year production estimate average for Rock County, Wisconsin, is 22,075,540 Bu. of grain corn and 3,786,415 Bu. of soybeans. The minor loss of on-site agricultural lands, including prime farmland and farmland of state wide importance, and the subsequent loss of potential crop production to industrial facilities is a minor impact when compared to the amount of agricultural land, land designated as prime farmland or farmland of state wide importance, and potential crop production remaining within the region (see Table 19.4.1-1 and Subsection 19.3.1.1.4). Therefore, cumulative impacts to land use resources, including agricultural resources, are SMALL.

19.4.13.1.2 Visual Resources

The immediate location of the SHINE site and TIF District No. 35 is composed entirely of land used for agricultural purposes and has no existing architectural features, established structures, or natural-built barriers, screens, or buffers. Consequently, the SHINE facility and any light industrial structure built at the TIF District No. 35 location alters the on-site condition and partially obstructs views of the existing landscape. However, the visual setting of the site is generally flat and uniform in landform with low vegetation diversity and a low visual quality rating (see Subsection 19.3.1.3).

The viewshed to the west of the site across US 51 is a light industrial development landscape that consists of the Southern Wisconsin Regional Airport and its associated facilities, which includes the airport control tower and several large warehouses and hangers. The viewshed to the south of the site includes the two large warehouses immediately adjacent to the southern border of the site that support local agricultural operations and provide storage for large farming equipment. Additionally, the viewshed to the south includes several stacks associated with an Alliant Energy coal-fired power generation facility. While a portion of the plant is non-operational, the stacks are still visible as part of the viewshed. Together with the buildings and structures to the south and west, the facilities located at the SHINE and TIF District No. 35 sites do not significantly alter the visual setting. Therefore, cumulative impacts to visual resources are SMALL.

19.4.13.2 Air Quality and Noise

19.4.13.2.1 Air Quality

The description of the affected environment in Subsection 19.3.2 serves as a baseline for the air quality cumulative impact assessment. Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on air quality. Relevant "other actions" that are considered in this cumulative effects analysis include the TIF District No. 35 Project Plan (Rock County), the Alliant Energy – WP&L Turtle Generating Facility, NorthStar Medical Isotopes facility (Rock County), United Ethanol (Rock County), Generac Power Systems (Jefferson County), Kraft Foods Global (Dane County), and University of Wisconsin Madison (Dane County). With the exception of the TIF District No. 35 Project Plan and NorthStar Medical facility, which are future actions, all of the projects are present and on-going actions.

The geographic area of analysis for evaluation of cumulative effects on air quality is the same as that used in Subsection 19.4.2 and includes Rock County and the four surrounding counties in Wisconsin: Green, Dane, Jefferson, and Walworth. As described in Subsection 19.4.2.1.1, air emission impacts from construction are SMALL as emissions are controlled at the source where practicable; maintained within established regulatory limits designed to minimize impacts; and located a significant distance from the public. Operations of the facility have a SMALL impact on air quality, as discussed in Subsection 19.4.2.1.2.

Criteria Pollutants

Air emission impacts as a result of concurrent construction activities are expected at both the SHINE and NorthStar Medical facilities. In addition, construction at the TIF District No. 35 site could overlap with construction activities at either of these facilities. Construction activity at NorthStar is expected to begin in 2013, with completion slated for mid-2014 (NorthStar Medical Radioisotopes, 2012). Depending on the actual completion date for NorthStar, this construction schedule may overlap with the proposed construction schedule for SHINE, which is scheduled to begin in 2015. Implementation of mitigation measures described in Subsection 19.4.2.1.1 minimizes impacts to local ambient air quality and the nuisance impacts to the public in proximity to the project. Impacts to air quality from construction activities are expected to be minor, localized, and short-term; therefore, overlapping construction schedules are not expected to contribute significantly to cumulative effects.

The proposed NorthStar facility will produce small air emissions from operation of the building's heating system and from the use of chemicals to dissolve Mo-99 targets (DOE, 2012). Gaseous effluents at the SHINE facility are a result of isotope production and fuel combustion, as discussed in Subsection 19.4.2.1.2. The SHINE facility does not result in exceedances of federal or state criteria air quality criteria. Operations emissions from both facilities are subject to permitting by the WDNR and controlled at the source using appropriate emissions control systems. In addition, the electricity demand of the SHINE and NorthStar facilities may result in an increase in regional electricity demand. However, this increase is not expected to exceed supply or the ability to deliver it and would not substantially increase air emissions for the region.

