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July 9, 2019

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ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Director, Office of Nuclear Material Safety and Safeguards
11555 Rockville Pike
Rockville, MD 20852

Docket No. 40-3392; License No. SUB-526

SUBJECT: HONEWYWELL METROPOLIS WORKS REVISED LICENSE RENEWAL APPLICATION

On February 9, 2017 Honeywell Metropolis Works (MTW) submitted to the US Nuclear Regulatory Commission (USNRC) an application for renewal of USNRC Source Materials License SUB-526. The USNRC, in a letter dated May 2, 2017, accepted the License Renewal Application (LRA) for detailed review. In the same letter the USNRC indicated that Honeywell had filed the LRA more than 30 days prior to the expiration date of the existing license. Because the LRA was filed ahead of the expiration date the USNRC has indicated that the current license will not expire until the USNRC makes a final determination on the LRA, in accordance with the timely renewal provision of 10 CFR 40.42(a).

The enclosed revision to the LRA (Enclosure 1) includes changes to the LRA based on NRC discussions. These discussions were related to the addition of ISA content in Chapter 3 and the clarification of MTW license commitments and safety basis.

There is no security-related or other proprietary information in the LRA package

Should you have any questions or require additional information, please contact Mr. Sean Patterson, Regulatory Affairs Manager, at (618) 524-6341.

Sincerely,

Jon B. Price

Jon Price
Acting Plant Manager

NMSS20

Enclosure 1 – Revised License Renewal Application

Cc: US NRC
Attn: David Titinski
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Honeywell Metropolis Works
Application for Renewal of USNRC Source Materials License SUB-526

Docket No. 40-3392

Revision 7/09/2019

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ACRONYMS/ABBREVIATIONS

ALARA	As Low As Is Reasonably Achievable
ALI	Annual Limit on Intake
ANSI	American National Standards Institute
CDP	Census Designated Place
CFR	Code of Federal Regulations
cpm	counts per minute
DAC	Derived Air Concentration
DBE	Design Basis Earthquake
DDE	Deep Dose Equivalent
DFP	Decommissioning Funding Plan
dpm	disintegrations per minute
EPDM	Ethylene-Propylene Diene Monomer
EPF	Environmental Protection Facility
EQ	Earthquake
F	Fahrenheit
FMB	Feed Materials Building
gpm	gallons per minute
HDR	Honeywell Designated Representative
HF	Hydrofluoric Acid
HP	Health Physics
HSE	Health, Safety, and Environmental
ICRP	International Commission on Radiological Protection
ISA	Integrated Safety Analysis
KOH	Potassium Hydroxide
KPA	Kinetic Phosphorescence Analyzer
mrem	Millirem
msl	mean sea level
MTW	Metropolis Works or Metropolis Plant
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NMMSS	Nuclear Materials Management Safeguards System
NMSZ	New Madrid Seismic Zone
NSP	Nuclear Services Procedure
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	U.S. Occupational Safety and Health Administration

ACRONYMS/ABBREVIATIONS

PGA	Peak Ground Acceleration
PFAP	Plant Features and Procedures
PHA	Process Hazards Analysis
PM	Preventative Maintenance
PSI	Process Safety Information
psig	pounds per square inch (gauge)
PSM	Process Safety Management
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RP	Radiation Protection
SCFH	Standard cubic feet per hour
TEDE	Total Effective Dose Equivalent
UF_4	Uranium Tetrafluoride
UF6	Uranium Hexafluoride
USDOE	United States Department of Energy
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USNRC	United States Nuclear Regulatory Commission

DEFINITIONS

The following terms are used to define frequencies and allowable grace periods for activities with frequencies specified in this Application:

- Annually means once per twelve calendar months, plus one calendar month.
- Quarterly means once per three calendar months, plus two calendar weeks.
- Monthly means once per calendar month, plus seven days.
- Weekly means once every seven days, plus two days.

The required frequencies for Site Access Training and Respiratory Protection Training are established in their respective programmatic documents. Therefore, the grace periods defined above do not apply to these activities.

Other definitions used in the application include the following:

Regulatory Guide 3.55 License Commitments - Defined as statements or actions that are captured and implemented using MTW policies and procedures.

Safety Basis -Refers to the licensee's safety analyses which ensure compliance with regulatory requirements and the safe operation of the facility with licensed materials. This includes the ISA development methodologies and criteria to which Honeywell is specifically committed as indicated in Sections 3.3 and 3.4 (and the referenced data tables) of this Application. These safety elements are marked with an asterisk (*) within this Application to indicate their status as part of the "safety basis."

INTRODUCTION

Honeywell International Inc. (Honeywell) has developed this License Renewal Application (the Application) to meet the requirements for content of a license application as established in 10 CFR Part 40, "Domestic Licensing of Source Material," with emphases on the requirements of 10 CFR 40.31, "Application for Specific Licenses," and 10 CFR 40.32, "General Requirements for Issuance of Specific Licenses." The content of the Application is generally consistent with the guidance provided in USNRC Regulatory Guide 3.55, "Standard Format and Content for the Health and Safety Sections of License Renewal Applications for Uranium Hexafluoride Production." Honeywell has used additional USNRC Regulatory Guides, NUREGs, other USNRC guidance documents, and industry standards where applicable to specific topics discussed in the Application. These guidance documents, and any limitations on their usage, are cited within the relevant sections of the Application.

10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," establishes requirements for applicants for licenses to undertake certain activities involving special nuclear material. 10 CFR Part 70, Subpart H, includes requirements for performance by the applicant of an integrated safety analysis (ISA). NUREG-1520, "Standard Review Plan for Fuel Cycle Facilities License Applications," provides guidance for performance of the ISA and for USNRC review of an applicant's license application and ISA Summary. Although 10 CFR Part 70 (and therefore NUREG-1520) is not applicable to Honeywell's activities at the Metropolis site, which are licensed under 10 CFR Part 40, Honeywell has previously conducted an ISA, tailored to the activities and hazards associated with a uranium conversion facility, to provide a structured analysis of MTW site hazards and the safety controls applied to prevention and/or mitigation of identified accident sequences. Honeywell has also developed an ISA Summary to document the results of the analysis and has provided the ISA Summary to USNRC for review and subsequent approval. Honeywell used applicable portions of NUREG-1520 to inform: 1) the conduct of the ISA and development of the MTW ISA Summary; and 2) the development of certain portions of the Application. In addition, the Application is formatted in a manner generally consistent with NUREG-1520 to facilitate review by the USNRC staff.

Honeywell's adoption of the format suggested by NUREG-1520 is consistent with developments in the MTW licensing basis since the 2005 submittal of the previous MTW License Renewal Application. First, the Regulatory Guide 3.55 format, including the Safety Demonstration Report, does not recognize the existence of the ISA process. Second, the Regulatory Guide 3.55 format does not provide for recognition of the risk insights and ongoing programmatic improvements that result from implementation of the MTW ISA.

To the extent that conflicts exist between the guidance for content of license applications provided in Regulatory Guide 3.55 and NUREG-1520, Honeywell used the guidance provided in NUREG-1520, to the extent appropriate to a 10 CFR Part 40 licensee. Honeywell's reliance on the guidance provided in NUREG-1520 recognizes the risk-informed approach included in the development of NUREG-1520 and USNRC's efforts to

update the guidance for 10 CFR Part 40 applicants and licensees. These efforts are incomplete at the time of Honeywell's submittal.

As discussed in Regulatory Guide 3.55, the Application includes two types of information – license conditions and detailed safety information/descriptive information. License conditions, as discussed in the Introduction to Regulatory Guide 3.55, state "the performance requirements to which the applicant proposes to commit." Detailed safety information/descriptive information demonstrates "the applicant's adherence to the conditions of the first part" (the license conditions). Throughout this Application, Honeywell has used *underlined italic text* to highlight those portions that should be considered license conditions as defined in Regulatory Guide 3.55. The remaining portions should be considered detailed safety information/descriptive information (typically included in the "Safety Demonstration Report" section of a two-part license application).

Note that the commitments that are part of the MTW safety basis are marked with an asterisk (*) within this Application.

1.0 GENERAL INFORMATION

1.1 Corporate Information

The Metropolis Works uranium hexafluoride (UF6) conversion plant (Metropolis Works or MTW) is located at:

2768 North US 45 Road
Metropolis, IL 62960

The facility is owned and operated by units of Honeywell International Inc. (Honeywell), which is incorporated in the State of Delaware. Corporate headquarters are in Morris Plains, New Jersey. The top-ranking member of management at the plant site is the Plant Manager, who reports directly to executive level personnel in Honeywell's corporate offices.

Honeywell operates those portions of the MTW facility requiring licensing by USNRC under USNRC License SUB-526.

1.2 Financial Qualification

Honeywell is a large, financially-secure organization. The assets of the corporation are adequate to provide financial assurance for the operation of the Metropolis Works. The Honeywell Annual Report was included in the Application Revision 02/08/2017 and provides evidence of Honeywell's financial capability for continued safe plant operation.

Section 10.0 of this Application provides additional information regarding financial assurance for decommissioning of the site.

1.3 Material Characteristics and Possession Limits

Table 1-1 provides the licensed material characteristics and possession limits.

Table 1-1
Material Characteristics and Possession Limits

Type of Licensed Material	*Possession Limit*	*Physical and/or Chemical Form*
Natural uranium	*150 million pounds*	*Yellowcake, U_3O_8, UO_2, UF_4, and UF6, chemical intermediates of these compounds*
Depleted uranium	*68 kg (150 pounds)*	*Depleted uranium*
Cesium (Cs) - 137	*300 milliCuries (mCi)*	*Sealed radioactive sources*
Any licensed material between atomic numbers 3 – 83	*2 milliCuries (mCi)*	*Sealed and unsealed radioactive sources*
Any licensed material between atomic number 84 – 95	*1 microcurie*	*Sealed and unsealed radioactive sources.*

The authorized place of use of the licensed materials listed above is the licensee's existing facility as described in Section 1.1 of this Application.

Section 4.0 of this Application establishes specific requirements for radiological controls associated with the licensed materials listed above.

1.4 Period of License

Honeywell requests renewal of USNRC License SUB-526 for a period of 40 years as specifically addressed in the Justification for Forty-Year License Term that was included as Enclosure 2 in the Application Revision 02/08/2017.

1.5 Authorized Activities

MTW chemically converts natural uranium ore concentrates into high purity UF6. The UF6 product from the facility is shipped to uranium enrichment plants. Following enrichment, the uranium is typically converted into fuel for use in nuclear power reactors.

The production of uranium hexafluoride is the operation requiring licensing by USNRC pursuant to the provisions of 10 CFR Part 40 (Ref. 1). *The licensed facility is designed to produce uranium as UF6 from uranium ore concentrates.* Generally, the plant feed assays about 75% uranium and the final UF6 product contains less than 300 parts per million impurities. In the Honeywell process, the ore concentrates feed is carried through the successive steps of feed preparation, reduction, hydrofluorination, fluorination and distillation. Chemical reactions are

carried out in fluid bed reactors. The process is sometimes referred to as the "fluoride volatility process."

Most of the uranium processing equipment is housed in a seven-story (six above ground) structure termed the Feed Materials Building (FMB) where essentially all the steps in the UF6 manufacturing process are conducted.

Authorized activities include the successive steps of:

- Receiving ore concentrates;
- Sampling ore concentrates;
- Charging ore concentrates into the UF6 conversion process through a drum dumping station and calciner;
- Blending, agglomerating, drying, crushing, and sizing ore concentrates to a uniform particle called "prepared feed";
- Processing prepared feed through fluid bed reductors where uranium is reduced to the dioxide form utilizing hydrogen;
- Feeding uranium dioxide from the reductor into fluid bed hydrofluorinators. Each pair of hydrofluorinators, operated in series, provides a countercurrent flow of anhydrous hydrofluoric Acid (HF) to convert the uranium dioxide into uranium tetrafluoride (UF_4);
- Feeding the UF_4 into a fluid bed fluorinator that also contains an inert fluidizing matrix (CaF_2) to convert the UF_4 into gaseous UF6, which is volatilized from the fluorinator;
- Passing the volatilized UF6 gas, which also contains excess fluorine and HF, through a series of filters for particulate removal, and through a series of cold traps for UF6 collection;
- Intermittently removing crude UF6 from the cold traps following liquefaction by heating, and then transferring it to still feed tanks to await purification by fractional distillation;
- Feeding crude UF6 from the still feed tanks through a low boiler distillation column, and then a high boiler distillation column for final product purification;
- Packaging the product UF6 into cylinders approved by the responsible regulatory authority; and
- Shipping the product UF6 offsite.

Process off-grade materials that contain significant quantities of uranium may be processed through an on-site uranium recovery unit or shipped off-site to a licensed facility for uranium recovery processing. Uranium recovered from these operations may be recycled through the UF6 conversion plant.

Some low-level uranium-bearing residues may be packaged and shipped directly to a licensed radioactive waste broker or to a licensed radioactive waste disposal site when recovery of the contained uranium is not economical.

Low-level uranium-bearing residues that meet the "unimportant quantity" criteria of 10 CFR 40.13(a) may be offered for recycling by selected commercial organizations.

Product UF6 cylinders are periodically washed and tested to ensure design integrity. Cylinder cleaning residues that contain uranium daughter products (principally ^{234}Th and ^{234}Pa) are stored on-site and ultimately disposed of at a licensed waste disposal facility.

Concentrates that are classified as wet or hard ores may be processed through Wet Process or other procedurally-controlled process prior to blending with other concentrates.

Other operations that involve handling of significant quantities of source materials include:

- Outdoor and indoor storage pads for ore concentrates, uranium intermediate inventories, UF6 cylinders, and recyclable and waste materials;
- Potassium Hydroxide (KOH) Muds recovery unit;
- Pond muds calciner;
- Drum Shredder unit;
- Laboratory Building that houses facilities for conducting process control, product, and radiological analyses; and
- Facilities and equipment for clothing, area, and equipment decontamination, maintenance activities, and waste processing and packaging.

The following sections provide a narrative description of the significant onsite processes. Figure 1.1 provides a simplified flow diagram for the uranium conversion process.

1.5.1 Sampling and Storage

The plant receives uranium ore concentrates (in 55-gallon drums) from uranium mills via rail car or common carrier (truck). The uranium ore concentrates are sampled in the Sampling Plant (except hard or wet ore) to obtain statistically-significant analytical samples in accordance with industry standards. Each lot of concentrates is weighed and stored on storage pads until accountability procedures and the uranium and impurity analyses are completed.

1.5.2 Pre-Treatment Facility

Uranium compounds from the uranium recovery processes contain contaminants that must be minimized before the concentrates are converted into UF6. The method of pretreatment used is a two-stage sulfuric acid leach followed by aqueous ammonia precipitation. After precipitation, the uranium-bearing solids are settled and filtered into a calciner prior to introduction into the Ore Preparation process.

The pre-treatment facility is also equipped to process ore concentrates that have absorbed moisture or become hard. These drums cannot be processed through the normal drum dumping station.

1.5.3 Ore Concentrate Preparation

Incoming ore concentrates are charged into the system through a drum dumping station and then a calciner. Following the calciner, the ore concentrates are blended, agglomerated, dried, crushed and sized for uniformity. In the agglomeration step, water, sulfuric acid, magnesium hydroxide, and/or sodium hydroxide are used depending on the concentrate characteristics. Dusts and fumes from this process are controlled by use of dust collectors.

1.5.4 Reduction

The sized uranium concentrates enter one of two fluid-bed reactors (reductors). In the reductor, the mixed uranium oxides (U_3O_8) are reduced to uranium dioxide (UO_2) form utilizing hydrogen. A liquid hydrogen system is used as a source of hydrogen. This system, located within a gated enclosure south of the Maintenance building, consists of a cryogenic storage tank and vaporizers. This system is owned and maintained by the vendor. Outside the liquid hydrogen system's fence, a nitrogen/hydrogen mixing station provides the appropriate fluidizing and reactive gas mixtures to the Green Salt reductors. The reductor off-gas (principally nitrogen, water vapor, hydrogen and hydrogen sulfide) is passed through filters to remove particulate uranium and the residual gas is then incinerated to convert the hydrogen sulfide into sulfur dioxide and water and to burn the excess hydrogen.

1.5.5 Hydrofluorination

The uranium dioxide from the reductor is fed into one of two fluid-bed hydrofluorinators operated in series; two trains are available for operation. A counter-current flow of anhydrous HF fluidizing gas, supplied from on-site rail cars, converts the uranium dioxide into uranium tetrafluoride (UF_4). Through a system of vaporizers and heat exchangers the HF is changed to a gaseous form and brought to the proper reaction temperature before being introduced into the fluid-bed reactors.

The off-gas is filtered to remove particulate uranium and scrubbed with water and a potassium hydroxide solution to remove HF before being vented to the atmosphere. The HF scrubber liquors are pH-adjusted and treated to remove fluoride. This waste fluoride is subsequently converted into a recyclable synthetic calcium fluoride (CaF_2) product.

1.5.6 Fluorination

The UF_4 is fed into a fluid-bed fluorinator that also contains inert bed material. Elemental fluorine is used as the fluidizing gas to convert solid UF_4 to gaseous UF6 which is volatilized from the fluorinator. A cobalt catalyst may be used to enhance the reactivity and improve the fluorine yields. The cobalt is added during Ore Preparation. Some residual uranium, non-volatile impurities and uranium daughter products remain in the bed material, which is recycled and reused until the buildup of contaminants prohibits further use. The bed material is then retired for radioactive decay and subsequently shipped to a contractor for reprocessing of the uranium. The volatilized gas containing UF6, excess fluorine, and HF is passed through a series of filters for particulate removal, and through a series of cold traps for UF6 desublimation.

1.5.7 Cold Traps and Off-Gas Cleanup

The bulk of the UF6 is desublimated in a series of primary cold traps which are operated at approximately -20 degF to 0 degF. The secondary and tertiary traps operate at lower temperatures and remove essentially all of the remaining UF6. The secondary and tertiary cold traps are not essential for the process. One or both could be bypassed without adversely affecting the operation. Crude UF6 is removed from the cold traps intermittently following liquefaction by heating, and then transferred to still feed tanks to await purification by fractional distillation.

Uncondensed gas from the cold traps, consisting of F_2, air, HF, N_2 and traces of UF6, is routed into scrubbers where contact with potassium hydroxide solution removes fluorides and traces of uranium prior to release to the atmosphere. The spent scrubbing solutions are routed through Wet Process, where the potassium diuranate is precipitated and filtered. The filtrate (spent KOH) is sent to the Environmental Protection Facility (EPF) where it is regenerated and subsequently reused.

The potassium diuranate is further treated and the uranium is then re-introduced into the Ore Preparation process.

1.5.8 Distillation and Product Packaging

Crude UF6 from the still feed tanks is fed into a low boiler distillation column. The UF6 that has been stripped of low-boiling impurities is then fed into a high boiler distillation column where high boiling impurities are

eliminated. The product, which meets or exceeds purity requirements, is condensed and packaged into approved product cylinders. Gaseous effluents from this process are fed back to Fluorination and are treated along with the fluorination off-gas.

Honeywell establishes administrative controls to limit the risks of any incidents involving handling of filled UF6 cylinders as follows:

- Filled cylinders are lifted only to the height necessary to provide clearance over any cylinders located in the intervening fill spots (e.g., the cylinder diameter plus a safety margin determined by the crane operator).
- Cylinders are then moved horizontally approximately 50 yards (depending on the originating fill spot) for final product weight determination.
- Following final weight determination, cylinders are lifted several feet vertically and approximately ten feet horizontally for placement on a mobile storage buggy, which is then moved approximately 150 yards to a designated storage/cooling area.
- Filled UF6 cylinders are stored on the mobile storage buggy for four or more days to allow for complete solidification of the UF6 product prior to shipment or transfer to a designated cylinder storage area.

Honeywell has applied engineering and procedural controls to the UF6 cylinder filling process to reduce the likelihood that a product cylinder would be overfilled during routine plant operations. To reduce the potential hazards associated with heating and sampling of UF6 cylinders, Honeywell implements the following controls:

- MTW typically uses the UF6 continuous sampling system to obtain required UF6 samples between the high boiler column and the product take-off control valve, thus reducing the need for UF6 cylinder sampling.
- When a sample must be drawn from a UF6 cylinder, MTW confirms the cylinder weight prior to heating.

  If the cylinder weight exceeds administrative limits established in Honeywell's written procedures, Honeywell notifies USNRC of planned remedial actions prior to cylinder heating.

1.5.9 Uranium Recovery

Diverse types of uranium-bearing liquors are processed in Wet Process/Uranium Recovery to recover as much uranium as possible.

These include FMB and cylinder wash liquors, rainwater from certain storage pads, and Fluorination scrubber liquors. Regardless of the origin of the uranium-bearing liquors, the uranium is precipitated from solution by pH adjustment, separated from the solution using rotary drum vacuum filtration at the Pond Muds Calciner and drummed for future use in Ore Preparation. The liquors in each case are treated in the EPF to remove fluorides and then discharged into the plant effluent. Fluorination scrubbing liquors, which contain potassium diuranate solids, may also be shipped to a mill for toll reprocessing.

1.5.10 Cylinder Wash Facility

Periodically, UF6 product cylinders must be washed and pressure-tested to assure that there has been no significant degradation of design integrity and to comply with the recertification requirements of American National Standards Institute (ANSI) N14.1, "Packaging of Uranium Hexafluoride for Transport" (Ref. 2). The cylinders are washed with sodium carbonate or sodium hydroxide solution to recover uranium. The leach liquors are then filtered and the uranium-bearing liquid transferred to the uranium recovery facility. The filter residue, which contains daughter products of uranium, principally ^{234}Th and ^{234}Pa, is stored on-site and eventually disposed of at a licensed waste disposal facility.

1.5.11 Hydrocarbon Controls

Honeywell employs controls to reduce hydrocarbon contamination of the UF6 cold trap systems and UF6 product cylinders, including:

- *Production of UF6 in a closed system;*
- *Implementation of system design features to trap and eliminate oil contamination from system components;*
- *Implementation of administrative controls and degreasing procedures during system maintenance;*
- *Control, cleaning, and inspection of Honeywell-owned UF6 cylinders in accordance with the revision of ANSI N14.1 effective at the time of inspection; and* *
- *Certification that customer-owned cylinders are compliant with ANSI N14.1.* *

1.6 Utilities and Support Systems

Utilities and support systems at MTW include electrical power, compressed air and nitrogen, water, steam, and refrigeration.

1.6.1 Electrical Power

Electrical power is provided through a 69,000 volt to 4,160 volt substation within the restricted area fence. Because the chemical processes contain hazardous materials at elevated temperatures and pressures, these processes operate using electrically- and/or pneumatically-operated safety features. In addition, some of the processes contain chemicals that should be kept warm.

A loss of offsite power will result in a safe shutdown of the process units without provision of standby power. Standby electrical power is provided from a diesel-powered electrical generator located in the Powerhouse Building. In the event that electrical power is interrupted, the standby generator automatically starts and comes to a standby mode. The standby power is then distributed, as required, to the following:

- The Administration Building and the Laboratory Building for standby lighting in the Dispensary, Lab, Security, and Health Physics areas.
- One deep well pump providing for operation of the process boilers.
- Three process boiler instrument panels and boiler support equipment which, along with the emergency water supply, allows the production of steam for space heating and for critical process equipment.
- Pre-designated instrumentation and equipment, including a selected fluorination scrubbing train, providing operating personnel the capability to monitor the in-process UF6.

1.6.2 Compressed Air and Nitrogen Systems

1.6.2.1 Compressed Air

The plant air system provides dry, contaminant free air for general plant usage. Air is used for motive force in pneumatic control systems and for general plant air needs. Air is compressed, dried, and filtered before delivering it into the plant air system.

1.6.2.2 Nitrogen System

A pressurized nitrogen system is used to provide backup nitrogen pressure for pneumatic instrumentation and to provide an inert gas for purging process piping and vessels. Valves are located on tie lines between the nitrogen header and the plant air and inert gas headers. During a loss of air pressure, these valves automatically open thereby supplying nitrogen pressure for critical pneumatic instrumentation and purging of equipment.

Nitrogen is also used as an inert gas for selected pressure-testing and processing operations.

1.6.3 Water

There are three primary water systems in the plant: 1) the Process Water System; 2) the Sanitary Water System; and 3) the Fire Water System. Process Water is supplied from three deep wells. Sanitary Water is supplied from a fourth well. All wells are located within the restricted area. The Fire Water System is considered a "closed" system in that it does not normally need fresh water makeup. Firefighting water is supplied from the fire water storage tank, which may be replenished as needed from the Process Water System. Each of these systems has a specific function, but interconnections are provided to ensure adequate water supply during emergencies or for deep well pump repairs.

1.6.4 Steam

Some chemical processes at the plant require steam in order to produce the final products. The primary use of steam is for:

- Steam tracing both indoors (mostly UF6 lines) and outdoors for freeze protection; and
- The UF6 Distillation process for vaporizing and reboiling the UF6.

Steam is produced by natural gas-fueled boilers, which are located at the Powerhouse, along with other supporting equipment.

1.6.5 Refrigeration

UF6 vapor produced in the fluorinators passes through a set of refrigerated cold traps to desublimate the UF6.

The cold trap system consists of primary, secondary, and tertiary cold traps. The UF6 gas flows through each type of cold trap in series. Cooling and heating for the primary cold traps is accomplished with glycol in three steps to minimize thermal stress. The secondary and tertiary cold traps are chilled with a refrigerant and heated with steam. Cooling for the refrigeration system's condenser is provided by a second refrigeration system.

1.7 Location of Buildings on Site

Drawing MTW-4781, included with the Application Revision 02/08/2017, illustrates the locations of buildings on the site for the UF6 conversion and related support services. This drawing also shows the location of the restricted area fence and distance and direction of public facilities of interest. Figure 1.2 indicates the location of the site relative to Southern Illinois and Western Kentucky.

1.8 Special Exemptions and Special Authorizations

1.8.1 Special Exemptions

In recognition of the nature of the MTW facility and the radiation protection program implemented at the facility, USNRC has previously granted to Honeywell exemptions from:

- *The radiological hazard posting requirements of 10 CFR 20.1902(a) (Ref. 3);*
- *The radioactive material labeling requirements of 10 CFR 20.1904(a) (Ref. 3);*
- *The requirements for use of the organ dose weighting factors provided in 10 CFR 20.1003, for effective dose assessments listed in International Commission on Radiological Protection (ICRP) 68 methodologies (Ref. 4);*
- *The requirements for use of the Derived Air Concentration (DAC) and Annual Limit on Intake (ALI) values provided in 10 CFR 20, Appendix B (Ref. 4).*
- *The requirements of 10 CFR 40.60(b)(3) for reporting of medical treatment of contaminated individuals at the on-site medical facility (Ref. 5).*

Section 4.0 of this Application discusses the controls implemented by Honeywell in lieu of strict compliance with the radiation protection requirements listed above. Section 11.6.2 of this Application provides a discussion of Honeywell's measures for recording medical treatment of contaminated individuals in lieu of reporting.

1.8.2 Special Authorizations

None.

1.9 Protection of Safeguards and Classified Information

Section 13.0 of this Application addresses protection of safeguards and classified information.

1.10 Site Description

The MTW Environmental Report, which is submitted with this Application, provides a description of the MTW site and its environs. The following subsections provide summaries of this information.

1.10.1 Geographical

MTW is located on approximately 1000 acres of land in Massac County at the southern tip of Illinois. The primary site perimeter is formed by U.S. Highway 45 to the north, the Ohio River to the south, an industrial coal

blending plant to the west and privately-owned, developed land to the east. Plant operations are conducted in a fenced restricted area (as defined at 10 CFR 20.1003) covering approximately 59 acres in the north-middle portion of the site. The licensee also owns approximately 100 acres of land directly across U.S. Highway 45.

The plant site is in gently rolling hills, typical of Southern Illinois, and is bounded on the south by the Ohio River flood plain. The surface water drainage of the site is to the south into the Ohio River.

The flood plain, between the restricted area and the Ohio River, was cultivated in the past. It is no longer farmed and is returning to a more natural vegetation stand.

1.10.2 Demographical

The plant site is in a predominantly agricultural area. Within a two-mile radius of the plant, approximately 68% of the land is undeveloped (e.g., cropland, forest, or wetland) and the remainder is developed.

Table 1-2 provides the populations and population densities of Massac County, IL, neighboring McCracken County, KY, and the surrounding 50-mile radius. Table 1-3 provides a summary of population data for communities in the surrounding area.

Figures 1.3 and 1.4 present the population distribution within a 50-mile radius of MTW.

The nearest residence is located approximately 1,850 feet north-northeast of the FMB. The nearest school is located approximately two miles east-northeast of the FMB.

The Protective Action Recommendations provided in the Emergency Response Plan are limited to shelter-in-place only; no provisions are required for evacuation of the near-site public.

1.10.3 Meteorological

Due to the location of the site at the southern tip of Illinois, the climate is more characteristic of Kentucky than of Illinois. Because of a slight moderating influence of the Ohio River, the absolute temperature range is smaller than that found in much of Illinois.

The region has two predominant weather patterns that define the winter and summer circulation regimes. Winter is characterized by evenly distributed precipitation events and moderate diurnal changes in temperature. During the summer, frontal and pressure systems generally pass north of the region, resulting in a more tranquil weather pattern over the area.

The average annual dry bulb temperature from 1995 through 2014 was 58 degrees Fahrenheit, with the warmest month being July (78.6 degrees) and the coolest being January (35.4 degrees). The minimum and maximum temperatures during this period were 8 degrees and 108 degrees Fahrenheit, respectively.

The average annual precipitation for the 1995 through 2014 period was 49.8 inches. Snowfall during this period averaged 8.7 inches per year. During much of the average winter, the ground remains unfrozen.

Recent data indicate that the seven county area averages 70 thunderstorm days per year.

The MTW Environmental Report provides a wind rose based on data collected at Paducah for the years 1993 through 2014. The average wind speed for this period was 5.8 knots. Figure 1.5 reproduces the wind rose from the MTW Environmental Report.

1.10.4 Hydrological

1.10.4.1 Groundwater

Within the site area, deposits of alluvium and loess do not yield enough water for domestic use. When saturated by precipitation, these formations transmit water to the underlying aquifers of the Pleistocene and Pliocene series. The mixed gravel, sand and clay of the Pleistocene and Pliocene series is the principal aquifer for domestic use. Domestic wells may be bored to a depth of 120 feet before encountering the Porter's Creek Clay formation. The shallowest aquifer adequate for most industrial needs is the Mississippian limestone, which occurs at a depth of 300 to 500 feet.

The Metropolis Plant water supply is pumped from wells bored into the Mississippian limestone. The total capacity of these four wells is more than 4500 gallons per minute (gpm) and significantly greater than normal operating requirements.

The Illinois Department of Public Health administers the drinking water regulations of the U.S. Environmental Protection Agency. The analyses required, and frequencies of testing are determined by the Department of Public Health based on the results obtained from previous analyses. The results of the most recent testing for lead, copper, volatile organic chemicals, herbicides/pesticides, and inorganics/metals indicate that the water meets current EPA standards.

There are no other private water users within the boundaries of the site. Public water use is obtained from the Massac County Water District (county residents) and the City of Metropolis.

The Plant's routine Resource Conservation and Recovery Act (RCRA) groundwater monitoring network consists of ten wells. One well is used for groundwater surface elevation determination only.

Other groundwater monitoring wells are installed and sampled as necessary to satisfy additional monitoring requirements established by the Illinois EPA.

1.10.4.2 Surface Water

There are no surface streams within the boundaries of the site; however, there are several natural water drainage concourses that carry rainwater run-off toward the Ohio River.

Most surface streams outside the site boundary are used for recreation and for watering livestock. Numerous farm ponds and lakes are found throughout the area. The Ohio River, which bounds the site on the south, is used for barge transportation, commercial and sport fishing and as a source of water supply for Paducah, Kentucky, eleven miles upstream of the site. The river is approximately 3000 feet wide with a normal pool elevation of 290 feet above mean sea level (msl). River flow is regulated by flood control structures, the nearest being lock and dam No. 52 at Brookport, Illinois, about seven miles upstream from the site.

Although flooding is an annual event, the plant site has never been reached by flood waters. While the 1937 flood reached an elevation of 342 feet, the probable elevation of a 100-year flood (1 in 100 chance of occurring in each year) in the area is 337 feet. The plant site elevation is approximately 375 feet and is considerably above the most extreme flood level projected.

1.10.5 Seismological

The Metropolis Works facility is located within the area of significant influence of the New Madrid Seismic Zone (NMSZ), an area considered to feature the highest seismicity in the United States east of the Rocky Mountains. Although smaller faults exist in Illinois, Eastern Tennessee and Southern Indiana, the NMSZ represents the controlling mechanism for maximum ground shaking intensities. The greatest earthquake hazards affecting the site are those associated with the NMSZ.

The MTW ISA Summary (Ref. 6) provides additional information regarding seismological characteristics of the site and measures implemented to address seismic hazards.

1.10.6 Geological

The topography of the MTW site is relatively flat. Southern Illinois has gently rolling hills, with MTW site terrain between 300 and 380 feet (91 and 116 meters) above msl. Within the restricted area, the maximum variation in elevation is about 10 feet.

The site is located at the northern end of the Mississippi Embayment, a depositional basin filled in with sediments 40 to 100 million years old that overlie older (300 to 600 million-year-old) bedrock. Surface soils at the Metropolis facility consist of silty loam and silty clay loam which have low permeability and poor drainage. Figure 1.6 presents a geologic map and cross section running along the Ohio River, showing the various geologic deposits underlying the MTW site.

Alluvial deposits consisting of sand, silt or clay and localized sandy gravel deposits are found along the Ohio River. Locally, the MTW site and much of the surrounding region overlies approximately a few meters of Quaternary loess. Surficial geologic maps (Figure 1.6) developed by the Illinois State Geological Survey (ISGS) exclude this loess veneer and show the area of the site to overlie the Metropolis Formation, consisting of clay-rich silty sand and sandy silt, ranging in thickness from 6 to 17 meters (20 to 50 feet).

The Metropolis Formation is composed of silty sand and sandy silt, having a clay matrix and containing scattered chert and quartz pebbles and lenses of clean sand and gravel with bedding is absent to weakly developed. The sediments are deeply weathered and thoroughly burrowed and contain multiple buried soil horizons and contain chert pebbles reworked from the underlying Mounds Gravel. The Metropolis Formation is interpreted as fluvial sediments that occupied an underfit valley ancestral to the modern Ohio. The sediment was subjected to long periods of weathering and soil formation.

Near the Ohio River, the Mounds underlies the Metropolis Formation at elevations below 380 feet. The Mounds Gravel is interpreted as deposits of large, braided rivers that were at least partly ancestral to the modern Tennessee River, and consists principally of gravel composed of chert pebbles ranging up to about 4 inches in diameter and lesser quantities of quartz pebbles up to 0.5 inch across. The gravel is crudely layered or cross-bedded and contains lenses of sand. The upper part of the Mounds includes fine to coarse grained sand in a clay matrix and contains scattered chert granules. The sand lacks mica and has indistinct layering. Sand of

the Mounds is exposed at the northwest corner of the Metropolis landfill, where it is dropped into a graben. Groundwater monitoring wells at the MTW site are completed in the Mounds Gravel.

Bedrock underlying the unconsolidated Mounds Gravel surface deposits consists of Tertiary Porter's Creek Clay, Cretaceous McNairy Formation sand, silts and clays, and Mississippian limestones and sandstones. The McNairy Formation sands, silt and clay are approximately of 40 to 49 meters (130 to 160 feet) thick. The Mississippian Salem Limestone is approximately 86 meters (250 feet) thick and occurs at an approximate depth of 91 meters (300 feet).

1.11 References

1. Title 10, Code of Federal Regulations, Part 40, Domestic Licensing of Source Material, USNRC.
2. ANSI N14.1, Packaging of Uranium Hexafluoride for Transport, American National Standards Institute, 2012.
3. Letter, USNRC to Honeywell International, Inc., Amendment Request for an Exemption to 10 CFR 20.1902(a) and 20.1904(a), TAC L32390, dated November 2, 2007.
4. Letter, USNRC to Honeywell Metropolis Works, Exemption from the Requirements of Title 10 of the Code of Federal Regulations Part 20 Appendix B and Title 10 Code of Federal Regulations Part 20.1003 to Modify Derived Air Concentration, Annual Limit on Intake, and Organ Dose Weighting Factor Values (TAC No. L32775), dated June 13, 2012.
5. Letter, USNRC to Honeywell Metropolis Works, Approval of Exemption from the 24-Hour Reporting Requirement of Title 10 of the Code of Federal Regulations Section 40.60(b)(3) for Medical Treatment of Contaminated Individuals at the Honeywell Metropolis Works On-Site Medical Facility (Cost Activity Code 000224), dated January 30,2018.
6. Integrated Safety Analysis Summary, Honeywell Performance Materials and Technology, 2016.
7. US Census Bureau tiger files - 2010 SF1 2010-2014 ACS – Illinois and Kentucky Block and Block Group Data, Place Data, et. al. Retrieved from <http://www.census.gov/geo/maps-data/data/tiger-data.html> (accessed March 4, 2016).
8. US Census Bureau 2010 SF1 – Massac County, Illinois and McCracken County, Kentucky. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml> (accessed March 4, 2016).

Table 1-2
Population Density Within a 50-Mile Radius of MTW

Geographic Area	2010 Population	Density (People/Mile^2)
Massac County, IL	15,429	64
McCracken County, KY	65,565	245
50-mile Radius from MTW	528,404	67
(Ref. 7, Ref. 8)		

Table 1-3
Communities Near MTW

City	County/State	Distance from MTW (miles)	Direction from MTW	2010 Population
Metropolis (city)	Massac, IL	2.0	SE	6,537
Joppa (village)	Massac, IL	5.5	WNW	360
Brookport (city)	Massac, IL	7.5	ESE	984
Kevil (city)	Ballard, KY	9	SW	376
Bandana (CDP)	Ballard, KY	11	West	203
Paducah (city)	McCracken, KY	11	SE	25,024
Massac (CDP)[a]	McCracken, KY	10	SSE	4,505
Hendron (CDP)[a]	McCracken, KY	11	SE	4,687
Farley (CDP)[a]	McCracken, KY	14	SE	4,701
Woodlawn-Oakdale (CDP)[a]	McCracken, KY	14	SE	Null
Reidland (CDP)[a]	McCracken, KY	16	SE	4,491
Ledbetter (CDP)[a]	Livingston, KY	18	ESE	1,683

a. Communities adjacent to Paducah, Kentucky

Distances are approximate.