Existing permitted emissions facilities are considered part of the baseline air quality. Given its proximity to the SHINE site, it is notable that the Alliant Energy – WP&L Turtle Generating Facility recently received an Air Pollution Control Operation Permit (WDNR, 2011b). New construction-related emissions permits identified through the WDNR permit application website are all small-scaled and are not expected to have a significant impact on air quality in the region. United Ethanol, an ethanol production facility in Rock County, has one active Construction Permit that was issued in May, 2012 for upgrades to the existing facility. In Jefferson County, Generac Power Systems has an active operating permit renewed to 2015 and is planning modifications to one of their venting stacks, which was issued a Construction Permit exemption in April, 2012. In

Dane County, Kraft Foods Global was issued a Construction Permit in June, 2012 to construct and operate three natural gas or distillate fuel fired boilers. The University of Wisconsin (West Campus) cogeneration facility is planning to add a four-cell cooling tower associated with the chiller plant expansion (exempted from obtaining a Construction Permit in August, 2012). The University of Wisconsin (Charter Street) was issued a Construction Permit in February, 2012 to construct boilers and emergency equipment. The University of Wisconsin is also planning to replace a coal-fired boiler with a natural gas boiler, which will reduce overall emissions (University of Wisconsin, 2009). It is expected that each of these projects will operate in such a manner as to not violate the established permit levels or federal and state criteria. Additionally, permitting reviews performed by the WDNR are conducted to ensure that new permits do not result in regional air quality degradation. Therefore, the cumulative impacts of criteria pollutants to air quality are SMALL.

Greenhouse Gas Emissions

The cumulative impacts of a single or combination of GHG emission sources must be placed in geographic context, considering the following factors:

- The environmental impact should be assessed on a global rather than local or regional basis.
- The effect is not sensitive to the location of the emission release point.
- The magnitudes of individual GHG sources related to human activity, no matter how large compared to other sources, are small when compared to the total mass of GHGs in the atmosphere.
- The total number and variety of GHG sources is extremely large and the sources are ubiquitous.

GHG emissions associated with building, operating, and decommissioning the new facility are discussed in Subsection 19.4.2.1.2.3. As noted in Subsection 19.4.3.2.5, SHINE will develop a comprehensive program to avoid and control GHG emissions associated with the facility.

Evaluation of cumulative impacts of GHG emissions requires the use of a global climate model. A synthesis of the results of numerous climate modeling studies are presented in the report from Karl, et al. (Karl, et al., 2009). The cumulative impacts of global GHG emissions as presented in the report are the appropriate basis for evaluation of cumulative impacts with regards to the SHINE facility. The report concludes that climate changes are underway in the United States as part of the global climate and that these changes are projected to grow. While noticeable, none of the changes will result in a destabilization of the global climate. In 2010 the EPA issued the CO_2 Tailoring Rule (75 Federal Register [FR] 31514), which stated that GHG emissions will be factors in PSD and Title V permitting and reporting. This revised permitting criterion indicates the need to regulate CO_2 and other GHGs from major emission sources. GHG emissions from individual stationary sources and, cumulatively, from multiple sources can contribute to national and global climate change. Given the relatively low emissions from the SHINE facility in comparison to total global emissions, cumulative impacts of the proposed facility are SMALL. Furthermore, the cumulative impacts of GHG emissions would still be the same at the national and global scale without the GHG emissions of the proposed SHINE facility.

19.4.13.2.2 Noise

The description of the affected environment in Subsection 19.3.2 serves as a baseline for the noise cumulative impact assessment. The geographic area of analysis for evaluation of cumulative effects from noise emissions includes the 91.27 ac. (36.94 ha) within the site boundary and the 1 mi. (1.6 km) area surrounding the site. This area was selected as it encompasses the nearest noise receptors to the SHINE site identified in Subsection 19.4.3.6.1 and is a distance over which noise generated at the SHINE site would attenuate to negligible levels. Noise impacts resulting from construction and operation of the SHINE facility are discussed in Subsections 19.4.2.2.1 and 19.4.2.2.2 and are SMALL.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on noise. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the proposed facility, TIF District No. 35 Project Plan, and the Southern Wisconsin Regional Airport. The proposed facility and TIF District No. 35 Project Plan are future actions and the airport is a current and on-going action.

During the construction periods for the SHINE (including the off-site utility extension) and TIF District No. 35 facilities, additional impacts to noise are expected in the immediate area around each site. Noise levels from construction equipment are expected to attenuate rapidly with distance, and therefore, do not significantly impact nearby sensitive noise receptors. Noise levels are also impacted by increases in traffic volume during both construction and operation; however they are not expected to be significantly higher than current traffic levels. External noise emission from the SHINE facility during operation is primarily limited by the walls and other physical barriers of the facility itself.

Noise generated at the Southern Wisconsin Regional Airport contributes to the existing baseline noise levels of the region. The airport currently operates approximately 140 flights per day. Additional flight operations may increase due to the demand to transport materials to and from the SHINE and NorthStar facilities; however these increases are not anticipated to cause an appreciable increase in noise above the current operations. Therefore, cumulative impacts to noise in the region are SMALL.