CDP = Census Designated Place

Null: no available data

(Ref. 7, Ref. 8)

Figure 1.1 – UF6 Conversion Flow Diagram

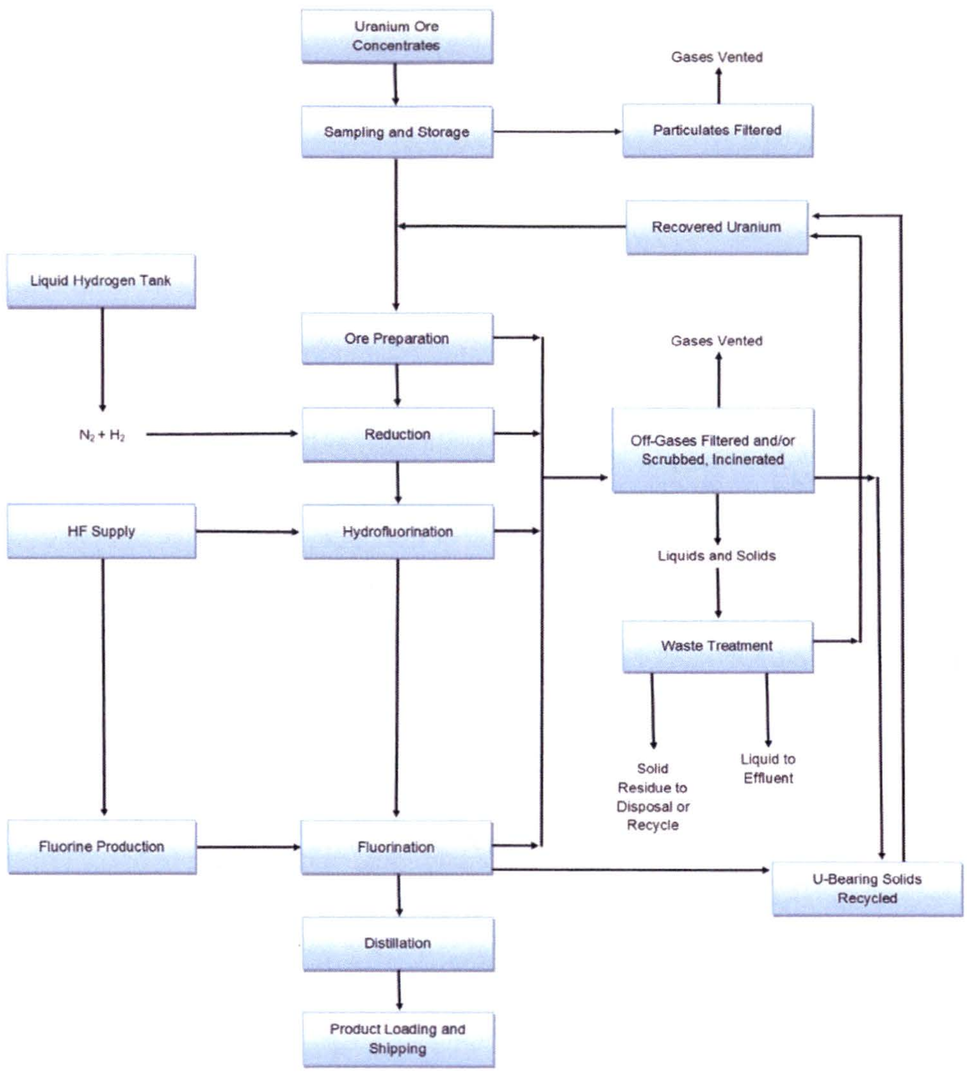


Figure 1.2 – Location of Honeywell Metropolis Works Site

Figure 1.3 – Population 0 – 10 Miles from Honeywell Metropolis Works - 2010

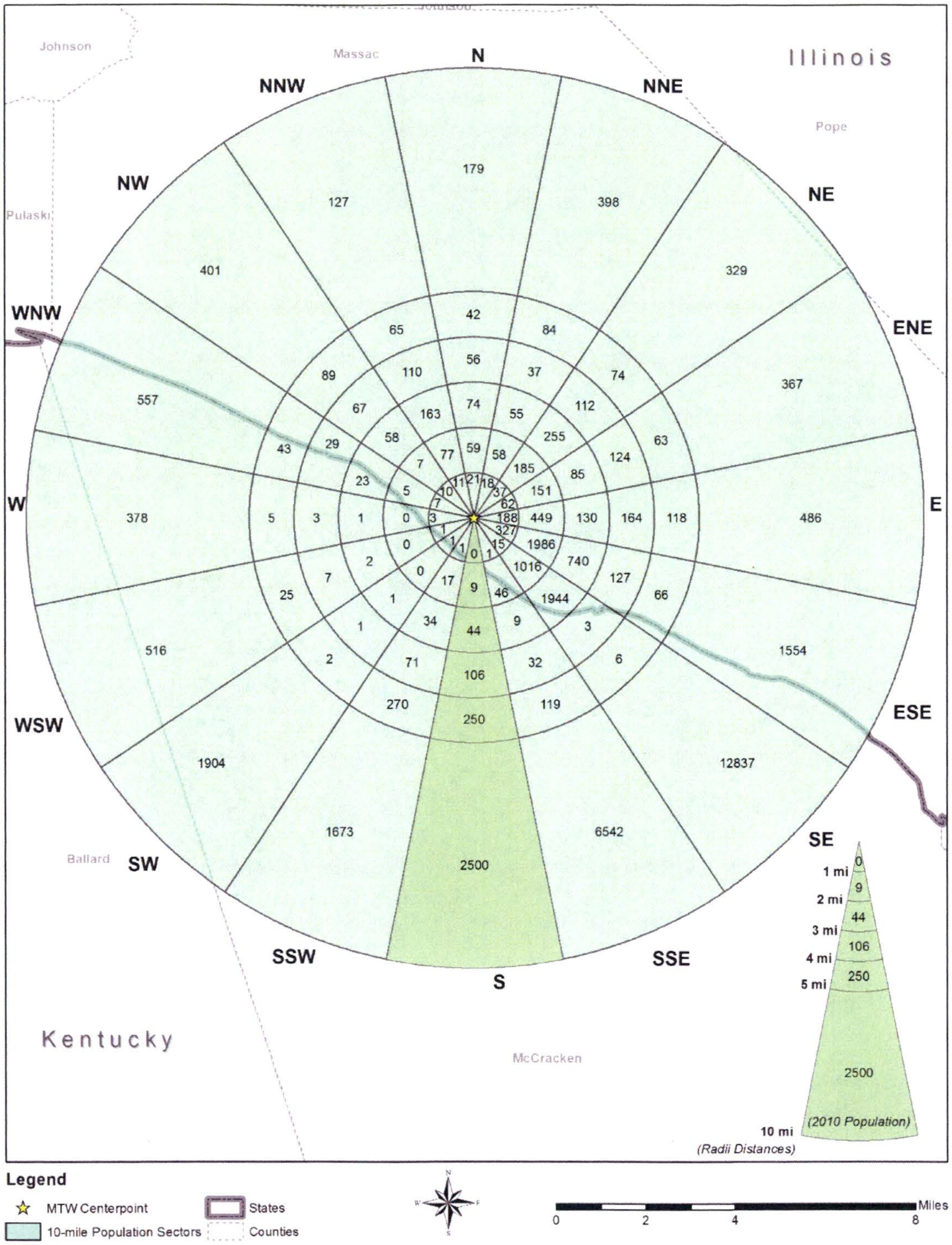


Figure 1.4 – Population 10 – 50 Miles from Honeywell Metropolis Works - 2010

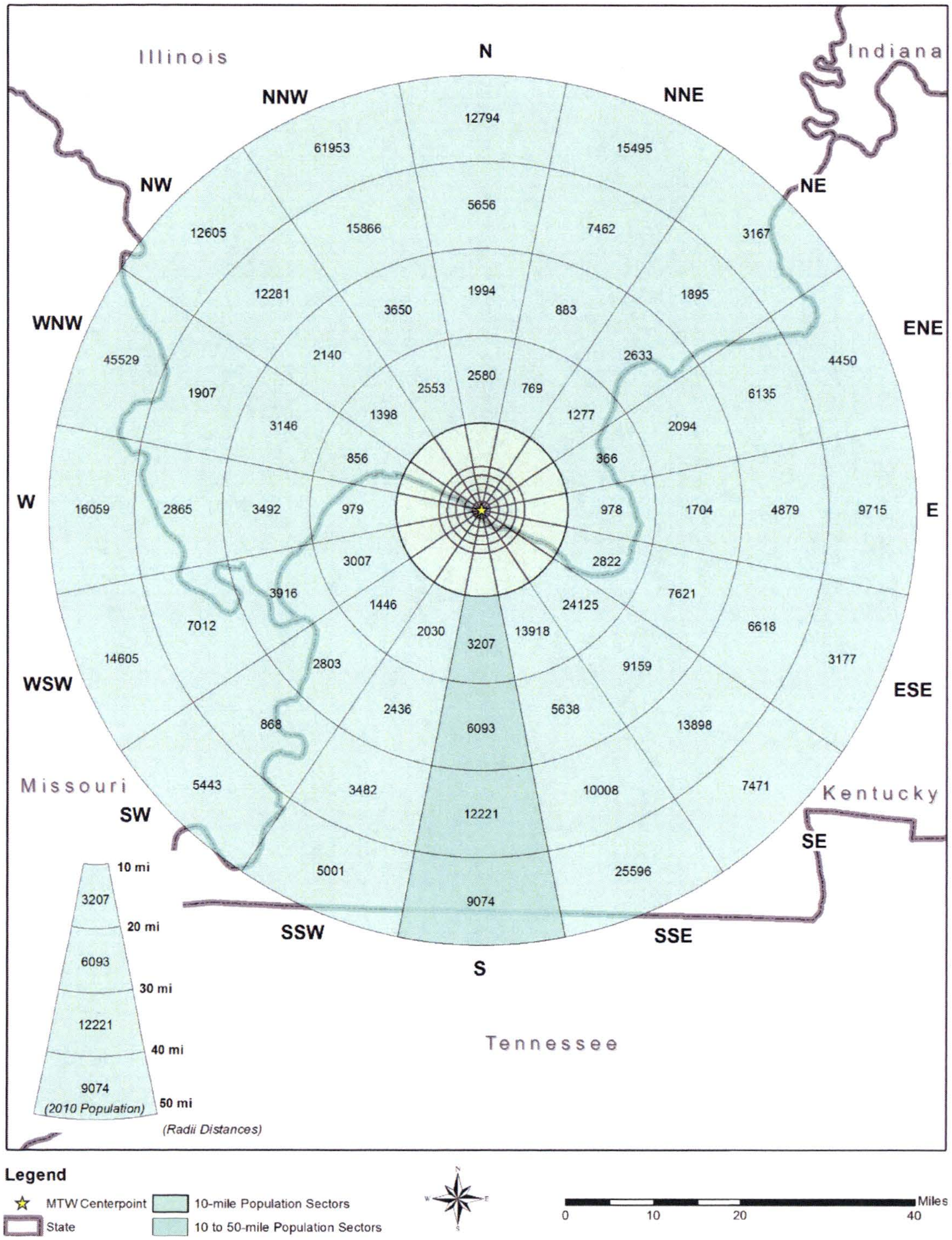


Figure 1.5 – Paducah, KY Wind Rose 1993 - 2012

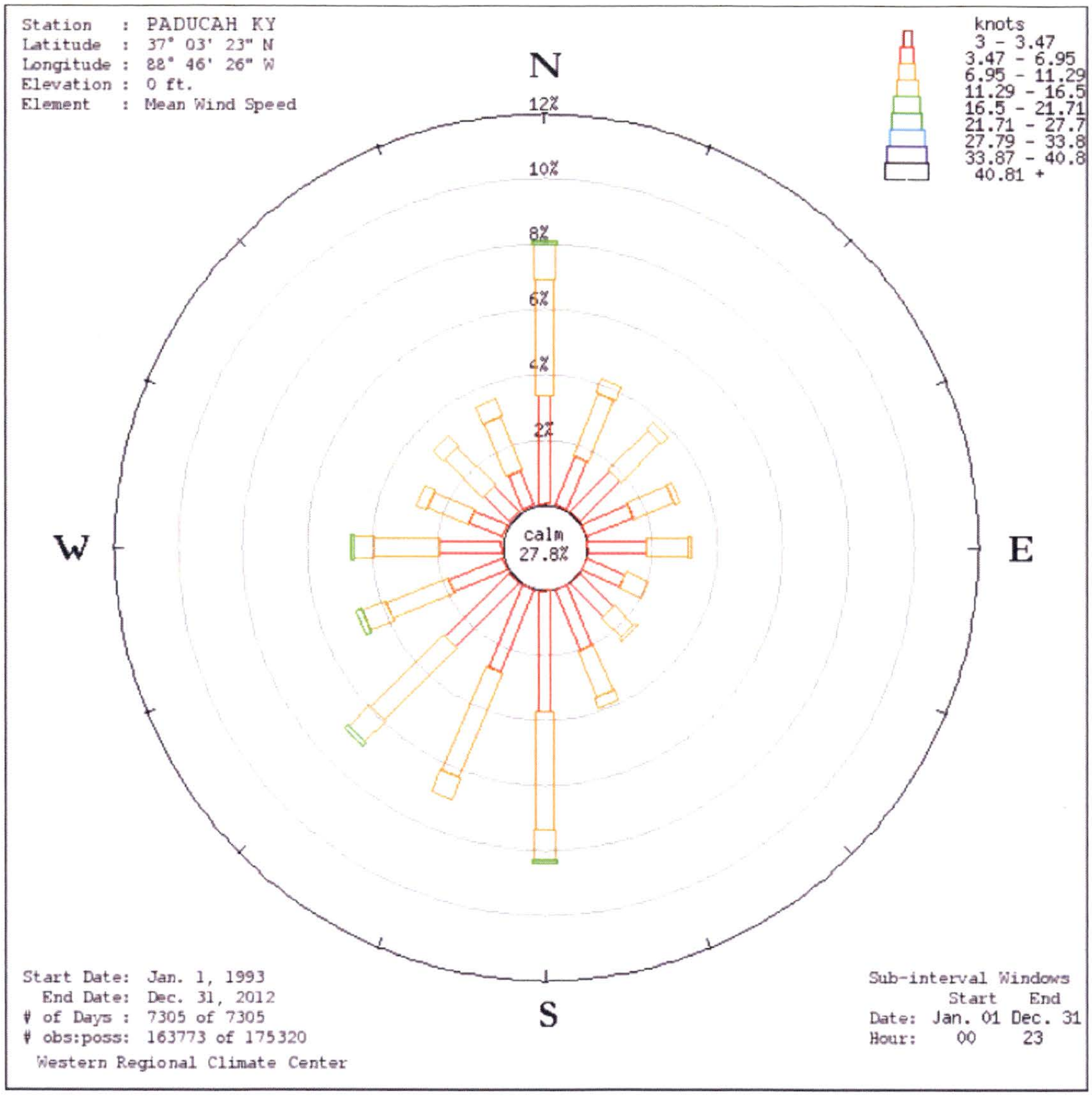
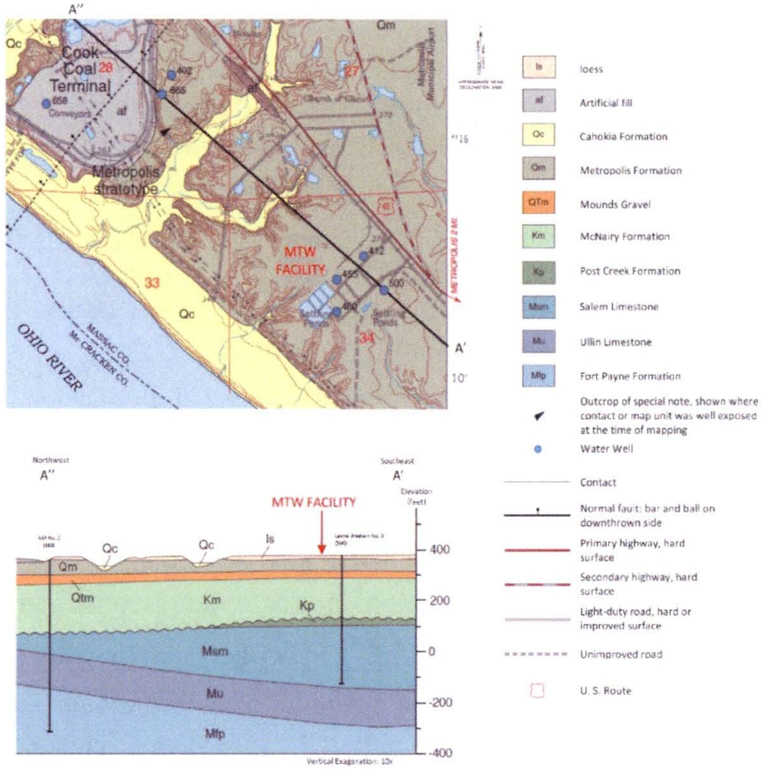


Figure 1.6 – Geologic Map and Cross Section A' – A''



2.0 ORGANIZATION AND ADMINISTRATION

2.1 Organizational Responsibilities and Authority

The Metropolis UF6 conversion plant is owned and operated by Honeywell International Inc. Corporate headquarters are located in Morris Plains, New Jersey. The top-ranking member of management at the plant site is the Plant Manager. The Plant Manager reports to business unit executives in Honeywell's corporate offices.

Personnel permanently assigned to the site typically report through a chain of command to the Plant Manager. The lines of authority for production, maintenance, process safety and engineering functions are independent of those for industrial safety, radiological safety, auditing, and regulatory affairs.

Figure 2.1 provides an organizational chart that outlines specific reporting arrangements and management roles.

The following sections discuss functional titles and responsibilities. The actual job titles, responsibilities, and reporting relationships may change as organizational needs evolve, and the various roles and responsibilities may be combined or separated as necessary to support ongoing organizational needs.

2.2 Personnel Education, and Experience Requirements

The following sections describe the qualification prerequisites for specified staff positions. *Individuals who do not meet the formal educational requirements specified below are not automatically eliminated where other factors provide sufficient demonstration of their abilities. The Plant Manager evaluates and approves these factors on a case-by-case basis.*

2.2.1 Plant Manager

The Plant Manager reports to corporate executive-level personnel and bears primary responsibility for the safe, efficient, and reliable operation of the facility. The Plant Manager delegates these responsibilities through his staff managers, as discussed in this section. Requirements for the position of Plant Manager include:

- Four-year degree or equivalent experience in Engineering, Science, or related discipline
- Eight years of diversified experience in chemical manufacturing, including supervisory or management experience
- Sound judgment and ability to work effectively with management, labor, and government officials.

2.2.2 Nuclear Compliance Director

The Nuclear Compliance Director is responsible for providing technical leadership, functional oversight, and coordinating expert support for the radiation safety, nuclear culture development, emergency response programs, and management systems for the site. In conjunction with the Plant Manager, the Nuclear Compliance Director represents the site in contacts with regulatory agencies, the local community, and industry advocacy groups. Requirements for the position of Nuclear Compliance Director include:

- Four-year degree or equivalent experience in Engineering, Chemistry, Safety Management, Environmental Science, or a related science or technical field
- Two years of nuclear fuel cycle experience
- Sound judgment and ability to work effectively with management and government officials.