19.4.13.3 Geologic Environment

The description of the affected environment in Subsection 19.3.3 serves as a baseline for the geologic environment cumulative impact assessment. The geographic area of analysis for evaluation of cumulative effects on geologic resources is the same as that used in Subsection 19.4.3 and includes the 91.27 ac. (36.94 ha) within the site boundary and the 5 mi. (8 km) region surrounding the site. As discussed in Subsection 19.4.3, construction and operation impacts from the SHINE site on the geologic environment are SMALL.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on the geologic environment. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the utility line extensions, the proposed facility, and the TIF District No. 35 Project Plan, all of which are future actions. No present or on-going actions were identified that are relevant to this analysis.

Impacts to the geologic environment from other actions are minor. The proximity of the utility line extensions and TIF District No. 35 project to the SHINE site results in impacts to the same geologic resources as those affected by the SHINE facility. However, there are no sensitive geologic resources in the region surrounding the SHINE site. Impacts from these identified projects are expected to be localized and minor. Therefore, cumulative impacts are SMALL.

19.4.13.4 Water Resources

The description of the affected environment in Subsection 19.3.4 serves as a baseline for the water resources cumulative impact assessment. The geographic area of analysis for evaluation of cumulative effects on water resources is the same as that used in Subsection 19.4.4 and includes the 91.27 ac. (36.94 ha) within the site boundary and the 5 mi. (8 km) region surrounding the site. As discussed in Subsection 19.4.4.1, construction impacts to water resources are SMALL. Impacts from operation of the facility are discussed in Subsection 19.4.4.2 and are SMALL.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on water resources. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the utility line extensions planned in support of the SHINE facility, proposed facility, TIF District No. 35 Project Plan, Southern Wisconsin Regional Airport, and Glen Erin Golf Course. The utility lines, proposed facility, and TIF development are all future actions. Present and on-going actions include the airport and golf course.

19.4.13.4.1 Hydrology

There are no surface water resources located on either the SHINE or TIF District No. 35 sites; therefore there are no direct impacts as a result of alteration of streams or water bodies. The nearest water bodies are the nearby unnamed tributary to Rock River, located 1.6 mi (2.6 km) south of the SHINE site, and the Rock River, located 1.9 mi. (3.1 km) southwest of the SHINE site. Construction of the SHINE facility and at the TIF District No. 35 location represents potential sources of pollution associated with runoff from construction sites. It is anticipated that at both sites BMP are used in accordance with the SWPPP, as required by the WDNR, to prevent sediment runoff and subsequent siltation in receiving streams during construction.

During operations, potential impacts associated with hydrology are related to stormwater management as agricultural lands at the site are converted to urban development. Currently, sheet flow runoff at the SHINE site location follows natural drainage patterns and discharges to a ditch along US 51. The planned SHINE facility collects runoff from the developed parts to be directed through a vegetated on-site detention swale before being discharged through an outfall control structure to the ditch along US 51 (Subsection 19.4.5). Future facilities at the TIF District No. 35 may include a storm sewer collection system that includes underground piping, surface detention area, and safety fencing (City of Janesville, 2012b). Additionally, when combined with the distance to the nearest off-site water bodies, runoff and siltation to the receiving streams is minimized. Cumulative hydrologic impacts are therefore, SMALL.

19.4.13.4.2 Water Use

All public water supplies in Rock County, including the City of Janesville are derived from groundwater. No public water supplies are provided by surface water within the region. In addition to the SHINE facility, the only other future demand on the groundwater supply in Janesville is the potential TIF District No. 35 development. Approval of the TIF District No. 35 Project Plan indicates that the City of Janesville has the capacity to serve the future development with both public water supply and wastewater treatment. According to the City of Janesville, the water main and sewer main infrastructure will have more than enough capacity to support the SHINE facility; therefore no upgrades to the City water supply system and sanitary sewer system are anticipated (Subsection 19.4.7). Therefore, cumulative impacts from water use are SMALL.

19.4.13.4.3 Water Quality

Existing stormwater pollutant sources within the region around the SHINE site include urban developments, which are associated with pollutants such as phosphorous and chloride. Phosphorous has been identified as a general pollutant of concern across Wisconsin due to the impacts associated with nutrient build up in lakes. Phosphorous is also a potential pollutant associated with fertilizer application on agricultural lands. Fertilizers, herbicides and pesticides also are generally applied on golf courses. Chloride is another typical pollutant associated with development, particularly resulting from winter applications of salt on roadways and sidewalks for de-icing. Chloride is not readily adsorbed on soil particles or taken up by vegetation.