2.2.3 Regulatory Affairs Manager

The Regulatory Affairs Manager is responsible for monitoring the development and implementation of plant programs and activities to ensure they meet applicable regulatory and licensing requirements. The Regulatory Affairs Manager oversees the activities of the Audits and Inspections and Corrective Action Programs and manages Honeywell's interface with regulatory agencies. This individual provides management oversight for development and implementation of the radiation protection program and monitors compliance with related USNRC regulatory and licensing requirements. The Regulatory Affairs Manager is also responsible for ensuring the ISA and ISA Summary are developed, maintained, and revised in a manner consistent with applicable USNRC regulatory and licensing requirements, adapted as necessary to reflect site-specific considerations. Responsibilities also include management and implementation of the Emergency Response and Fire Protection Programs. Requirements for the position of Regulatory Affairs Manager include:

- Four-year degree or equivalent experience in Engineering, Science, or related discipline
- Eight years of diversified experience in chemical or nuclear industry, including supervisory, management, or oversight experience
- Knowledge of applicable regulations and other standards
- Two years of nuclear fuel cycle experience

- Sound judgment and ability to work effectively with management and government officials
- Eight to ten years' health physics or related experience.

2.2.4 Health, Safety, and Environmental (HSE) Manager

The HSE Manager is responsible for the Environmental, Chemical, and Industrial Safety programs. Requirements for the position of HSE Manager include:

- Four-year degree in a Health, Safety, and Environmental or related discipline.
- Five years of experience in a Health, Safety, or Environmental role within a manufacturing environment, including supervisory or management experience
- Knowledge of applicable regulations and other standards
- Sound judgment and ability to work effectively with management and government officials.

2.2.5 Maintenance Manager

The Maintenance Manager is responsible for process and facility maintenance activities, including preventative and corrective maintenance and management of the Maintenance staff. Requirements for the position of Maintenance Manager include:

- Four-year degree or equivalent experience in Mechanical or Chemical Engineering or equivalent technical discipline
- Seven years of maintenance experience, including supervisory or management experience
- Sound judgment and ability to work effectively with management and government officials.

2.2.6 Technology Manager

The Technology Manager is responsible for overseeing the activities of the Process Engineering staff in development and implementation of plant design changes and maintenance of the design status, consistent with applicable codes and standards. The Technology Manager provides oversight for the design change process using the configuration management system described in Section 11.0 of this Application. Also, the Technology Manager is responsible for implementation of the Process Safety Management (PSM) program at the MTW site. Requirements for the position of Technology Manager include:

- Four-year degree or equivalent experience in Chemistry or Chemical Engineering or equivalent technical discipline
- Six years of technical experience, including supervisory or management experience
- Sound judgment and ability to work effectively with management and government officials.

2.2.7 Operations Manager

The Operations Manager is responsible for managing production functions associated with Honeywell's uranium processing operations, including maintaining compliance with applicable regulatory and license requirements. Requirements for the position include:

- Four-year degree or equivalent experience in Chemistry or Chemical Engineering or equivalent technical discipline
- At least five years chemical processing experience, including supervisory or management experience
- Knowledge of applicable regulations and other standards
- Sound judgment and ability to work effectively with management and government officials.

2.3 Implementation of HSE Functions

The HSE Manager holds overall authority for implementation of the industrial HSE functions on the MTW site, including development of appropriate HSE procedures using the site procedure development and control process as described in Section 11.0 of this Application. The HSE Manager has authority to shut down operations that appear to be unsafe. Following completion of corrective actions, a Honeywell supervisor may approve restart of operations that have been shut down under these conditions.

The Regulatory Affairs Manager holds equivalent authorities for implementation of the radiological safety functions.

All employees on site have the right and responsibility to identify potentially unsafe conditions, stop work, and report the unsafe conditions to the responsible supervisor, the HSE organization, or site leadership. Honeywell establishes and maintains procedures to ensure effective implementation of this process.

All employees and contractor personnel working on-site have the responsibility and right to initiate a "stop work" process, relative to any safety or health concerns, in accordance with the project or facility procedures to ensure the workplace and associated work activities are safe. Employees are trained to notify the designated supervisor of a concern or questionable safety practice or condition. Contractors

also receive orientation on the responsibility and reporting of personnel safety and health concerns.

Employees and contractors are also trained to be aware that other avenues of reporting and resolving safety concerns are available and that employees and other persons on-site have the right and responsibility to utilize those resources.

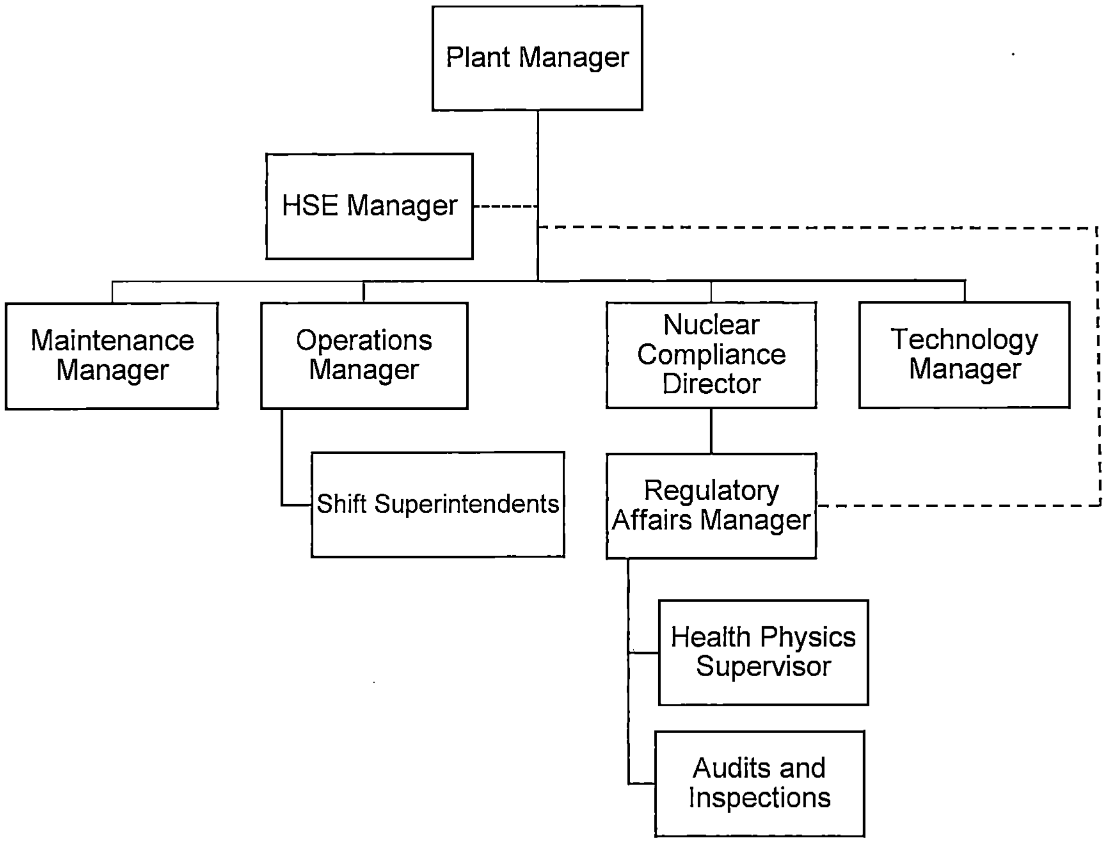
2.4 Management Measures

Section 11.0 of this Application provides a description of the management measures that are applied to Plant Features and Procedures (PFAP) as identified in the MTW ISA Summary, to ensure the PFAPs are available and reliable to perform their functions when needed.

2.5 Offsite Emergency Response Resources

Honeywell maintains written agreements to assure the availability of offsite emergency response support for site emergencies. Honeywell maintains these agreements in accordance with the MTW Emergency Response Plan.

Figure 2.1 – MTW Organizational Chart



3.0 INTEGRATED SAFETY ANALYSIS

3.1 Introduction

To assess the risks associated with accidents involving licensed materials, *Honeywell has conducted and maintains an integrated safety analysis which is informed by the technically relevant and appropriate requirements of Subpart H of 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material" (Ref. 1) and guidance provided in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (Ref. 2).* Although MTW is not licensed under 10 CFR Part 70, Honeywell has previously conducted an ISA to provide a structured analysis of MTW site hazards and the safety controls applied to prevention and/or mitigation of identified accident sequences.

This section addresses MTW's ISA methods and commitments. Section 11.0 of this Application provides a discussion of Honeywell's process for reviewing and approving changes to the MTW ISA Summary.

3.2 ISA Process Overview

3.2.1 Process Safety Information

Honeywell develops and maintains written elements of Process Safety Information (PSI). Depending on the complexity of, and hazards associated with, the process, PSI may include:

- The hazards of materials used or produced in the process;
- Process technology (including flow diagrams), outlines of process chemistry, operating parameters and limits, evaluations of health and safety consequences of process deviations; and
- Equipment descriptions, including materials of construction, piping and instrumentation diagrams, ventilation, applicable codes and standards, and safety features.

Honeywell updates the PSI as changes are made or new information becomes available. Honeywell implements the configuration management process discussed in Section 11.0 of this Application to control changes to MTW facilities and processes.

Honeywell also uses PSI for performing updates to the ISA.

3.2.2 Integrated Safety Analysis

Honeywell has conducted and maintains an ISA for selected processes as described in the MTW ISA Summary. This discussion addresses the major processes that are involved in the production of uranium hexafluoride (UF6) from uranium ore. Process concerns are related to the loss of confinement of UF6 or hydrofluoric acid (HF). Other concerns include radiation exposure (from uranium ore or compounds), worker safety, public safety, equipment

damage and uncontrolled releases of hazardous chemicals to the environment. These incidents could be initiated because of failures in process components, human error or operational errors, or external events (e.g., natural phenomenon).

The MTW ISA identifies:

- *Radiological hazards related to possessing or processing licensed material;*
- *Chemical hazards of licensed material and hazardous chemicals produced from licensed material (including evaluations of credible exposure pathways associated with the identified accident sequences);*
- *Facility hazards that could affect the safety of licensed materials and thus present an increased radiological risk;*
- *Potential accident sequences caused by process deviations or other events internal to the facility and credible external events, including natural phenomena;*
- *The consequence and the likelihood of occurrence of potential accident sequences, and the methods used to determine the consequences and likelihoods; and*
- *Plant Features and Procedures (PFAP), including the assumptions and conditions under which they support compliance with the identified performance requirements. PFAP are analogous to Items Relied On For Safety (IROFS) in Part 70, Subpart H, and NUREG-1520.*

The chemical and radiological hazards identified in the first three bullets, above, are those that fall within the USNRC's authority and responsibility per Sections II.1 and II.2 of the Memorandum of Understanding (MOU) between the U.S. Nuclear Regulatory Commission and the Occupational Safety and Health Administration (Ref. 3).

Honeywell identifies credible accident scenarios using the Process Hazards Analysis (PHA) methodologies implemented under the PSM Program. *Honeywell performs and maintains the ISA using methods described in NUREG-1513, "Integrated Safety Analysis Guidance Document" (Ref. 4).* *

For each credible accident scenario, Honeywell evaluates the unmitigated consequences using qualitative and/or quantitative methods, such as those described in NUREG/CR-6410, "Nuclear Fuel Cycle Facility Accident Analysis Handbook" (Ref. 5). Based on the evaluation results Honeywell assigns each credible accident scenario a consequence category of "Low," "Intermediate," or "High." *

A risk assessment is performed for credible accident scenarios with "intermediate" or "high" consequences. Qualitative or quantitative risk assessment methods are used to determine the risk of each credible accident scenario.

Honeywell identifies PFAP to prevent or mitigate each credible accident scenario such that the performance requirements of 10 CFR 70.61 (Ref. 6) are met by "intermediate" consequence events being unlikely and "high" consequence events being highly unlikely as defined in the ISA Summary. PFAP may be engineered controls or administrative controls.

PHA team leaders receive training in accordance with the PSM Program as outlined in Section 11.0 of this Application. Honeywell personnel who are responsible for maintaining the ISA receive training on applicable site procedures. Honeywell may assign external support personnel having suitable qualifications to support development of the ISA and ISA Summary.

Consistent with Section 11.0 of this Application, Honeywell will initiate licensed operations only after completion of the required analyses and implementation of identified protective measures.

Honeywell develops and maintains one or more site procedures governing development and maintenance of the ISA and the ISA Summary. Honeywell initiates and processes updates to the ISA and ISA Summary using the configuration management process described in Section 11.0 of this Application.

3.2.3 ISA Summary

The ISA Summary contains (or provides reference to) the following elements as specified in 10 CFR 70.65 (Ref. 7):

- *General description of the site;*
- *General description of the facility;*
- *Description of facility processes, hazards, and types of accident sequences;*
- *Demonstration of compliance with identified performance requirements;*
- *Description of the ISA team qualifications and ISA methods;*
- *List of PFAP;*
- *Description of chemical consequence standards;*
- *List of sole PFAP; and*
- *Definitions of the terms "credible," "unlikely," and "highly unlikely."*

3.2.4 Management Measures

Section 11.0 of this Application provides a description of the management measures implemented to ensure the reliability and availability of PFAP as identified in the Integrated Safety Analysis Summary. Honeywell is committed to implementation of the management measures described in Section 11.0 of this Application.

3.3 ISA Process Implementation

This section outlines the approach utilized for performing the ISA. The approach is consistent with the Example Procedure for Accident Sequence Evaluation, Appendix A to Chapter 3 of NUREG-1520. *This approach employs a semi-quantitative risk index method for categorizing accident sequences in terms of their likelihood of occurrence and their consequences of concern. The risk index method framework identifies which accident sequences have consequences that could exceed the performance requirements of 10 CFR 70.61 and therefore require designation of Plant Features and Procedures (PFAP) and supporting management measures.* * Descriptions of these general types of higher consequence accident sequences are reported in the ISA Summary.

The risk index method is regarded as a screening method, not as a definitive method of proving the adequacy or inadequacy of the PFAP for any accident. The MTW ISA Summary identifies the engineered and administrative PFAP that are required to protect accident sequences that could exceed the performance requirements of 10 CFR 70.61.

3.3.1 Hazard Identification

Honeywell uses the hazard and operability analysis method to evaluate the UF6 process systems and facilities. * This method is consistent with the guidance provided in NUREG-1513 and NUREG-1520. The hazards identification process results in identification of physical, radiological or chemical characteristics that have the potential for causing harm to site workers, the public, or to the environment. The hazards identification process entails the use of system descriptions, piping and instrumentation diagrams, process flow diagrams, plot plans, topographic maps, utility system drawings, and specifications of major process equipment.

Honeywell considers external events at the site and facility level instead of the individual system level. The external event ISA considers both natural phenomena and man-made hazards. Given that external events were considered at the facility level, the ISA for external events was performed after the ISA for all plant systems were completed. Each external event was assessed for both the uncontrolled (Unmitigated) case and then for the controlled case. The controlled cases could be a specific design basis for

that external event, a PFAP or a combination of both. An Accident Sequence and Risk Matrix was prepared for each external event.

3.3.2 Process Hazard Analysis Method

The process hazard analysis (PHA) method is consistent with the guidance provided in NUREG-1513 and Occupational Safety and Health Administration's (OSHA) Process Safety Management (PSM) Standard 29 CFR 1910.119 (Ref. 8).

- For each potential hazard, the causes, including potential interactions among materials are considered. Then, for each cause, the consequences and consequence severity category for the consequences of interest (Chemical Releases, Radiation Exposure, Environment impacts) are considered.
- For each hazard, the existing safeguards designed to prevent the hazard from occurring are considered.
- For each hazard, the existing design features that could mitigate/reduce the consequences are considered.
- For each external event hazard, it was determined if the external hazard is credible (i.e., external event initiating frequency >10^{-6} per year).

3.3.3 Selection of Quantitative Standards

Uranium hexafluoride (UF6) is a chemical of concern that is generated at the facility. For licensed material or hazardous chemicals produced from licensed materials, chemicals of concern are those that, in the event of release, have the potential to exceed concentrations defined in 10 CFR Part 70. UF6 represents a health hazard to facility workers and the public if released to the atmosphere due to the radiological and toxicological properties of two byproducts - hydrogen fluoride (HF) and uranyl fluoride (UO_2F_2) - which are generated when UF6 is released and reacts with water vapor in the air. _Criteria for evaluating potential releases and characterizing their consequences as either "high" or "intermediate" for members of the public and facility workers are presented in Table 3-1, Consequence Severity Categories Based on 10 CFR 70.61_, and Table 3-2, Chemical Dose Information. A second chemical of concern is anhydrous hydrogen fluoride, HF, which is used in the production process.

3.3.4 Consequence Analysis Method

10 CFR 70.61 specifies two categories for accident sequence consequences: "high consequences" and "intermediate consequences." Implicitly there is a third category for accidents that produce consequences less than "intermediate." These are referred to as "low consequence" accident sequences. _The primary purpose of ISA is to identify all_

uncontrolled and unmitigated accident sequences. These accident sequences are then categorized into one of the three consequence categories (high, intermediate, low) based on their expected radiological, chemical, and/or environmental impacts. This section describes the methodology used to determine chemical exposure/dose and radiochemical exposure/dose criteria used to evaluate potential impact to the workers and the public in the event of material release. This section limits itself to the potential effects associated with accidental release conditions. Potential impacts from chronic (e.g., long-term) discharges from the facility are detailed in the Environmental Report.

In evaluating the magnitude of the accident consequences, calculations were made to assess both the chemotoxic and radiological consequences. The calculated consequences were evaluated and compared to the criteria for "high" and "intermediate" consequences.

Table 3-1, Consequence Severity Categories Based on 10 CFR 70.61, presents the radiological and chemical consequence severity limits of 10 CFR 70.61 for each of the three accident consequence categories. Table 3-2, Chemical Dose Information, provides information on the chemical dose limits specific to MTW. *

3.3.5 Defining Consequence Severity Categories

The accident sequences identified by the MTW ISA were categorized into one of three consequence categories (high, intermediate, or low) based on their forecast radiological, chemical, and/or environmental impacts. *The MTW ISA presents the radiological and chemical consequence severity limits defined by 10 CFR 70.61 for the high and intermediate consequence categories. To quantify criteria of 10 CFR 70.61 for chemical exposure, standards for each applicable hazardous chemical must be applied to determine exposure that could: (a) endanger the life of a worker; (b) lead to irreversible or other serious long-lasting health effects to an individual; and (c) cause mild transient health effects to an individual. Per NUREG-1520, acceptable exposure standards include the Emergency Response Planning Guidelines (ERPG) established by the American Industrial Hygiene Association and the Acute Exposure Guideline Levels (AEGL) established by the National Advisory Committee for Acute Guideline Levels for Hazardous Substances.* *

The consequence severity limits of 10 CFR 70.61 have been summarized and presented in Table 3-1, Consequence Severity Categories Based on 10 CFR 70.61. The severity limits defined in this table are developed against set criteria. Therefore, some of these limits have been further refined so that they are useful for conducting consequence analysis assessment with respect to the total dose (i.e., concentration multiplied by

duration of exposure) that could reasonably be received under accident conditions.

These refinements are necessary as the chemical and radiological exposure target values are time dependent. As an example, ERPG and AEGL values for chemical exposure limits assume fixed exposure durations; these values must be appropriately scaled to exposure durations that reflect realistic exposure durations associated with a given accident.

The toxicity of UF6 is due to its two hydrolysis products, HF and UO_2F_2. The toxicological effects of UF6 as well as these byproducts are described in MTW ISA Summary AEGL and NUREG-1391 (Ref. 9) values for HF and UF6 were utilized for evaluation of chemotoxic exposure. Additionally, because the byproduct uranyl fluoride is a soluble uranium compound, the AEGL values were derived for evaluating soluble uranium exposure in terms of both chemical toxicity and radiological dose. In general, the chemotoxicity of uranium inhalation/ingestion is of more significance than radiation dose resulting from internal U exposure. The ERPG and AEGL values for HF are presented in Table 3-3, ERPG and AEGL values for Hydrogen Fluoride. The ERPG and AEGL values for UF6 (as soluble U) are presented in Table 3-4, ERPG and AEGL values for Uranium Hexafluoride (as soluble U). *

Table 3-5, Enhanced Definition of Consequence Severity Categories, represents enhanced derived values as extrapolated from the HF and UF6 (as soluble U) AEGL and NUREG-1391 values. These enhanced definitions have been applied in order to determine consequence severity as characterized against the criteria of 10 CFR 70.61. These enhanced values have been derived using EPA recognized methodologies for normalizing chemical exposure to values appropriate for the time intervals under consideration. * The rationale associated with exposure times are further defined below.

3.3.6 Worker Exposure Assumptions

Any release from UF6 systems/cylinders at the facility would predominantly consist of HF with some potential entrainment of uranic particulate. An HF release would cause a visible cloud and a pungent odor. The odor threshold for HF is less than 1 ppm and the irritating effects of HF are intolerable at concentrations well below those that could cause permanent injury or produce escape-impairing symptoms.

Honeywell uses the following assumptions when evaluating worker exposure in cases where a local worker would be expected to be in the immediate proximity of a release (e.g., pigtail connect/disconnect, maintenance, etc.):

- As a result of site training, affected workers will take immediate self-protective action to escape a release area upon detecting any significant HF odor.
- The values have been normalized to a one-minute exposure. The operator will not begin to move away from the source of the leak until HF is present.
- The source term of UF6/HF is released into a hemisphere that reflects the close proximity of the worker's breathing zone and that the worker would remain in this space for a period of 10 seconds before moving away. Therefore, use of the one-minute exposure criterion is conservative.

For the purposes of evaluating worker exposures for workers who may be present elsewhere in the room of release, Honeywell normalizes the values in Table 3-5, Enhanced Definition of Consequence Severity Categories, to 2.5 minute and five-minute exposures. Once a release is detected through visual observation and/or odor, Honeywell estimates that it would take a worker no more than 2.5 minutes to evacuate the area of concern.

Another assumption made in conducting consequence severity analysis is that for releases precipitated by a fire event, Honeywell considers only public exposure in determining consequence severity; worker exposures were not considered. Fires of sufficient magnitude to generate chemical/radiological release must either have caused failure of a mechanical system/component or involve substantive combustibles containing uranic content. In either case, the space would be untenable for unprotected workers. Honeywell procedures require that fire brigade/fire department members responding to emergencies to have suitable respiratory and personal protective equipment.

3.3.7 Public Exposure Assumptions

Honeywell also evaluates potential exposures to members of the public using conservative assumptions for both exposure concentrations and durations. Exposure was evaluated for consequence severity against chemotoxic, radiotoxic, and radiological dose.

Honeywell estimates public exposures to last for a duration of 30 minutes. This is consistent with self-protective criteria for UF6/HF plumes listed in NUREG-1140 (Ref. 10). *

3.3.8 Chemical Release Scenarios

The MTW ISA Summary presents the evaluation level chemical release scenarios based on the criteria applied in the Integrated Safety Analysis. The MTW ISA Summary also provides information on the criteria used for development of these scenarios.

3.3.9 Source Term

The methodologies used to determine source term are those prescribed in NUREG/CR-6410. *

3.3.10 Dispersion Methodology

Honeywell uses conservative dispersion methodologies in estimating the dispersion of chemical releases from the facility. Historically, Honeywell has used a toxic gas dispersion model based on the Environmental Protection Agency (EPA) code "ALOHA." **ALOHA** (Arial Locations of Hazardous Atmospheres) is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. ALOHA can predict the rates at which chemical vapors may escape into the atmosphere from broken gas pipes, leaking tanks, and evaporating puddles. It can then predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release.

Honeywell has analyzed releases of UF6 using the RASCAL computer program. The RASCAL code uses similar conservative "puff" and "plume" meteorological models from user input based on current actual or postulated expected conditions. The RASCAL code also has the capability of considering temporal variations in meteorological data, building wake effects, and site topography (topography for MTW is built into the program).

For releases inside of buildings, volumetric dilution and mixing prior to release to atmosphere were not considered.

For future analyses Honeywell may use alternate dispersion modeling codes, based on USNRC guidance, industry standards, and Honeywell's evaluation of the codes' effect on the conservatism incorporated into the ISA process.

3.3.11 Chemical Hazard Evaluation

This section is focused on presenting potential deleterious effects that might occur because of chemical release from the facility. For special nuclear material licensees, 10 CFR Part 70 requires that the likelihood of these accidental releases fall into either unlikely or highly unlikely categories.

3.3.11.1 Potential Effects to Workers/Public

The toxicological properties of potential chemicals of concern are detailed in the MTW ISA Summary. MTW ISA Summary presents the evaluation level accident scenarios identified in the Integrated Safety Analysis and presents the potential consequence to facility workers or members of the public.

All postulated incidents have been determined to present low consequences to the workers/public, or where determined to have the potential for intermediate or high consequences, are protected with *PFAP to values less than the likelihood thresholds required by 10 CFR 70.61 for special nuclear material licensees.*

3.3.11.2 Potential Effects to Facility

All postulated incidents have been determined to present inherently low consequences to the facility. No individual incident scenarios were identified that propagate additional consequence to the facility process systems or process equipment. The MTW ISA Summary discusses the impact of external events on the facility and their ability to impact process systems or equipment.

3.3.12 Likelihood Evaluation Method

10 CFR 70.61 specifies the permissible likelihood of occurrence of accident sequences of different consequences. "High consequence" accident sequences must be "highly unlikely" and "intermediate consequence" accident sequences must be "unlikely." Accidents in the "low consequence" category can have a likelihood of occurrence that is "not unlikely." *In conducting the ISA, Honeywell uses the likelihood categories specified in Tale A-6 of NUREG-1520. The definitions of "not credible," "not unlikely", "unlikely" and "highly unlikely" are taken from NUREG-1520.* * If an event is not credible, PFAP are not required to prevent or mitigate the event. The fact that an event is not "credible" must not depend on any facility feature that could credibly fail to function.

Any one of the following independent acceptable sets of qualities could define an event as not credible:

- An external event for which the frequency of occurrence can conservatively be estimated as less than once in a million years (the likelihood risk terms and definitions applicable specifically to rare seismic event risk analysis are presented in Table 3-8.
- A process deviation that consists of a sequence of many unlikely human actions or errors for which there is no reason or motive (In determining that there is no reason for such actions, a wide range of possible motives, short of intent to cause harm, must be considered. Necessarily, no such sequence of events can ever have actually happened in any fuel cycle facility.)
- Process deviations for which there is a convincing argument, given physical laws that they are not possible, or are unquestionably extremely unlikely.

3.3.13 Risk Matrix

The three categories of consequence and likelihood can be displayed as a 3 x 3 risk index matrix. By assigning a number to each category of consequence and likelihood, a qualitative risk index can be calculated for each combination of consequence and likelihood. The risk index equals the product of the integers assigned to the respective consequence and likelihood categories. Honeywell uses the risk matrix illustrated in Table A-3 of NUREG-1520 (also see table 3-9).

The risk indices can initially be used to examine whether the consequences of an uncontrolled and unmitigated accident sequence (i.e., without any PFAP) could exceed the performance requirements of 10 CFR 70.61. If the performance requirements could be exceeded, Honeywell designates PFAP to prevent the accident or to mitigate its consequences to an acceptable level. * A risk index value less than or equal to four indicates the accident sequence is acceptably protected and/or mitigated. If the risk index of an uncontrolled and unmitigated accident sequence exceeds four, the likelihood of the accident must be reduced through designation of PFAP. In this risk index method, the likelihood index for the uncontrolled and unmitigated accident sequence is adjusted by adding a score corresponding to the type and number of PFAP that have been designated.

3.3.14 Plant Features and Procedures

When designating and determining the suitability of preventive or mitigative PFAPS, the ISA Team must employ knowledge of the frequency, probability, and duration of possible PFAP failures. *Honeywell uses the failure frequency probability and duration index values provided in Tables A-9, A-10, and A-11of NUREG-1520.* *

3.3.15 ISA Team

Honeywell utilizes an ISA Team with credentials consistent with the requirements of 10 CFR 70.65 and the guidance provided in NUREG-1520. *

3.4 Analysis of Seismic, Wind, and Flood Events

Beginning in 2012 Honeywell implemented significant modifications to plant structures, systems and components that meet or exceed USNRC risk performance requirements and provide reasonable assurance of public health and safety. This section provides specific details pertaining to MTW's revised seismic safety design bases, associated risk analyses and risk mitigation actions implemented. The MTW ISA Summary has been updated to reflect the modifications and improvements to plant structures, systems and components. *Honeywell is committed to maintaining the plant's design bases, described in this*

section, by applying the existing configuration management process as described in Section 11.1 of this Application. *

3.4.1 Seismic Design Bases

3.4.1.1 FMB Structure

In 1997 Honeywell implemented FMB structural modifications and UF6 equipment seismic restraints based on a 475-yr return period earthquake (EQ) (10% probability of exceedance in 50 years; mean PGA=0.26g) per the 1990 BOCA National Building Code and the 1991 Uniform Building Code. These modifications established MTW's NRC license basis for seismic events as a 475-year return period EQ.

Honeywell further enhanced MTW's seismic capability through additional seismic upgrades based on a Design Basis Earthquake (DBE) defined by the 2002 USGS seismic hazard mapping values for a 10% probability of exceedance in 50 years EQ (475-yr return period; Peak Ground Acceleration (PGA)=0.36g) adjusted to site soil Class D. To achieve design seismic capability, Honeywell commissioned a linear dynamic seismic analysis on the FMB. The MTW ISA Summary provides details regarding the analyses and prescribed modifications.

3.4.1.2 Hazardous Material Equipment Restraints

Liquid UF6 equipment restraints were evaluated for structural adequacy based on seismic accelerations associated with a 1,300-year return period DBE (2008 USGS seismic hazard mapping values). Detailed engineering calculations were performed to assess load bearing capacities. The MTW ISA Summary provides details regarding the analyses and prescribed modifications.

3.4.1.3 Liquid UF6 Piping Supports

Honeywell commissioned a seismic capability verification evaluation on existing FMB liquid UF6 piping systems to determine specific vulnerabilities and upgrade needs. The MTW ISA Summary provides details regarding the analyses and prescribed modifications.

3.4.2 Source Term Definitions

3.4.2.1 UF6 Source Term – FMB

The worst-case release quantity is 206,111 pounds of liquid UF6 due to loss of containment of all liquid UF6 inventory (piping and equipment). This UF6 release quantity will generate 28,400 pounds

of HF upon hydrolysis with air moisture content. Table 3-7 describes UF6 mass distribution within the FMB.

3.4.3 Definition of Risk Terms

3.4.3.1 Likelihood Definition

Per guidance in NUREG-1520, Appendix D, Natural Phenomena Hazards, the likelihood risk terms for rare seismic external event risk analyses at MTW are defined as shown in Table 3-8. These definitions apply only to seismic events and are not applicable to the tornado risk analysis. These parameters are consistent with likelihood definitions utilized by other nuclear fuel cycle facilities and are determined to be acceptable for rare natural phenomena risk analyses such as seismic events. *

3.4.3.2 Consequence Definition

Consequence severity categories are addressed in MTW ISA Summary and are defined in Table 3-5. *

3.4.3.3 Acceptance Criteria for Seismic Risk

Honeywell uses the risk matrix illustrated in Table A-3 of NUREG-1520. *Based on the likelihood definitions for seismic events listed in Table 3-8 and the enhanced definitions of severity categories defined in Table 3-5, seismic risk acceptance criteria are summarized in Table 3-9.* *

3.4.4 Worst-Case Risk Determinations – Uncontrolled

3.4.4.1 UF6 Release – FMB

The MTW ISA Summary provides a discussion of seismic event risk determinations, accident scenarios, consequences and risk reduction methods.

3.4.5 Basis for Failure Probability Index Numbers (FPIN)

Due to the complexity and interdependency of the multiple PFAP layers of protection for a single accident sequence, no risk reduction credit is assumed for an individual PFAP. Rather, Honeywell assigns a single composite Failure Probability Value of 10^{-2} (FPIN = -2). This assigned value is very conservative for an exceptionally robust passive engineered control (PEC) as defined in NUREG-1520.

In addition to the PFAP listed in the MTW ISA Summary, several non-PFAP layers of protection are provided that help prevent or mitigate high consequence event impacts to the public. These layers include seismically activated isolation valves on all tanks containing liquid UF6 and modifications to the distillation area of the building providing confinement

of possible releases on the first three floors. These added layers of protection support the conclusion that a FPIN value of -2 for this composite PFAP is sufficiently conservative and provides additional assurance against hazardous material releases from the FMB during a seismic event.

3.4.6 Seismic Risk Analysis

3.4.6.1 Likelihood Determinations

FMB

For the mitigated accident sequence initiated by a 475-year return period earthquake, no release of UF6/HF is expected to occur. PFAP consisting of structural upgrades to the FMB, equipment restraints and liquid UF6 piping have sufficient design as to render these safeguards highly reliable and available during an event of this severity. MTW ISA Summary provides a detailed discussion

Main Pipe Rack

The pipe rack was designed to withstand a 1,000-year EQ with an Importance Factor = 1.5 per ASCE 41 code.

3.4.6.2 Overall Risk Conclusion

Due to the robust seismic modifications to the FMB structure and associated liquid UF6 equipment restraints and piping, no release of UF6 is expected due to seismic events up to the 475-year DBE event.

3.4.6.3 Other Considered Seismic-Related Risk Analyses

Honeywell's ISA considered the likelihood and consequence of additional events that might arise as a result of the postulated seismic activity, including loss of power, natural gas fire and explosion, and loss of compressed air or nitrogen, Honeywell's analyses indicate that no credible high or intermediate level consequences result from these events.

3.4.7 Wind/ Tornado Event Safety Basis

Honeywell prepared calculations in accordance with NUREG/CR-4461 which determined that the frequency of tornado interactions with the MTW site is 4 x 10^{-4}/yr. Since this frequency exceeds the non-credible events threshold (10^{-6}/yr), tornados are a credible external event at MTW.

3.4.7.1 Tornado Design Basis

The maximum wind speed for an unlikely ($\leq 10^{-5}$/yr frequency) tornado at MTW was calculated to be 152 mph. Projectile types considered included metal pipe and automobile per 10 CFR. 70.61(b)(4) guidance. Based on calculation, tornado damage to

hazardous material (UF6) containing equipment at MTW is bounded by the impact from a Schedule 40 metal pipe (6.5 inch diameter x 15 feet long) projectile traveling at 60 mph.

3.4.7.2 Source Term Definitions

UF6 Source Term – FMB

Tornado missile strikes on the FMB place the entire 206,111 pounds of liquid UF6 inventory contained within the Distillation area at risk. The MTW ISA Summary provides details regarding this determination.

3.4.7.3 Risk Terms Definitions

Likelihood

Honeywell uses tornado-related likelihood definitions that are consistent with NUREG-1520 Appendix A, Table A-6. *

Consequences

For purposes of determining consequence severity from tornado projectile strikes Honeywell assumes the resulting consequence is always a high consequence severity event. This is a conservative position and applies in all cases involving tornado hazards.

Acceptance Criteria for Tornado Risk

The acceptance criteria summarized in Table 3-6 Risk Matrix with Risk Index Values, are applicable to flood events. *

3.4.7.4 Tornado Risk Assessment

Rather than calculate the airborne concentration of chemicals due to a projectile rupture of a pipe or vessel during operation, Honeywell conservatively assumes that any projectile strike on a vulnerable system or component would lead to a high consequence event. Based on the likelihood of a tornado affecting the plant, projectile strikes are assumed to have unacceptable risk; therefore, PFAPs are required to reduce risk to meet NRC performance requirements.

Honeywell implements a combination of Administrative Controls and/or Passive or Active Engineered Controls to protect vulnerable targets. The MTW ISA Summary provides a summary of tornado related accident sequences and protective PFAP

3.4.8 Flood Event Safety Basis

The MTW ISA indicates that the Ohio River pool elevation at the site is 290 feet above sea level and the banks of the river are about 310 feet in elevation. The MTW operations buildings are sited on a flat area at an elevation of 375 feet above sea level. The historic maximum elevation flood at Metropolis was 342 feet in 1937. Honeywell evaluated impacts from the 100-year or 500-year flood events and concluded that there were no impacts to the site. The licensee also evaluated the impacts from floods due to dam failures. Based on the above, the licensee concluded that the MTW site was not susceptible to impacts from flooding events and considered the event not credible.

3.4.8.1 Source Term Definitions

The accident sequence related to flooding at the MTW would consist of a catastrophic rise in Ohio River levels that would flood the plant so that operations could not continue. Safe shutdown procedures would be used to put the plant in a safe configuration.

3.4.8.2 Risk Term Definitions

Likelihood

Honeywell uses flood-related likelihood definitions consistent with NUREG-1520 Appendix A, Table A-6. *

Consequences

For purposes of determining consequence severity from flooding, Honeywell assumes the resulting consequence is always a high consequence severity event. This is a conservative position and applies in all cases involving flood hazards.

Acceptance Criteria for Flood Risk

Honeywell uses the risk matrix illustrated in Table A-3 of NUREG-1520. *

3.4.8.3 Flood Risk Assessment

Even though the MTW site is in close proximity to the Ohio River, the site is located at a significantly higher elevation than the surrounding areas and is outside of the 500-year floodplain. The risk of flooding due to an increase in the level of the river is not credible at this specific location. The region surrounding the MTW site does not see abnormally high precipitation levels. Even assuming a worst-case, maximum precipitation level, water would not rise more than a few inches on the site. A flooding incident due to precipitation is deemed to be not credible. The MTW ISA

Summary discusses the accident sequence and PFAP for any flooding events that might happen.

3.5 References

1. Title 10, Code of Federal Regulations, Part 70, Domestic Licensing of Special Nuclear Material, USNRC.
2. NUREG-1520, Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility, USNRC, June 2015.
3. Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the Occupational Safety and Health Administration Concerning "Worker protection at facilities licensed by the NRC," dated 09/06/2013.
4. NUREG-1513, Integrated Safety Analysis Guidance Document, USNRC, May 2001.
5. NUREG/CR-6410, Nuclear Fuel Cycle Facility Accident Analysis Handbook, USNRC, March 1998.
6. Title 10, Code of Federal Regulations, Part 70, Section 70.61, Performance Requirements, USNRC.
7. Title 10, Code of Federal Regulations, Part 70, Section 70.65, Additional Content of Applications, USNRC.
8. Title 29, Code of Federal Regulations, Part 1910, Section 119, Process Safety Management of Highly Hazardous Chemicals, U.S. Occupational Safety and Health Administration.
9. NUREG-1391, Chemical Toxicity of Uranium Hexafluoride Compared to Acute Effects of Radiation, USNRC, February 1991.
10. NUREG 1140, A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees, USNRC, January 1988.
11. Regulatory Guide 1.183 – Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, USNRC, March 1999.
12. Honeywell MTW Integrated Safety Analysis Summary, Revision 16, Honeywell MTW, November 2017.