The TIF District No. 35 Project Plan is the only other potential future project within the region of the SHINE site that has the potential to contribute to cumulative impacts on water quality as it is in the same subwatershed as the SHINE site. Other notable developed uses within the same subwatershed that may be the source of pollutant loading include the Southern Wisconsin Regional Airport and the Glen Erin Golf Club. However, runoff from the SHINE site is detained in grassed detention areas and because of the high infiltration rates of the soil, is not conveyed to downstream areas within any organized stream channel. Similarly, no organized stream channel is evident near the SHINE site on either the airport or the golf course. Designs for development of the TIF District No. 35 site are expected to incorporate similar detention basins and best management practices as required by Wisconsin DNR and local regulations. Therefore, in consideration of the SHINE site design, future designs for detention associated with the TIF development site, high infiltration rates, and the absence of an organized stream channel near the SHINE site, cumulative impacts on surface water resources are SMALL.

The SHINE facility is 91.27 ac. (36.94 ha) in size, and 53.75 ac. (21.75 ha) are expected to remain in use for the production of agricultural row crops or be returned to pre-settlement conditions. The removal of 38.52 ac. (15.58 ha) from row crop production results in a proportional reduction in the amount of agricultural chemicals (fertilizers, etc.) applied on the site, and less potential impact to groundwater quality from pollutant loading. If the remaining 53.75 ac (21.75 ha) were returned to pre-settlement conditions it would result in an even greater reduction in the use of agriculture chemicals. Similarly, the TIF development reduces the area of active agricultural lands and reduces the amount of agricultural chemical application. Consequently, less pollutant loading to groundwater would occur from agricultural practices. No other cumulative impacts to groundwater quality are expected. Therefore, cumulative impacts to groundwater resources are SMALL.

19.4.13.5 Ecological Resources

The description of the affected environment in Subsection 19.3.5 serves as a baseline for the ecological resources cumulative impact assessment. The geographic area of analysis for evaluation of cumulative effects on ecological resources is the same as that used in

Subsection 19.4.5 and includes the 91.27 ac. (36.94 ha) within the site boundary and the 5 mi. (8 km) region surrounding the site. As discussed in Subsection 19.4.5.1, impacts from construction on terrestrial and aquatic ecosystems, including protected species, are SMALL. Subsection 19.4.5.2 demonstrates that the potential impacts from operation of the SHINE facility on terrestrial and aquatic ecosystems, including protected species, are SMALL.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on ecological resources. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the utility line extensions, the proposed facility, and the TIF District No. 35 Project Plan, all of which are future actions. No present or on-going actions were identified that are relevant to this analysis.

Terrestrial community resources could be affected by the planned utility line extensions by the City of Janesville and the TIF District No. 35 Project Plan. The proximity of the utility line extensions and TIF District No. 35 project to the SHINE site indicates that the ecological resources at these locations are likely similar. All projects include disturbance of cultivated crop lands and prime farmland. As described in Subsection 19.4.5.1.3, plant communities in the region include cultivated crops (corn, soybean, winter wheat) and opportunistic weedy species. There are no federal or state-listed threatened, endangered, or special concern plant species observed or in the proximity of the site. Faunal resources in this area are limited due to the agricultural nature of the land. Field investigations identified bird and mammal species occurring in the region, however there were no state or federally listed species. Therefore, cumulative impacts to terrestrial ecological resources are SMALL.

Aquatic community resources that could be affected by the proposed facility and TIF District No. 35 Project Plan include the unnamed tributary to Rock River and the Rock River. The unnamed tributary, a small intermittent stream, is 1.6 mi. (2.6 km) south of the SHINE site and the Rock River is 1.9 mi. (3.1 km) southwest of the site. There are no wetlands within the SHINE site and dewatering of groundwater in excavations is not anticipated. BMPs will be used in accordance with the SWPPP, as required by the WDNR, to prevent sediment runoff and subsequent siltation in receiving streams during construction. Because of the distance to the off-site streams and the implementation of BMPs on-site during construction, cumulative impacts to aquatic resources are SMALL.

19.4.13.6 Historical and Cultural Resources

The description of the affected environment in Subsection 19.3.6 serves as a baseline for the historical and cultural resources cumulative impact assessment. The geographic area of analysis for evaluation of cumulative effects on historical and cultural resources is the same as that used in Section 19.4.6 and includes the 91.27 ac. (36.94 ha) within the site boundary and the 10 mi. (16 km) region surrounding the site. As discussed in Subsection 19.4.6.1, impacts from construction and operation of the SHINE facility are SMALL.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on historical and cultural resources. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the utility line extensions, the proposed facility, the TIF District No. 35 Project Plan, and NorthStar Medical Radioisotopes, all of which are future actions. No present or on-going actions were identified that are relevant to this analysis.

The utility line extensions and TIF District No. 35 are in the same cultural context as the SHINE site. Based on the absence of archaeological sites found on the SHINE site and the immediate project area (Subsection 19.3.6) it is expected that the potential for undiscovered historic properties (archaeology or historic architecture) occurring on the TIF District No. 35 project area is also low. Furthermore, there have been no Native American traditional properties identified within the region of the SHINE site. It is expected that site development practices at the TIF District No. 35 project include appropriate reviews by the WHS such that potential impacts to historic resources are either avoided or mitigated. Impacts to cultural resources were evaluated in the Environmental Assessment for NorthStar and it was determined that no cultural resources will be impacted by the project (DOE, 2012). Therefore, cumulative impacts to historic and cultural resources are SMALL.