Table 3-1 Consequence Severity Categories Based on 10 CFF 70.61*

Consequence Categories	Workers	Offsite Public	Environment
Category 3 High Consequence	*RD>1Sv (100 rem) RD ≥400 mg sol U intake **CD>AEGL-3, ERPG-3	RD>0.25 Sv (25 rem) 30 mg sol U intake CD> AEGL-2, ERPG-2	
Category 2 Intermediate Consequence	0.25 Sv (25 rem) <RD ≤ 1 Sv (100 rem) 150 mg sol U intake < RD < 400 mg sol U intake AEGL-2, ERGP-2 <CD ≤ AEGL-3, ERPG-3	0.05 Sv (5 rem) <RD ≤0.25 Sv (25 rem) AEGL-1, ERGP-1 <CD ≤ AEGL-2, ERPG-2	Radioactive release >5000 x Table 2 Appendix B of 10 CFR Part 20
Category 1 Low Consequence	Accidents with lower radiological and chemical exposures than those above in this column.	Accidents with lower radiological and chemical exposures than those above in this column.	Radioactive releases with lower effects than those referenced above in this column

*RD - Radiological Dose

**CD - Chemical Dose

Table 3-2 Chemical Dose Information*

	High Consequence (Category 3)	Intermediate Consequence (Category 2)
Worker (local) (1-min exposure)	>1,300 mg HF/m^3	>137 mg HF/m^3
Worker (elsewhere in room) (2.5-min exposure)	Note 1, Note 2	>30 mg U/m3 Note 2
Worker (elsewhere in room) (5-min exposure)	>298 mg U/m^3; >175 mg HF/m^3	>24 mg U/m^3; >98 mg HF/m^3
Outside Controlled Area (30-min exposure)	>13 mg U/m^3; >28 mg HF/m^3	>2.4 mg U/m^3; >0.8 mg HF/m^3

Notes:

1. Use the conservative 5-minute exposure value for uranium.
2. Use the conservative 5-minute exposure value for hydrogen fluoride.

Table 3-3 ERPG and AEGL Values for Hydrogen Fluoride*

ERPG (ppm)			AEGL (Values in mg HF/m³)					
	1-hr	10-min*		10-min	30-min	1-hr	4-hr	8-hr
ERPG-1	2	2	AEGL-1	1.0	1.0	1.0	1.0	1.0
ERPG-2	20	50	AEGL-2	95	34	24	12	12
ERPG-3	50	170	AEGL-3	170	62	44	22	22

* American Industrial Hygiene Association (AIHA) ERPG (2005), addendum published in 1999 with new 10-min values for HF

TABLE 3-4 ERPG AND AEGL Values for Uranium Hexafluoride*(Values in mg soluble U/m³)

ERPG		AEGL					
	1-hr*		10-min	30-min	1-hr	4-hr	8-hr
ERPG-1	5	AEGL-1	3.6	3.6	3.6	NR	NR
ERPG-2	15	AEGL-2	28	19	9.6	2.4	1.2
ERPG-3	30	AEGL-3	216	72	36	9.0	4.5

*AIHA ERPGs (2005)

Table 3-5. Enhanced Definition of Consequence Severity Categories*

		High Consequence (Category 3)	Intermediate Consequence (Category 2)
Acute Radiological Doses	Worker	>100 rem TEDE	>25 rem TEDE
	Outside Controlled Area	>25 rem TEDE	>5 rem TEDE
Acute Radiological Exposure	Worker	≥400 mg sol U intake	>150 mg sol U intake
	Outside Controlled Area	>30 mg U intake	>5.4 mg U/m3(24-hr average)
Acute Chemical Exposure	Worker (local) (1-min exposure)	>1,300 mg HF/m³	>137 mg HF/m³
	Worker (elsewhere in room) (2.5-min exposure)	Note 1, Note 2	>30 mg U/m3 Note 2
	Worker (elsewhere in room) (5-min exposure)	>298 mg U/m³; >175 mg HF/m³	>24 mg U/m³; >98 mg HF/m³
	Outside Controlled Area (30-min exposure)	>13 mg U/m³; >28 mg HF/m³	>2.4 mg U/m3; >0.8 mg HF/m3

Notes:

1. Use the conservative 5-minute exposure value for uranium.
2. Use the conservative 5-minute exposure value for hydrogen fluoride.

Table 3-6. Risk Matrix with Risk Index Values*

Severity of Consequences	Likelihood of Occurrence Likelihood Category 1 Highly Unlikely (1)	Likelihood Category 2 Unlikely (2)	Likelihood Category 3 Not Unlikely (3)
Consequence Category 3 High (3)	Acceptable Risk 3	Unacceptable Risk 6	Unacceptable Risk 9
Consequence Category 2 Intermediate (2)	Acceptable Risk 2	Acceptable Risk 4	Unacceptable Risk 6
Consequence Category 1 Low (1)	Acceptable Risk 1	Acceptable Risk 2	Acceptable Risk 3

Table 3-7 Mass of UF6 in Lines per Floor*

Floor	Elevation Above Grade (ft)	Pounds of Material in Lines Per Floor PCTs to SFTs*	STF to VAP	LBC to LBC Reblr	LBC Reflux Line	HBC to HBC Rebir	Prod Cond to Cyl Fill	UF6 lb. in equipment on each floor	Eqpt Description
Pipe Fragility Type		Medium	Weak	Strong	Medium	Strong	Weak		
6	72	-	-	-	149	-	-	N/A	-
5	56	-	-	-	50	-	-	N/A	-
4	42	1,129	-	-	-	-	33	36,000**	Cold Traps (10)
3	31	376	45	-	-	-	109	105,000	Still Feed Tanks (3)
2	14	-	149	-	-	-	109	N/A	
1	0	-	149	-	-	-	79	27,000	UF6 Cylinder (1)
Basement	N/A	-	109	20	-	20	-	37,000	1 Vap, 2 Rebls, 2 Cols
Total UF6 lbs per line		90*	452	20	199	20	330	1,111	
Total Inventory (lbs)		-	-	-	-	-	-	206,111	
Notes:	*PCTs to SFTs Line only in operation 6% of the time; time-weighted mass=90 lbs.								
	**Only two primary cold traps (36,000lbs liquid UF6) heated at a time								

Table 3-8 Seismic Total Risk Likelihood Categories*

	Likelihood Category	Probability of Occurrence
Not Unlikely	3	More than 10^{-3} per event, per year
Unlikely	2	Between 10^{-3} and 10^{-4} per event, per year
Highly Unlikely	1	Less than 10^{-4} per event, per year

Table 3-9 Seismic Risk Matrix*

	Likelihood for Seismic Events (per event, per year)		
	Highly Unlikely ($<10^{-4}$)	Unlikely (between 10^{-3} & 10^{-4})	Not Unlikely ($>10^{-3}$)
High Consequence	Acceptable Risk	Unacceptable Risk	Unacceptable Risk
Intermediate Consequence	Acceptable Risk	Acceptable Risk	Unacceptable Risk
Low Consequence	Acceptable Risk	Acceptable Risk	Acceptable Risk

4.0 RADIATION PROTECTION

4.1 Program

Honeywell management and staff are committed to maintaining employee and environmental radiation exposures As Low As Is Reasonably Achievable (ALARA). Honeywell commits sufficient manpower, resources, and equipment to assure an effective radiation protection program.

Honeywell uses USNRC Regulatory Guides to identify program elements that are appropriate for a uranium conversion plant radiation protection program. The Radiation Protection (RP) Program has been developed using the following Regulatory Guides only to the extent that Honeywell has determined this guidance to be appropriate to site hazards and activities:

- 8.2 - Administrative Practices in Radiation Surveys and Monitoring (Ref. 1)
- 8.7 - Instructions for Recording and Reporting Occupational Radiation Exposure Data (Ref. 2)
- 8.9 - Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program (Ref. 3)
- 8.10 - Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable (Ref. 4)
- 8.11 - Applications of Bioassay for Uranium (Ref. 5)
- 8.13 - Instruction Concerning Prenatal Radiation Exposure (Ref. 6)
- 8.15 - Acceptable Programs for Respiratory Protection (Ref. 7)
- 8.25 - Air Sampling in the Workplace (Ref. 8)
- 8.29 - Instruction Concerning Risks from Occupational Radiation Exposure (Ref. 9)
- 8.30 - Health Physics Surveys in Uranium Recovery Facilities (Ref. 10)
- 8.31 - Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Is Reasonably Achievable (Ref. 11)
- 8.34 - Monitoring Criteria and Methods To Calculate Occupational Radiation Doses (Ref. 12)
- 8.37 - ALARA Levels for Effluents from Materials Facilities (Ref. 13)

Sections 4.2 through 4.11 provide a description of the MTW Radiation Protection Program.

4.2 Radiation Protection Organization

Figure 2.1 provides an organizational chart for the site organization. *The Health Physics Supervisor has primary responsibility for the technical adequacy and correctness of the radiation protection and ALARA program and has continuing responsibility for surveillance and supervisory action in the enforcement of the program. Health Physics personnel report through the Health Physics Supervisor to the Regulatory Affairs Manager.*

4.3 Facilities, Equipment, and Procedures

4.3.1 Health Physics Facilities

The Health Physics facilities include:

- Office space for Health Physics (HP) supervisor and technicians;
- Dedicated laboratory space and fume hoods as needed for preparation and radiological analyses of samples, including smears, bioassay samples and air samples;
- Space for performance of quantitative respirator fit testing;
- Space for performance of instrument calibration, sealed radioactive source storage, and instrument storage.

4.3.2 Instruments and Equipment

The natural uranium processed in the plant is primarily an alpha emitter; however, the uranium and uranium daughters emit sufficient beta-gamma radiation to provide an alternate method for measuring contamination. Radiological monitoring instruments for external radiation, surface contamination, and monitoring of effluents have been selected to be appropriate for the type, range, and energies of the emitted radiations.

Alpha counting is the primary method utilized for analyzing airborne radioactivity, removable contamination, and stack monitoring samples. Beta-gamma measurements are used for direct surface contamination measurements and smear measurements of transport vehicles and packages. Exposure rate instruments are typically used for general area radiation surveys and confined space entry surveys. Thin window beta-gamma survey instruments are utilized for surface contamination monitoring of personnel and materials exiting the plant. Alpha measurements may be substituted for the beta-gamma measurements discussed above if the applicable detection capabilities are achieved.

Operating experience indicates that beta-gamma monitoring instruments and techniques can provide detection capabilities sufficient to satisfy the surface contamination monitoring guidance provided in Table 2 of Regulatory Guide 8.30. Due to the comparative ruggedness and reliability of the beta-gamma instruments, Honeywell uses beta-gamma

measurements as a surrogate for alpha measurements for a variety of contamination monitoring activities, including personnel contamination monitoring, vehicle exit monitoring, and unrestricted release of materials from the restricted areas. Alpha measurements are used for other types of health physics surveys, such as routine contamination surveys and specified radioactive material shipment surveys and may be substituted for the beta-gamma measurements discussed above if the applicable detection capabilities are achieved.

Kinetic Phosphorescence Analyzer (KPA) analysis for uranium is a very sensitive analytical method and may be used to perform other measurements in the plant.

Sufficient instrumentation and back-ups are maintained to assure an effective Health Physics monitoring capability. Instruments routinely used in radiological monitoring activities are shown in Table 4-2.

The thin window, scintillation, and proportional counters are calibrated using a certified U_3O_8 source. Exposure rate meters are calibrated using a Cs137 sealed source. Appropriate check sources are also available to monitor instrument response during use. In the event measurements are required which are beyond the capabilities of plant instrumentation, an outside vendor is utilized to perform the analysis.

Health Physics instrumentation is stored primarily in the plant Health Physics facility. Instrument calibration is performed by trained Health Physics technicians or qualified vendors.

4.3.3 Procedures

Honeywell develops and maintains written procedures to guide implementation of the program in accordance with regulatory and license requirements and accepted guidance.

4.3.4 Program Review

Honeywell conducts an annual review of RP Program content and implementation.

4.4 ALARA Program

4.4.1 ALARA Commitment

MTW's ALARA Program consists of multiple features and activities and is consistent with the guidance provided in Regulatory Guide 8.10. Features of the ALARA Program include:

- *Management commitment, demonstrated through a written policy statement, procedures, and other directives.*
- *Formal program audits, conducted on at least an annual basis.*

- *Well-supervised and defined radiation protection capability, including appropriate supervisors and technicians. All personnel on site have the authority to stop work as needed to ensure appropriate safety precautions are observed.*
- *Appropriate training for the workforce, including training consistent with the requirements of 10 CFR 19.12 (Ref. 14) and incorporating appropriate portions of the guidance provided in Regulatory Guides 8.13 and 8.29.*
- *Appropriate authority vested in HP personnel, including stop work authority and authority for the HP Supervisor to communicate with corporate-level HSE personnel as needed.*
- *Consideration of the need for plant modifications as warranted to reduce personnel doses at reasonable costs.*

4.4.2 ALARA Committee

The ALARA Committee provides review and oversight of facility operations to ensure that occupational radiation exposures and effluent releases of radioactive material are effectively controlled. The ALARA Committee meets at least once each quarter.

Membership of the ALARA Committee includes, at a minimum:

- The Plant Manager or designee;
- Selected department managers;
- The Regulatory Affairs Manager and
- Selected hourly personnel.

Participation of management and hourly personnel provides a mechanism for ensuring interaction between Health Physics and Operations personnel.

The scope of the ALARA Committee's activities include:

- Reviewing site radiological operating performance on a quarterly basis;
- Reviewing operations and exposure records to determine where exposures may be reduced;
- Reviewing employee training and methods for utilizing information on-the-job to keep exposure ALARA; and
- Reviewing potential modifications of procedures and equipment when changes will reduce exposure at reasonable cost.

The ALARA Committee uses the guidance provided in Regulatory Guides 8.10 and 8.37 for formulating plant operating philosophy in reducing exposures.

4.5 Health Physics Organization and Personnel Qualifications

Requirements for the positions of HP Supervisor and HP Specialist include:

- Four-year degree or equivalent experience in Engineering, Science, or related discipline;
- Knowledge of applicable regulations and other standards;
- Sound judgment and ability to work effectively with management and government officials; and
- Four years Health Physics or related experience.

HP Technicians are subject to a qualification process that includes completion of specified job performance measures, which are evaluated by HP Department supervision or management. The content of the training is based on applicable tasks and procedural requirements.

4.6 Written Procedures and Radiation Work Permits (RWPs)

4.6.1 Written Procedures

Section 11.0 of this Application addresses development and implementation of site procedures, including procedures related to the RP Program.

4.6.2 Radiation Work Permits

Certain maintenance operations may involve entry into tanks or other vessels containing licensed material where exposure rates exceed 5.0 millirem per hour. Honeywell implements a permit system to ensure safe job performance in these areas.

The permit system includes the following features:

- Preparation of the permit by the responsible individual with assistance, as needed, from HP personnel;
- Delineation on the permit of specific instructions regarding the task, the necessary safety precautions, and any safety equipment required;
- Appropriate monitoring of the affected space;
- Approval and acknowledgement signatures.

In addition, Health Physics personnel shall be present whenever entry is made into containment structures, including ventilation baghouses, where the likelihood exists for exposure to airborne radioactivity.

Following elimination of the radiological hazard (by closure of the vessel, decontamination, or other process), the permit shall be terminated and routed for retention in accordance with plant procedures.

Records associated with the permit system include completed permits and records of area entry.

4.7 Radiation Safety Training

Honeywell implements a training program that ensures unescorted personnel working on site possess the knowledge necessary to work safely and take appropriate actions in an emergency. The training is provided using a graded approach that ensures that each individual receives training commensurate with the nature of the work performed and the hazards encountered.

4.7.1 Initial Training

Honeywell provides training to new employees before beginning work.

Training for new employees includes the following, at a minimum:

- *An indoctrination in plant safety procedures, including proper use of personal safety equipment;*
- *Radiation safety training, to the extent appropriate to the hazards, in accordance with 10 CFR 19.12, including information from Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure," and Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure";*
- *Safety Conscious Work Environment and employee rights and responsibilities training;*
- *Environmental safety training, including waste handling and disposal.*

Honeywell provides to site visitors a briefing consistent with the areas to be entered and activities to be performed.

4.7.2 Refresher Training

Honeywell provides continuing training in safety hazards and proper radiation protection procedures through annual radiation safety presentations. Typical radiation safety topics used in employee training include: radiological emergency planning; ALARA; air activity measurements; surface contamination; waste disposal; external dose control; dose units and limits; uranium deposition and toxicity; biological effects of radiation; respiratory protection; and employee rights and responsibilities.

4.8 Ventilation and Respiratory Protection Programs

4.8.1 Ventilation

Equipment in the UF6 process that produces dusts, mists, or fumes containing uranium or other toxic materials is provided with dust collectors and scrubbers or other ventilation equipment designed to reduce employee or environmental exposure to levels that are as low as is reasonably achievable. Honeywell establishes a system to sample operating exhaust points to determine uranium content.

The ventilation system used in the FMB consists of a series of fresh air intake units and a series of window fans and roof vents. Honeywell calculates environmental uranium losses based on workroom activity samples.

The FMB Control Room has a separate air conditioning system. The Control Room is maintained under a slight positive pressure during a UF6 release and has fresh air intakes located outside the UF6 process building. Honeywell provides workroom air sampling in this area.

Operating personnel monitor the operation of pollution control equipment. Additional samples, visual observation, and other precautions shall be taken as necessary to ensure effective performance of pollution control equipment.

MTW performs periodic measurements of face velocity of laboratory hoods that are routinely used to handle radioactive materials. If the average face velocity does not exceed 100 linear feet per minute, the hood shall not be used for radioactive materials until proper operation has been restored.

MTW's ventilation systems are not designated as PFAP in the MTW ISA Summary.

4.8.2 Respiratory Protection Program

Airborne radioactivity areas may be created during maintenance activities and following process equipment breakdowns that result in area contamination. An in-plant administrative level is used as the air activity level at which areas are posted as Airborne Radioactivity Areas. Airborne radioactivity areas may also be posted as a precaution during planned activities having the potential to release airborne contamination. Flashing red lights, area posting, and written instructions are used to prompt employees to wear respirators in airborne radioactivity areas until such time that air sampling indicates the air activity in the area has been reduced below the administrative level.

The Respiratory Protection Program is implemented in accordance with 10 CFR Part Part20 (Ref. 15) and Regulatory Guide 8.15. Written

procedures clearly define the conditions that require respirator usage for radiological protection, such as appropriate consideration of airborne radioactivity concentrations and work activities consistent with the facility ALARA program. Honeywell also develops and implements written procedures addressing respirator selection, fitting, maintenance, testing, storage, personnel training and qualifications, limitations on respirator usage, and airborne radioactivity sampling and monitoring. Honeywell maintains records of the respiratory protection program consistent with Section 4.11 of this Application.

Respiratory protective equipment is available at strategic locations throughout the plant for immediate use. Honeywell determines individual doses using the results of bioassay monitoring; respiratory protection factors are not used for this purpose.

Only National Institute of Occupational Safety and Health (NIOSH)-certified respiratory equipment is utilized. Each new employee who may be required to wear a respirator is medically-approved by a physician, fit-tested, and instructed in the proper fitting of respirators. Employees are also instructed regarding field tests for respirator function prior to use. Training and quantitative fit-testing are conducted annually for each respirator-qualified employee.

Used respirators are deposited in a designated receptacle, collected, disassembled, and cleaned. Each particulate cartridge is checked for radioactivity using a beta-gamma probe to detect low levels of activity. All parts of the used respirator except the cartridges are then washed, disinfected, rinsed, dried, and packaged prior to re-issue. *Respirator facepieces are surveyed to ensure removable alpha contamination levels are less than 100 dpm/100 cm^2, consistent with Section 2.10 of Regulatory Guide 8.30.*

4.9 Radiation Survey and Monitoring Programs

Honeywell develops and implements written procedures to govern performance of radiological surveys and monitoring in the workplace, including performance of radiation, surface contamination, and airborne radioactivity surveys and monitoring and personnel internal and external dose monitoring. The results of these programs are used to ensure adequate area posting and access controls and to maintain personnel doses ALARA.

Section 4.3 of this Application provides a discussion of the radiological monitoring instruments used in the facility.

4.9.1 Determination of Personnel Doses

External Exposures

Honeywell implements an external dosimetry program that includes the following features:

- *Use of a Honeywell-issued personnel dosimeter by each individual who enters an area where occupational external exposures are likely to exceed 10% of the applicable dose limits as established in Subpart C of 10 CFR 20.*
- *Processing (on at least a quarterly basis) of personnel dosimeters by a dosimetry processor holding current National Voluntary Laboratory Accreditation Program (NVLAP) accreditation.*
- *Notification of Health Physics by the processor of any external dose exceeding administrative control levels established by the ALARA Committee.*
- *For any external doses exceeding the administrative control levels established by the ALARA Committee, completion of an investigation to determine the source of the exposure and corrective actions to prevent further exposures exceeding administrative control levels.*

Internal Exposures

Internal exposures are determined primarily through implementation of the bioassay program, including both routine and special urinary sampling and analysis. Honeywell shall enroll in the program all individuals who are likely to receive an intake exceeding 10 percent of the applicable adjusted ALI(s) values derived from dose coefficients found within ICRP 68. For purposes of practicality, the routine bioassay program typically includes all individuals who routinely access areas where unsealed quantities of uranium are used or processed.

The bioassay program includes the following features:

- Routine urinalysis on an established schedule.
- Special urinalysis following specified events and evolutions.
- An established evaluation level in which a repeat sample is collected.
- An established investigation level which requires investigation of the measured intake.

Special urinary uranium samples are collected following confined space entries (e.g., baghouses), where the air concentrations may exceed DAC, and following a UF6 release, if employees have been exposed. In addition, employees are encouraged to submit urine samples at the start of the next work shift following a suspected exposure to airborne uranium to

determine if an exposure has occurred. Follow-up special samples are obtained if results from routine or special samples exceed the evaluation level.

If an employee's urinary uranium excretion rate exceeds the investigation level, the intake is investigated, and additional urinary uranium samples are normally obtained until sufficient data is collected to perform an intake assessment.

Employees exposed to highly soluble UF6 because of unplanned workplace releases are required to submit one or more special urine samples, typically one sample immediately following the shift on which the exposure occurred and another at the start of the individual's next shift.

The bioassay evaluation level and investigation level correspond to 2% and 10%, respectively, of the defined ALI (annual limit on intake). Exposure to UF6 is limited by chemical toxicity to the kidney rather than annual radiation dose (10 CFR 20.1201(e)). It is extremely unlikely that an unknown exposure to UF6 could occur in the plant due to the highly visible "smoke" produced by a small quantity of UF6. Honeywell imposes work restrictions if an individual's intake exceeds the weekly intake limit (10 mg) for soluble Type F uranium.

Routine whole-body counting is not a useful method for measuring low-level exposures to natural uranium compounds. Exposures are readily detected from excretion of the Type F or Type M uranium. Solubility studies indicate that Type S material is not presently found at the facility.

Honeywell may implement whole-body counting by an outside contractor if, based on urinalysis results, an insoluble uranium intake could result in a committed effective dose equivalent exceeding 5 Rem. Work restrictions and whole-body counting are considered if bioassay data indicate the intake could exceed 30% of the appropriate ALI for the material of exposure.

The ALARA Committee establishes administrative control levels applicable to the program and reviews performance on a periodic basis.

The program utilizes guidance provided in Regulatory Guide 8.9. Intakes are calculated using the methodology provided in NUREG/CR-4884, "Interpretation of Bioassay Measurements" (Ref. 16). This methodology is applied to the models described within ICRP 60 (Ref. 17), ICRP 66 (Ref. 18), and ICRP 68 (Ref. 19).

4.9.2 Airborne Radioactivity Sampling

The primary method for maintaining internal exposures ALARA is confinement of source material within process vessels. Extensive air sampling provides an indication of degradation of the confinement

systems. *During these occasions respiratory protection is utilized by employees working in the affected area consistent with the requirements of the Respiratory Protection Program.*

MTW's air sampling program utilizes work area samplers (fixed or portable) in areas where radioactive materials are handled or processed when operations could expose workers, without credit for respiratory protection, to the inhalation of quantities of radioactive material exceeding 10% of a Derived Air Concentration.

Each fixed work area air sampler is located approximately five feet above the floor and consists of: a filter holder and particulate filter; flow meter; and associated fittings for connection to a central sample vacuum system. The sampling rate used is approximately 40 standard cubic feet per hour (SCFH), which is approximately equal to "standard man" respiration rate. Grab samples may also be used in specific exposure evaluations.

Portable air samplers also may be assigned to areas as deemed necessary by Health Physics.

During periods of abnormal operating conditions (visible spills or leaks), the sample filters in the affected area are changed after the upset is corrected and the area decontaminated of visible contamination. Respirators are required for potentially-exposed employees during this period if the exposure conditions exceed the criteria established by the Respiratory Protection Program. The sample filters are then changed at more frequent intervals until analytical results indicate the air activity is less than the relevant action level.

The air samplers are divided into groups which may consist of one or multiple air samplers that share a common air space limited by physical barriers. The results of each group are assessed independently and necessary response actions (e.g., red lights, investigations, etc.) are activated when established action levels are exceeded.

Two action levels have been established: 1 DAC and 30% DAC. One DAC is calculated to be 3.1x10-10 µCi/ml by assuming the exposure is to Type M Natural Uranium; subsequently, 30% of DAC is determined to be 9x10-11 µCi/ml. If the average activity in any area is equal to or greater than 30% of DAC, the area is posted as an Airborne Radioactivity Area and, if due to an unplanned event, an informal investigation is conducted by the Operations Supervisor with support from the Health Physics department to correct the problem. *If any single air sample is greater than 1 DAC due to an unplanned event, a formal investigation is initiated by the Operations Supervisor with support from Health Physics.*

4.9.3 Area Radiation Surveys

Honeywell conducts routine gamma radiation surveys consistent with the guidance provided in Section 2.4 of Regulatory Guide 8.30, e.g., quarterly within known radiation areas and semi-annually in other areas where radioactive materials are used, processed, or stored. The results of these surveys are used to identify areas requiring posting, changes in radiological conditions, and areas where personnel dosimeters may be required. Radiation survey results are also used as an input to the ALARA Program.

Honeywell conducts investigative beta-gamma instrument surveys when a process or procedural change is made that could result in a significant increase in employee exposure. Exposure rates and occupancy factors are appropriately utilized to determine if additional precautions are needed.

4.9.4 Surface Contamination Surveys

4.9.4.1 Area Designations

For purposes of contamination monitoring and control, areas within the restricted area are designated as follows, consistent with Regulatory Guide 3.55:

Controlled Areas: Plant areas in which uranium is processed and could be present in unencapsulated form.

Intermediate Areas: Production areas for non-radioactive fluorine-based chemicals, and plant support facilities.

Uncontrolled Areas: Plant areas where food may be consumed, locker rooms, and entrance/exit areas from the plant.

Surface contamination will be identified by a combination of routine visual observation (not normally documented unless related to a specific unplanned event) and smear surveys.

The area designations, action levels, and contamination survey frequencies are provided in Table 4-1 below:

Table 4-1
Surface Contamination Control

Uncontrolled Areas	Intermediate Areas	Controlled Areas
Removable Contamination Action Level: 200 dpm/100 cm² (alpha)	*Removable Contamination Action Level: 200 dpm/100 cm² (alpha)*	*Removable Contamination Action Level: 75,000 dpm/100 cm² (alpha) (Ref. 20)*
Survey Frequency: Weekly	*Survey Frequency: Quarterly*	*Survey Frequency: Monthly*

To limit the likelihood of personnel intakes of radioactive material within authorized eating or smoking areas, Honeywell establishes written procedures governing required controls, including requirements for individuals to wash their hands before eating, drinking, or smoking. Honeywell reinforces the applicable requirements through periodic radiation safety training. If contamination at levels exceeding the applicable action level is found in any designated eating area, eating shall be prohibited until completion of decontamination and follow-up surveys.

4.9.4.2 Actions Upon Discovery of Contamination Exceeding Action Levels

Any area found to exceed the specified action level shall be scheduled for decontamination. Follow-up surveys shall be conducted following decontamination of the area.

4.9.5 Personnel and Material Release Surveys

4.9.5.1 Personnel Release Surveys

Honeywell requires individuals who have entered the restricted area to perform personal contamination monitoring (minimum hand and foot frisk) upon exiting. Honeywell provides operational contamination survey instruments for personnel contamination surveys at all exits in use. Health Physics procedures provide guidance for response to events involving personnel contamination.

The survey instruments and techniques provide detection capability consistent with the guidance provided in Section 2.6 of Regulatory Guide 8.30.

4.9.5.2 Personnel Decontamination Policy

Honeywell requires decontamination efforts if skin or personal clothing contamination is detected at levels exceeding the guidance

provided in Section 2.6 of Regulatory Guide 8.30. Decontamination facilities include sinks and personnel showers that are provided with mild soap and running water. If needed, more aggressive decontamination techniques may be undertaken under the supervision of Health Physics.

Honeywell requires Health Physics approval prior to allowing an individual to exit the restricted area with skin or clothing contamination at levels exceeding the guidance provided in Section 2.6 of Regulatory Guide 8.30.

4.9.5.3 Material Release

Honeywell requires that Health Physics personnel survey articles that have been used in the uranium process areas prior to release for unrestricted use to ensure contamination levels meet the criteria specified in Table 2 of Regulatory Guide 8.30.

Empty transport vehicles used to deliver ore concentrates into the plant shall be surveyed prior to release. Outgoing radioactive material shipments shall be surveyed to ensure compliance with applicable USDOT radiological limits.

4.9.6 Sealed Sources

To limit the likelihood of contamination spread resulting from leakage of licensed material from sealed radioactive sources, Honeywell performs periodic leak tests in a manner consistent with the guidance provided in Volume 11, Appendix O, of NUREG-1556, "Consolidated Guidance about Materials Licenses: Program-Specific Guidance about Licenses of Broad Scope" (Ref. 21). Leak tests will be conducted at the frequency specified in the source registration certificate.

4.10 Access Control Program

4.10.1 Posting and Labeling

4.10.1.1 Restricted Area and Radioactive Material Areas

The restricted area includes that area within the inner security fence, including the area within the Administration Building that lies within the Security checkpoint. Access to the restricted area is limited by the fence and Security force monitoring of the entrance points.

Honeywell establishes a Radioactive Material Area congruent with the restricted area and posts all entrance or access points to the Restricted Area with signs bearing the standard radiation trefoil and the words:

CAUTION
RADIATION AREA
RADIOACTIVE MATERIAL
Any area or container in this plant (or "beyond this point") may contain radioactive material

The terms "entrance or access point" and "restricted area" are used consistent with the definitions provided at 10 CFR 20.1003. This posting practice is consistent with the guidance provided in Section 7 of Regulatory Guide 8.30, "Health Physics Surveys in Uranium Recovery Facilities."

Honeywell does not post individual rooms or areas as radioactive material areas. The practice of posting individual rooms and areas as radioactive material areas arising from the presence of containers of radioactive material would not be practical, nor would it provide any significant improvement in the state of radiation safety. Adequate warning regarding the hazards associated with these containers is provided by both the primary posting of Radioactive Material Area warning signs, which meet the requirements of 10 CFR 20.1902(e) and the guidance provided in Section 7 of Regulatory Guide 8.30, and the radiation safety training program.

4.10.1.2 Radiation Areas

As indicated in Section 1.8 of this Application, USNRC has granted MTW an exemption from the posting requirements of 10 CFR 20.1902(a) (Ref. 22). Honeywell establishes postings for Radiation Areas as follows:

Restricted Area entrances are posted with signs that include the "Radiation Area" warning as described in Section 4.10.1.1 of this Application. For any process equipment that emits radiation such that an individual could receive a deep dose equivalent (DDE) exceeding 5 millirem in one hour at a distance of 30 centimeters from the source, Honeywell:

- *Posts the process equipment (or adjacent structures) "Caution - Radiation Area," and*
- *Establishes yellow and magenta floor markings around the process equipment at a distance sufficient to enclose the area where an individual may receive a DDE exceeding 5 millirem in one hour.*

4.10.1.3 Airborne Radioactivity Areas

Honeywell provides postings for Airborne Radioactivity Areas as required by 10 CFR 20.1902(d). Airborne radioactivity area postings are augmented by flashing red lights that alert personnel to the hazard.

4.10.1.4 High Radiation Areas

Honeywell posts High Radiation Areas in accordance with 10 CFR 20.1902(b) and provides access controls for these areas in accordance with 10 CFR 20.1601.

4.10.2 Labeling

As indicated in Section 1.8 of this Application, USNRC has granted MTW an exemption from the labeling requirements of 10 CFR 20.1904(a) (Ref. 22). Maintenance of radioactive material labels on individual containers as required by 10 CFR 20.1904(a) would not be practical due to the large quantity (thousands) of drums and the need to stack the drums close together, rendering the labels inaccessible for both observation and maintenance.

In addition, labeling of these drums would not provide any significant improvement in the state of radiation safety due to the limited radiological hazards of the radioactive material processed at MTW and the administrative controls implemented to ensure adequate employee protection.

In lieu of labeling each individual radioactive material container as specified in 10 CFR 20.1904(a), Honeywell posts the entrances to the Restricted Area as indicated in Section 4.10.1.1 of this Application. In addition, Honeywell maintains other means of providing radiological hazard warnings to employees, including radiation safety training and other radiological postings.

Individuals authorized to enter the restricted area unescorted receive appropriate radiation safety information via the area posting, the radiation safety training program, and supplemental radiological postings and warnings and are therefore informed of the presence of and hazards associated with the radioactive material present in their work areas. In the presence of these controls, labeling of individual containers would be redundant, providing no information that is not already readily accessible to affected individuals.

4.10.3 Restricted Area – Access Control

Honeywell establishes the boundaries of the Radioactive Material Area congruent with the restricted area by erecting area postings as discussed

in Section 4.10.1 of this Application. These boundaries may be moved as needed to provide for personnel protection consistent with operational needs and changes in facility configuration. Routine authorized entry to the restricted area may occur through both the Main Gate and the Sampling Plant Gate. The Security force provides entrance gate surveillance and control through both direct and remote visual monitoring.

Honeywell provides Change Rooms to facilitate donning, removal, and storage of protective clothing. Entry into the Change Rooms from outside of the restricted area is controlled. Personnel exiting the Change Rooms pass the personnel monitoring station before they exit the facility.

4.10.4 Protective Clothing

Protective clothing available for personnel performing routine work in the restricted area includes lab coats, shoe covers, coveralls, and gloves. Honeywell requires the use of this clothing in designated areas. This clothing is manufactured consistent with conventional industrial clothing practice and provides sufficient protection against routine exposure to dry particulate contamination. Health Physics may grant exceptions to the protective clothing policy for individuals who enter specified areas of the plant where the potential for contamination spread is low.

Additional protective clothing and equipment is required for activities that could potentially expose the employee to hazardous chemicals. Administrative controls establish protective equipment requirements for each job.

4.10.5 Radioactive Material Transportation

Honeywell conducts radioactive material shipment and receipt activities using written procedures to assure compliance with the requirements of 10 CFR Part 20, 10 CFR Part 40, 10 CFR Part 71, and 49 CFR.

4.11 Reports and Records

4.11.1 Radiation Protection Program Records

Honeywell implements a program to ensure the proper production, storage, and retention of records related to health and safety. Included in this program are records of (retention periods in parentheses):

- *Events involving releases of radioactive materials beyond regulatory limits (until license termination);*
- *Radiological monitoring instrument calibration (5 years);*
- *The ALARA Program (5 years);*
- *Personnel radiation exposures (until authorized by USNRC); and*
- *Radiological surveys (5 years).*

Honeywell retains records that relate directly to radiation exposure of employees or members of the public (e.g., external dose monitoring results, bioassay results, environmental air concentrations, etc.) until USNRC authorizes disposition. Honeywell retains other records related indirectly to personnel exposures (e.g., contamination smears, daily air activity measurement, daily stack sampling, etc.) for a minimum of five years; however, prior to their disposition a summary report shall be prepared. Honeywell retains these summary reports until USNRC authorizes disposition.

On a semiannual basis, Honeywell prepares a report summarizing and evaluating the radiological measurements made at the facility, including airborne radioactivity, surface contamination, internal and external exposures, effluents, and environmental monitoring. This report shall be provided to the ALARA Committee, the Plant Manager, and other levels of supervision as necessary for appropriate action.

4.11.2 Radiation Exposure Records

Records related directly to radiation exposure of employees or members of the public are retained until USNRC authorizes disposition. These records include:

- *Personnel and environmental dosimetry results;*
- *Bioassay results (urinalysis and whole-body counts);*
- *Environmental measurements (air, soil, sediment, vegetation and water); and*
- *Events reportable to USNRC (overexposures, excessive concentrations, etc.).*

4.11.3 Records Supporting Exposure Evaluations

Records that relate indirectly to employee or environmental exposure are maintained a minimum of five years; a summary report is prepared prior to disposal. These records include:

- *Contamination survey results;*
- *Daily workroom air activity measurements;*
- *Daily gaseous and liquid effluent measurements;*
- *Fence line air sampling data; and*
- *Health Physics incident reports.*

4.11.4 Other Records and Reports

The following reports and records are maintained a minimum of five years:

- *ALARA Committee Meeting Minutes;*
- *Health Physics Audit Reports;*
- *Semi-annual Radiological Environmental Report; and*
- *Health Physics Instrument Calibrations.*

4.11.5 Radiation Protection Program Reports

Honeywell develops and submits reports related to the radiation protection program consistent with the requirements of 10 CFR 19.13, 10 CFR 20.2202 and 20.2206, and 10 CFR 40.60.