19.4.13.7 Socioeconomic Environment

The description of the affected environment in Subsection 19.3.7 serves as a baseline for the socioeconomic cumulative impact assessment. The geographic area of analysis for evaluation of cumulative effects on socioeconomic resources is the same as that used in Subsection 19.4.7 and includes the 91.27 ac. (36.94 ha) within the site boundary and the surrounding Rock County. As discussed in Subsection 19.4.7.1, impacts from construction and operation of the SHINE facility have a SMALL impact on socioeconomic conditions. Impacts to transportation in Rock County associated with the development of the SHINE site are discussed in Subsection 19.4.7.2 and are SMALL.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on the socioeconomic environment. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the associated utility line extensions, the proposed SHINE facility, the TIF District No. 35 Project Plan, and NorthStar Medical Radioisotopes, all of which are future actions. No present or on-going actions were identified that are relevant to this analysis.

The TIF District No. 35 Project Plan approved in August, 2011, established TIF District No. 35 adjacent to the northern boundary of the SHINE site. In February, 2012, the Project Plan was amended to expand the district boundary to include the SHINE site. Prior to the inclusion of the SHINE site, the 226 ac. (91 ha) district was created to facilitate development of a new industrial park. The district is zoned for light industrial uses and has the potential to be subdivided into 16 parcels ranging from 10.99 to 18.86 ac. (4.45 to 7.6 ha) in size. Wisconsin’s Tax Increment District Law allows the City of Janesville to retain the property taxes levied against projected improved property value within TIF District No. 35 to pay for improvement costs that are incurred to attract new industrial development. The Project Plan proposes extension of utilities to the district and construction of an extension of Progress Drive from the north. Construction of additional utility and roadway extensions is expected to be phased to meet the needs of specific development projects.

19.4.13.7.1 Water Supply and Water Treatment

As described in Subsection 19.4.13.2, the City of Janesville plans to install a water main and sanitary sewer main along the northern boundary of the SHINE site. The City has indicated that the water main and sewer main have more than enough capacity to support the facility and construction related population increase. Therefore, the City’s water supply system and sanitary sewer system are not expected to require any upgrades. Development of the TIF District No. 35

immediately north of the SHINE site will likely place additional demands on the City's water supply and water treatment system. The project plan for the TIF District No. 35 states that improvements to utilities will be made as needed to facilitate development and expansion (City of Janesville, 2012b). As new streets are constructed to provide access to new sites, sewer and water utilities are expected to be installed within the rights-of-way to minimize impacts. Therefore, cumulative effects to water supply and water treatment are SMALL.

19.4.13.7.2 Tax Base

The development of TIF District No. 35 facilitates industrial expansion, increases property values, and creates new jobs in the City of Janesville. These jobs support the diversification of the local economy and the increased manufacturing and warehousing/distribution payrolls and have a positive multiplier effect in the trade and service sectors. However, as discussed in Subsection 19.4.7.1, the overall tax revenues from the SHINE and TIF District No. 35 projects are positive, and relatively small in comparison to the established tax bases. Therefore, cumulative effects to the tax bases are SMALL.

19.4.13.7.3 Labor Force and Population

The NorthStar Medical Radioisotopes facility is planned to be constructed in neighboring Beloit in Rock County, WI. NorthStar plans to break ground in 2013, with production beginning in 2016, and is expected to create more than 150 jobs by 2016 (NorthStar Medical Radioisotopes, 2012 and Beloit Daily News, 2011). The NorthStar facility is smaller in land area (33 ac. [13 ha]) and facility footprint (82,000 square ft. [7618 square m]) compared to that of the SHINE facility. No workforce breakdown is available for the NorthStar facility. However, it is possible that the demand for workers may overlap between the two facilities for several labor categories. However, given the large workforce availability within the region, no significant labor category shortfalls are expected. The presence of the Blackhawk Technical College and the University of Wisconsin, Madison will help to ensure the availability of a workforce well trained for the required positions. In consideration of the availability and composition of the existing workforce, the cumulative effects on population growth are SMALL.

19.4.13.7.4 Transportation

As described in Subsection 19.4.7.2, no modifications to the local traffic infrastructure are necessary as a result of construction-related traffic at the SHINE site. If construction activities at the TIF District No. 35 site are concurrent with those at SHINE, it is not expected to result in a significant impact on local traffic patterns or infrastructure. The other future development project in the area, NorthStar Medical Radioisotopes, is located in the neighboring City of Beloit and therefore does not contribute to cumulative impacts due to the distance between facilities. Mitigation measures described in Subsection 19.4.7.2.1 alleviate impacts on traffic patterns due to operation of the SHINE facility. It is anticipated that any impacts from operation of the TIF District No. 35 or NorthStar facilities can be mitigated in a similar fashion. Therefore, cumulative effects to transportation infrastructure and traffic patterns are SMALL.

19.4.13.7.5 Summary of Socioeconomic Cumulative Impacts

In summary, cumulative impacts from other actions identified in Table 19.4.13-1 on aspects of socioeconomics, including water/wastewater systems, population growth, local tax base, the labor force, and transportation are SMALL.

19.4.13.8 Human Health

The geographic area of analysis for evaluation of cumulative effects on human health is the same as that used in Subsection 19.4.8 and includes the 91.27 ac. (36.94 ha) within the site boundary and the 5 mi. (8 km) region surrounding the site. As discussed in Subsections 19.4.8.1 and 19.4.8.2, impacts from operation of the SHINE facility has a SMALL impact on human health.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on human health. Relevant "other actions" that are considered in this cumulative effects analysis are limited to the proposed facility, NorthStar Medical Radioisotopes, and the two medical facilities located in Janesville: Mercy Clinic South and Mercy Hospital. The proposed SHINE and NorthStar facilities are future actions, whereas the hospital facilities are present and on-going.

19.4.13.8.1 Non-Radiological Impacts

Construction of the SHINE and NorthStar facilities includes potential hazards to workers typical of any construction site. Normal construction safety practices will be employed to promote worker safety and reduce the likelihood of worker injury during construction. Since the Mercy Clinic South and Mercy Hospital are already operating, they have no associated construction impacts.

Potential non-radiological public and occupational hazards pertaining to the operation of the SHINE and NorthStar facilities are associated with emissions, discharges, and waste associated with processes within the facility as well as accidental spills/releases. The great majority of chemical processes at the SHINE facility are conducted inside of the RCA. Any wastes created by these processes are disposed of as radioactive waste and shipped off-site. Some lab-scale chemical use occurs outside the RCA. Liquid wastes produced as a result of these activities are treated to ensure they meet the requirements of the Janesville wastewater treatment facility before being discharged to the municipal sewer. Additionally, the facility sanitary wastewater is treated by the Janesville wastewater treatment facility.

Control systems are in place for the SHINE facility and presumably for other permitted projects in accordance with WDNR and local requirements to minimize potential exposure to the public and include conveyance of all wastewater to appropriate approved wastewater treatment facilities, implementation of Spill Prevention Control and Countermeasure Plans, and air emission controls, as appropriate. Therefore, cumulative impacts to non-radiological health are SMALL.

19.4.13.8.2 Radiological Impacts

The proposed SHINE facility releases small quantities of radionuclides to the environment. Gaseous effluent activity releases and liquid effluent activity releases are discussed in Subsections 19.4.8.2.4.1 and 19.4.8.2.4.2, respectively. Direct dose to a member of the public at the site boundary is due to gamma radiation penetrating the walls of the production facility and the waste staging and shipping facility. As a result of site shielding design, the direct dose outside of the buildings is small and decreases with increasing distance. The nearest site boundary is located at an appreciable distance from the two fixed sources of radiation (production facility building and waste staging and shipping building); therefore the dose is negligible at the site boundary.

There are no nuclear fuel cycle facilities located within the 5 mi. (8 km) region around the SHINE site. However, Interstate 39/90 is approximately 2 mi. (3.2 km) from the site boundary, which may result in some radiation exposure from the transportation of radioactive material along the highway. The SHINE site is surrounded by railroads on all sides except for the southeast, so additional doses of radiation may result from transportation of radioactive materials along the railroads.

The NorthStar facility is not projecting to have any radioactive emissions related to the operation of the facility. The facility is designed to control the amount of radioactive material released to a negligible amount. Operations emissions are not expected to violate any federal or state criteria or trigger the need for a PSD or Title V operating permit. Additionally, liquid waste generated during operations will be collected, temporarily stored on-site, and sent off-site for treatment and disposal per WDNR regulations. No public dose from air emissions or wastewater from the NorthStar facility is expected. Mercy Clinic South and Mercy Hospital provide imaging services to patients that include radiation oncology and nuclear medicine. Doses of radiological exposure to the public from these facilities are negligible. Therefore, cumulative impacts to radiological health are SMALL.

As described in Subsection 19.4.10, the effect of transportation of radioactive material from the SHINE facility on the public is SMALL compared to the background radiological dose in the vicinity of the SHINE facility. Transportation workers will receive a larger dose due to the number of shipments originating at the SHINE facility. The shipment of radioactive material for the SHINE and NorthStar facilities contributes to the cumulative impact of radioactive material production, storage, utilization and disposal for all facilities in the United States that utilize radioactive material. The cumulative impacts of the transportation of radioactive materials for the existing facilities in the region, including the Mercy medical facilities, are SMALL and the impacts from the addition of the SHINE facility do not change that conclusion. Therefore, cumulative effects on transportation of nuclear material from the addition of the SHINE facility are SMALL.

19.4.13.9 Environmental Justice

The geographic area of analysis for evaluation of cumulative effects on environmental justice is the same as that used in Subsection 19.4.12 and includes the 91.27 ac. (36.94 ha) within the site boundary and the 5 mi. (8 km) region surrounding the site. As discussed in Subsection 19.4.12, construction and operation impacts to environmental justice in the region are SMALL.

Table 19.4.13-2 identifies recent past, present, and reasonably foreseeable future actions within the geographic extent of analysis that can be assessed to determine cumulative effects on environmental justice. Relevant “other actions” that are considered in this cumulative effects analysis are limited to the utility line extensions, the proposed facility, and the TIF District No. 35 Project Plan, all of which are future actions. No present or on-going actions were identified that are relevant to this analysis.

Disproportionate impacts on low-income or minority populations from other actions are not expected. The proximity of the utility line extensions and TIF District No. 35 project to the SHINE site indicates that the populations of concern at these locations will be the same and that the cumulative impacts on environmental justice are SMALL.

19.4.13.10 Conclusion

Table 19.4.13-3 summarizes the cumulative impacts in all resource areas. In conclusion, there are no significant cumulative adverse environmental impacts from the construction and operation of the SHINE site when considered together with other past, present, and reasonably foreseeable future projects in the area.

Table 19.4.13-1 Past, Present and Reasonably Foreseeable Projects and Other Actions Considered in the Cumulative Effects Analysis (Sheet 1 of 3)

Project Name	Summary of Project	Location	Potentially Affected Resource(s)	Retained for Cumulative Effects Analysis	Basis
Utility Projects					
Utility line extension	Installation of water and sewer lines	Adjacent to SHINE site	Land Use; Geology; Noise, Water; Ecology; Historical and Cultural; Socioeconomics; Environmental Justice	Y	Part of overall development of TIF District No. 35; SHINE to tie into line extension.
Water and Sewer System Improvements	Improvements throughout the City of Janesville	Rock County, WI	Land Use; Water; Socioeconomics	N	Construction activities limited to previously disturbed/ developed lands
Energy Projects					
Alliant Energy Generation Facility	Existing power generation facility	Rock County, WI	Air Quality, Visual Resources	Y	Existing operating facility. Stacks visible in site viewshed
University of Wisconsin Charter Street	Replacement of coal boilers with natural gas boilers	Dane County, WI	Air Quality	Y	Planned rebuild of current facilities with new construction permitted
West Campus Cogeneration	Construction of new cooling towers for chiller plant expansion	Dane County, WI	Air Quality	Y	Existing facility with new construction permitted
New Construction					
Future Urbanization	Construction of housing, commercial buildings, roads, bridges, rail, and other utility facilities, as described in local land use planning documents.	Throughout the region	Land Use; Visual; Geology; Air Quality; Noise; Water; Ecology; Historical and Cultural; Socioeconomics; Environmental Justice	N	All future actions with timeline uncertain. Not in immediate proximity to SHINE site

Table 19.4.13-1 Past, Present and Reasonably Foreseeable Projects and Other Actions Considered in the Cumulative Effects Analysis (Sheet 2 of 3)

Project Name	Summary of Project	Location	Potentially Affected Resource(s)	Retained for Cumulative Effects Analysis	Basis
Janesville Innovation Center	Provides support and assistance for small businesses and start-ups	Rock County, WI	Socioeconomics	N	Construction activities limited to previously disturbed/ developed lands
NorthStar Medical Radioisotopes	Medical radioisotope production facility	Rock County, WI	Air Quality; Historical and Cultural; Socioeconomics; Human Health	Y	Construction planned to start in 2013
TIF District No. 35 Project Plan	Parcel zoned for industrial use as a TIF district	Adjacent to SHINE site, Rock County, WI	Land Use; Geology; Noise, Ecology; Historical and Cultural; Socioeconomics; Environmental Justice	Y	Approved by City of Janesville
Manufacturing Facilities					
Generac Power Systems	Modifications to venting stack at generator manufacturing location	Jefferson County, WI	Air Quality	Y	Existing operation with new construction permitted
Kraft Foods Global	New boiler construction at a processing location for prepared foods	Dane County, WI	Air Quality	Y	Existing operation with new construction permitted
United Ethanol	Facility upgrades at an ethanol production plant	Rock County, WI	Air Quality	Y	Existing operation with new construction permitted
Traffic Projects					
Interstate 39/90 Corridor	Expansion and improvements	Dane and Rock Counties, WI	Land Use; Water Resources; Air Quality; Noise; Socioeconomics	N	Timeframe uncertain

Table 19.4.13-1 Past, Present and Reasonably Foreseeable Projects and Other Actions Considered in the Cumulative Effects Analysis (Sheet 3 of 3)

Project Name	Summary of Project	Location	Potentially Affected Resource(s)	Retained for Cumulative Effects Analysis	Basis
Palmer Drive Bridge	Railing replacement	Rock County, WI	Land Use; Water Resources; Air Quality; Noise; Socioeconomics	N	Construction activities limited to previously disturbed/ developed lands
Road Improvement Projects	Curb, gutter and sidewalk replacement; manhole rehabilitation and replacement; street resurfacing	Rock County, WI	Land Use; Water Resources; Air Quality; Noise; Socioeconomics	N	Construction activities limited to previously disturbed/ developed lands
Southern Wisconsin Regional Airport	Public airport	Rock County, WI	Visual Resources; Noise; Water	Y	Existing facility. Operational
WIS 26 Corridor	Road expansion	Rock County, WI	Land Use; Water Resources; Air Quality; Noise; Socioeconomics	N	Timeframe uncertain
US 14 Corridor Study	Road expansion study	Dane and Rock Counties, WI	Land Use; Water Resources; Air Quality; Noise; Socioeconomics	N	Timeframe uncertain
US 14/WIS 11 Corridor Study	Road expansion study	Rock and Walworth Counties, WI	Land Use; Water Resources; Air Quality; Noise; Socioeconomics	N	Timeframe uncertain
Radiological Sources					
Mercy Clinic South	Medical services facility	Rock County, WI	Human Health	Y	Operational
Mercy Hospital	Medical services facility	Rock County, WI	Human Health	Y	Operational
Other Projects/ Actions					
Glen Erin Golf Course	7000-yd. public golf course	Rock County, WI	Water Quality	Y	Existing facility. Operational

Table 19.4.13-2 Past, Present and Reasonably Foreseeable Projects and Other Actions Retained for the Cumulative Effects Analysis (Sheet 1 of 2)

Project Name	Summary of Project	Location	Status
Utility Projects			
Utility line extension	Installation of water and sewer lines	0.1 mi. north of site	Timeframe dependent on SHINE facility construction
Energy Projects			
Alliant Energy Generation Facility	Existing power generation facility	3.2 mi south of site	Existing operating facility, stacks visible in site viewshed (WDNR, 2011b)
University of Wisconsin Charter St	Replacement of coal boilers with natural gas boilers	36.4 mi. northwest of site	Under construction (WDNR, 2011c; WDNR, 2012c)
West Campus Cogeneration	Construction of new cooling towers for chiller plant expansion	37.1 mi. northwest of site	Existing operation with new construction permitted (WDNR, 2010a)
New Construction			
TIF District No. 35 Project Plan	Parcel zoned for industrial use as a TIF district	0.9 mi. north of site	Approved by City of Janesville (City of Janesville, 2012b)
NorthStar Medical Radioisotopes	Medical radioisotope facility	7.7 mi. south of site	Construction planned to start in 2013 (NorthStar Medical Radioisotopes, 2012)
Transportation Projects			
Southern Wisconsin Regional Airport	Public airport	1.0 mi southwest of site	Operational (AirNav, 2013)
Manufacturing Facilities			
Generac Power Systems	Modifications to venting stack at generator manufacturing location	21.8 mi. northeast of site	Existing operation with new construction permitted (WDNR, 2010b)
Kraft Foods Global	New boiler construction at a processing location for prepared foods	37.5 mi. northwest of site	Existing operation with new construction permitted (WDNR, 2012e)
United Ethanol	Facility upgrades at an ethanol production plant	11.2 mi. northeast of site	Existing operation with new construction permitted (WDNR, 2012d)

Table 19.4.13-2 Past, Present and Reasonably Foreseeable Projects and Other Actions Retained for the Cumulative Effects Analysis (Sheet 2 of 2)

Project Name	Summary of Project	Location	Status
Radiological Sources			
Mercy Clinic South	Medical services facility	1.8 mi. north of site	Operational (Mercy Health System, 2012a)
Mercy Hospital	Medical services facility	4.4 mi. north of site	Operational (Mercy Health System, 2012b)
Other Projects/ Actions			
Glen Erin Golf Course	7000-yd. public golf course	1.6 mi southwest of site	Operational (Wisconsin Golf Courses, 2013)

Table 19.4.13-3 Cumulative Impacts on Environmental Resources, Including the Impacts of the Proposed Project

Resource Category	Cumulative Impact Level
Land Use and Visual Resources	
Land Use	SMALL
Visual Resources	SMALL
Air Quality and Noise	
Air Quality	SMALL
Noise	SMALL
Geologic Environment	SMALL
Water Resources	
Hydrology	SMALL
Water Use	SMALL
Water Quality	SMALL
Ecological Resources	
Terrestrial Ecosystems	SMALL
Aquatic Ecosystems	SMALL
Socioeconomics	SMALL
Historic and Cultural Resources	SMALL
Human Health	
Nonradiological Health	SMALL
Radiological Health	SMALL
Environmental Justice	SMALL
Transportation	SMALL