4.12 References

1. Regulatory Guide 8.2, Administrative Practices in Radiation Surveys and Monitoring, USNRC, May 2011.
2. Regulatory Guide 8.7, Revision 1, Instructions for Recording and Reporting Occupational Radiation Exposure Data, USNRC, June 1992.
3. Regulatory Guide 8.9, Revision 1, Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program, USNRC, July 1993.
4. Regulatory Guide 8.10, Revision 2, Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable, USNRC, August 2016.
5. Regulatory Guide 8.11, Applications of Bioassay for Uranium, USNRC, June 1974.
6. Regulatory Guide 8.13, Revision 3, Instruction Concerning Prenatal Radiation Exposure, USNRC, June 1999.
7. Regulatory Guide 8.15, Revision 1, Acceptable Programs for Respiratory Protection, USNRC, October 1999.
8. Regulatory Guide 8.25, Revision 1, Air Sampling in the Workplace, USNRC, June 1992.
9. Regulatory Guide 8.29, Revision 1, Instruction Concerning Risks from Occupational Radiation Exposure, USNRC, February 1996.
10. Regulatory Guide 8.30, Revision 1, Health Physics Surveys in Uranium Recovery Facilities, USNRC, May 2002.

11. Regulatory Guide 8.31, Revision 1, Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Is Reasonably Achievable, USNRC, May 2002.

12. Regulatory Guide 8.34, Monitoring Criteria and Methods To Calculate Occupational Radiation Doses, USNRC, July 1992.

13. Regulatory Guide 8.37, ALARA Levels for Effluents from Materials Facilities, USNRC, July 1993.

14. Title 10, Code of Federal Regulations, Part 19, Notices, instructions and reports to workers: inspection and investigations, USNRC.

15. Title 10, Code of Federal Regulations, Part 20, Standards for protection against radiation, USNRC, as amended.

16. NUREG/CR-4884, Interpretation of Bioassay Measurements, USNRC, June 1987.

17. ICRP, 1991. 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. Ann. ICRP 21 (1-3).

18. ICRP, 1994. Human Respiratory Tract Model for Radiological Protection. ICRP Publication 66. Ann. ICRP 24 (1-3).

19. ICRP, 1994. Dose Coefficients for Intakes of Radionuclides by Workers. ICRP Publication 68. Ann. ICRP 24 (4).

20. Letter, USNRC to Honeywell Metropolis Works, Approval of Amendment Request to Modify License Application Concerning Contamination Levels, Honeywell Metropolis Works (TAC No. L32712). Dated August 6, 2009.

21. NUREG-1556, Program-Specific Guidance about Licenses of Broad Scope, USNRC, April 1999.

22. Letter, USNRC to Honeywell International, Inc., Amendment Request for an Exemption to 10 CFR 20.1902(a) and 20.1904(a), TAC L32390, dated November 2, 2007.

Table 4-2
Radiological Monitoring Instruments

Type (Minimum Number)	Use	Sensitivity	Range	Calibration Frequency
Geiger Mueller Count Rate Meter (5)	Personnel and material exit monitoring	Beta/Gamma > 40 Kilo Electron Volt	0-50,000 cpm	Note 1
Exposure Rate Meters (3)	Exposure Rates	Beta/Gamma	0-5 rem/hr.	Note 1
Scintillation Alpha Counter (1)	Surface Contamination, Air Filters	Alpha	0 - 1E6 cpm	Note 1
Proportional Counter (1)	Air Filters, Surface Contamination	Alpha/Beta	0 - 1E6 cpm	Note 1
Kinetic Phosphorescence Analyzer (KPA) (1)	Uranium analysis	Uranium	1 part per billion (upper range determined by analytical techniques)	As needed (based on performance monitoring)
Portable air samplers (2)	Grab air sampling	NA	NA	Note 1

Note 1: Instruments are calibrated at a frequency recommended by the manufacturer.

5.0 NUCLEAR CRITICALITY SAFETY

Honeywell does not possess materials requiring nuclear criticality controls.

6.0 CHEMICAL PROCESS SAFETY

Honeywell implements a PSM Program consistent with the requirements of 29 CFR 1910.119 (Ref. 1). The PSM Program includes the fourteen program elements required by 29 CFR 1910.119 and addresses the following hazardous chemicals:

- Hydrogen (below the PSM threshold quantities);
- Aqueous Ammonia; and
- Anhydrous Hydrofluoric Acid

Because uranium hexafluoride can react to form hydrofluoric acid, it is considered in the PSM program.

The MTW PSM applicability document provides a complete listing of the chemicals, processes, and the areas impacted by the PSM program.

6.1 Chemical Process Description

Section 1.0 of this Application and the ISA provide descriptions of the chemical processes affecting licensed materials in use at MTW.

6.2 Chemical Hazards and Accident Sequences

The ISA provides a description of the chemical hazards and accident sequences affecting licensed material at MTW. Honeywell plant personnel participate in the MTW ISA Summary revision process.

6.3 Chemical Accident Sequence Likelihood and Consequences

The ISA provides a description of the chemical accident sequence likelihoods and consequences associated with processing of licensed material at MTW.

6.4 Chemical Process PFAP and Sole PFAP

The MTW ISA Summary provides a description of the chemical process PFAP and sole PFAP related to accident sequences affecting licensed material at MTW.

6.5 Chemical Process Management Measures

Section 11.0 of this Application provides a discussion of the management measures applied to PFAP at MTW.

6.6 Requirements for New Processes or Facilities

Section 11.0 of this Application provides a discussion of requirements for development and implementation of new processes or facilities.

6.7 References

1. 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, USEPA.

7.0 FIRE SAFETY

7.1 Fire Safety Management Measures

7.1.1 Fire Safety Administration

The Regulatory Affairs Manager is responsible for development and implementation of the fire protection program.

The MTW ISA did not identify any fire-related accident sequence requiring PFAP for prevention and/or mitigation. Therefore, there are no identified PFAP for fire-related accidents at MTW.

Section 11.0 of this Application provides a description of the MTW configuration management system, which includes review of proposed facility modifications by managers representing multiple disciplines.

7.1.2 Fire Prevention

All process areas are constructed of concrete and steel, which pose a minimal fire hazard. Storeroom areas that contain combustible or flammable materials are provided with sprinkler systems.

Honeywell conducts routine transient combustible audits to identify fire hazards and reduce the likelihoods of fire events.

7.1.3 Inspection, Testing, and Maintenance

Honeywell conducts routine testing and inspection of the plant fire apparatus and accessories. In addition, Honeywell's insurance carrier sponsors routine detailed inspections of the plant fire protection systems.

7.1.4 Emergency Response Organization

Honeywell maintains an Emergency Response Team (ERT) whose responsibilities include incipient fire response. The MTW Emergency Response Plan establishes requirements for ERT training.

Mutual Assistance Agreements have also been signed with the Massac County and City of Metropolis fire departments indicating the assistance to be provided if an emergency exceeds the facility firefighting capabilities.

The MTW Emergency Response Plan provides additional information regarding the emergency response organization, including provisions for training and drills.

7.1.5 Pre-fire Plans

Honeywell has developed pre-fire plans for the MTW facility and provided these plans to offsite firefighting organizations.

7.1.6 Fire Hazards Analysis

Honeywell maintains a fire hazard analysis that is updated as necessary.

7.2 System Design

There is no available record of the name of the person or firm that designed the installed plant fire water system (circa 1956). Industrial risk insurance carriers provide expertise and recommendations during audits of the fire protection systems.

The standards to which the Honeywell fire water protection system was designed and constructed were those codes and standards in effect at the time of construction in 1956.

7.2.1 Water Supply

A 250,000 gallon above-ground tank provides the primary water supply for fire-fighting/chemical mitigation. The tank level is automatically maintained. The tank is heated in winter. Fire pump suction can also be taken directly from the well water system.

There is a total of eight fire hydrants on site. Two fire hydrants, one located at the Sampling Plant and one located at the Construction entrance, are supplied by the plant's well water system.

7.2.2 Fire Water Pump

A split-case fire water pump rated at approximately 1000 gpm at 100 psig provides water for the fire water/chemical mitigation distribution system. The pump is equipped with a diesel engine and electric motor. The electric motor and diesel engine start on pressure drop controllers. The electric motor is primary, and the diesel motor is backup. If the electric and diesel motors fail, or the fire water pump fails, well water will supply the fire water/chemical mitigation distribution system through a check valve arrangement located in the fire pump room.

A jockey pump maintains the pressure in the fire mains and compensates for minor pressure variations.

The fire pump is routinely tested for proper function.

7.2.3 Fire Water/Chemical Mitigation Piping

Primary piping is eight inches in diameter with six-inch distribution pipes. The Tank Farm chemical mitigation towers are supplied by a 10-inch looped distribution system. *Fire main installation meets the standards of NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances" (Ref. 1) in effect at the time of installation.*

7.2.4 Fire Sprinkler Areas

A wet sprinkler system provides protection for the maintenance shop and stores area. The fire sprinkler system can be supplemented by a Fire Department Connection.

7.2.5 Standpipes

A 4-inch manual wet standpipe, installed in accordance with the standards of NFPA 14, "Standard for the Installation of Standpipe and Hose Systems," (Ref. 2) is located in the north and south FMB stairways with hose outlets located on intermediate landings. Hose valves are 2 ½-inch equipped with 1 ½-inch reducers and caps.

The standpipe system design flow rate is 500 gpm for the hydraulically most remote standpipe with an additional 250 gpm for the second standpipe, for a total of 750 gpm.

The standpipe system can be supplemented by a Fire Department Connection.

7.2.6 Fire Extinguishers

Honeywell maintains appropriate supplies of portable fire extinguishers. These are distributed and maintained in accordance with NFPA 10, "Standard for Portable Fire Extinguishers" (Ref. 3).

Periodic fire extinguisher hydrostatic testing is performed by qualified personnel.

7.2.7 Alternative Fire Suppression System

FM200 fire suppression systems are located in the following areas:

- Feed Material Building Distributed Control System room
- Modular Laboratory Building

7.3 Process Fire Safety

The ISA process provides an analysis of the likelihood and consequences of fire-related incidents affecting licensed materials at MTW. There are no PFAP related to fire-initiated incidents at MTW.

7.4 Fire Protection and Emergency Response

There are no PFAP related to fire-initiated incidents at MTW. Section 7.1.4 of this Application and the MTW Emergency Response Plan provide additional information regarding emergency response activities related to fire-initiated events at MTW.

7.5 Requirements for New Processes and Facilities

Section 11.0 of this Application provides a discussion of requirements for development, approval, and implementation of new processes or facilities.

7.6 References

1. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, National Fire Protection Association, 2002.

2. NFPA 14, Standard for the Installation of Standpipe and Hose Systems, National Fire Protection Association, 2010.

3. NFPA 10, Standard for Portable Fire Extinguishers, National Fire Protection Association, 2010.

8.0 EMERGENCY MANAGEMENT

8.1 Emergency Response Plan

Honeywell has developed an emergency response plan in accordance with 10 CFR 40.31(j) using guidance provided in Regulatory Guide 3.67, "Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities" (Ref. 1).

Honeywell develops and implements changes to the MTW Emergency Response Plan in accordance with 10 CFR 40.35(f) (Ref. 2).

8.2 References

1. Regulatory Guide 3.67 Revision 1, Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities, USNRC, April 2011.
2. Title 10, Code of Federal Regulations, Part 40, Section 40.35, Conditions of specific licenses issued pursuant to § 40.34, USNRC.

9.0 ENVIRONMENTAL SAFETY – RADIOLOGICAL AND NON-RADIOLOGICAL

Honeywell implements a comprehensive effluent control and environmental monitoring program to ensure effluent releases are controlled in accordance with applicable regulatory requirements and that exposures to affected members of the public are controlled to levels that are As Low as is Reasonably Achievable. Section 4.0 of this Application provides a discussion of the MTW ALARA Committee.

As discussed in Section 2.2.4 of this Application, the Health, Safety and Environmental Manager is responsible for overseeing development and implementation of the environmental protection program. The Health Physics group, under the direction of the Regulatory Affairs Manager, bears responsibility for collection and analysis of specified sample media and for supporting radioactive material transportation activities. The MTW ALARA Committee is responsible for reviewing selected effluent and environmental monitoring data as needed to establish ALARA goals consistent with the requirements of the ALARA Program.

Section 4.0 of this Application provides additional information regarding control and monitoring of radioactive effluents.

9.1 Environmental Report

In support of this Application, Honeywell has prepared and submitted to USNRC an environmental report consistent with the requirements of 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" (Ref. 1).

9.2 Effluent Controls and Waste Minimization

Honeywell establishes controls on facility effluents consistent with the requirements of 10 CFR 20.1101(d) to ensure the individual member of the public who is likely to receive the highest dose is not expected to receive a total effective dose equivalent (TEDE) exceeding 10 millirem per year from MTW airborne emissions.

Results from the Radiological Environmental Monitoring Program (air and water) are reviewed weekly by Health Physics. The environmental information is utilized to perform trend analysis. Undesirable trends are reported to Plant Management via ALARA Committee meetings, audits, or immediately depending on the severity of the condition. Appropriate information from the monitoring program is also utilized to prepare the Semi-Annual Effluent Report required by 10 CFR 40.65(a) (Ref. 2).

The MTW Environmental Report (Ref. 3) provides summaries of the results of Honeywell's effluent and environmental monitoring program.

9.2.1 Ventilation and Effluent Control Systems

Uranium processing areas that produce dusts, mists, or fumes containing uranium or other toxic materials are provided with dust collectors and/or scrubbers to reduce employee or environmental exposure to levels that are as low as is reasonably achievable (ALARA).

The gas exiting the tertiary cold traps flows through a caustic scrubbing system. In the caustic scrubbing system, the residual gas stream is contacted, in several vessels, with a potassium hydroxide (KOH) solution. The KOH solution removes essentially all the remaining fluoride-bearing components of the gas stream. The remaining air is then vented to the atmosphere through a stack. The stack is monitored to measure the quantity of uranium discharged to the atmosphere.

Reduction off-gases consist of H_2S, hydrogen, nitrogen and metallic sulfides. These are processed through a gas-fired incinerator to burn off the excess hydrogen and convert H_2S and other sulfides to SO_2, which exits the incinerator stack. Hydrofluorinator off-gases are twice scrubbed with water and then scrubbed with KOH to remove fluorides. The weak acidic HF liquors and spent KOH are transferred to the EPF for treatment.

The general ventilation system used in the FMB consists of several fresh-air intake units and window and roof exhaust fans. The distillation section is provided with containment walls to prevent the spread of UF6 vapors in the event of a release. The Fluorination Area south exit stairwell is enclosed and can be pressurized to facilitate emergency egress from the building.

The FMB Control Room can be maintained with slight positive pressure during a UF6 release. The positive pressure system is operator activated and has fresh air intakes located outside the UF6 process building.

Laboratory hoods that are routinely used to handle unencapsulated uranium are checked on a periodic basis to assure adequate face velocity.

Process area uranium air concentrations are monitored to assure the ventilation systems are adequately controlling employee exposures.

Each operating uranium emission source is monitored. This emission data is recorded to provide emission data on a daily, monthly, or annual basis. Operational and administrative controls are utilized to shut down equipment when the concentration of uranium in the exit stack exceeds the established administrative limit.

During operation, Honeywell performs continuous sampling of the process stacks to measure the uranium emission rate. Each (approximately) 24 hours, the individual filters for each sample point are composited and analyzed for total uranium emissions. Honeywell establishes an investigation limit for each dust collector stack (usually 5,000 dpm per

sample for secondary dust collectors). If the stack investigation limit is exceeded on three successive samples, Honeywell initiates an investigation to identify the source and required corrective actions. Due to the number of individual emission sources, Honeywell establishes an additional investigation level for airborne uranium emissions based on the average of four continuous air samples collected at the restricted area fence line, which are changed weekly. The investigation level is based on the average quarterly uranium concentration that would produce an annualized dose of 10 mrem (EDE), if an individual were continuously present at the fence line.

Essentially all stack emissions of uranium are of solubility Type M due to the variety of milling processes used to produce ore concentrates; however, in the fluorination and distillation sections the emissions are primarily highly soluble (Type F) UO_2F_2 from UF6 decomposition.

Samples are also analyzed from the off-gas scrubbers as required to control emissions. Additional samples, visual observation, and other precautions are taken as necessary to ensure effective performance of the pollution control equipment.

Stacks that contain non-radiological emissions are required to have an approved operating permit from the Illinois Environmental Protection Agency (IEPA). Each emission source is operated in accordance with the IEPA Air Permit.

9.2.2 Radioactive Waste Handling

9.2.2.1 Liquid Wastes

Liquid wastes from the facility are discharged via natural drainage into the Ohio River. Figure 9.1 provides a wastewater flow diagram. The main plant effluent is sampled, and the composite sample is analyzed daily for uranium. In the event of a spill that could significantly increase effluent water concentrations of uranium or other chemicals, controls such as diking, or neutralization are utilized to minimize contamination of the liquid effluent. Suspended solids, pH, temperature, flow, and fluoride are monitored in accordance with the National Pollutant Discharge Elimination System permit. The daily samples of the main effluent are composited into a monthly sample.

EPF is utilized to remove chemical pollutants (primarily fluoride) from the main plant liquid effluent stream. The facility process uses calcium hydroxide to precipitate fluorides as insoluble calcium fluoride. The "synthetic" calcium fluoride solids are precipitated and may be recovered and recycled to any commercial organization which can use synthetic CaF_2 as a substitute for naturally occurring

CaF_2 (fluorspar). *Prior to offering the synthetic CaF_2 for recycling, Honeywell limits the average concentration of uranium in calcium fluoride released to each commercial organization, for any consecutive 12-month period, to less than 212 pCi/gram (Ref 4).*

The effluent from the EPF is combined with other treated wastewater, which is then mixed with non-contact cooling water, stormwater, and the effluent from the uranium settling ponds and monitored as it is discharged into the Ohio River.

Wastewater that is known to contain uranium, and does not contain significant quantities of fluoride, is routed through the #3 and #4 uranium settling ponds.

The HF water scrubber liquors are routed directly to the EPF for HF neutralization. The uranium content of this stream typically averages less than 10 ppm uranium.

The pH of the uranium settling ponds (Ponds No. 3 & 4) is typically maintained slightly basic to minimize dissolved uranium loss. Experience indicates that approximately 80 - 90% of the uranium loss from these ponds is soluble uranium. As the effluent leaves the second uranium pond, the level is measured to determine flow rate and a sample is taken for a 24-hour composite sample. The pH and uranium content of the composite sample are analyzed daily. The average flow from these two ponds is approximately 25 gpm. The effluent from the uranium settling ponds is then mixed with the remainder of the facility effluent before discharging into the Ohio River.

The solids level in the ponds is measured periodically; an individual pond is removed from service when the available "freeboard" is reduced to approximately 2 feet. The solids removed from No. 3 and 4 Ponds during a cleanout may be transferred into the pond muds calciner for drying and packaged for onsite or offsite recycling. The settling ponds solids are processed for recovery of the contained uranium.

Each time a pond is emptied and cleaned, a thorough examination is made of the lining. The lining is 60 mil Ethylene-Propylene Diene Monomer (EPDM) rubber installed over the previously-used liners. The material in the ponds is alkaline and the EPDM rubber liner has excellent resistance to alkaline solutions. In the event a pond liner should develop a leak, seepage drains are installed under each pond which discharge into the main effluent.

Mixed waste is stored on covered, concrete storage pads that are permitted by the plant's RCRA permit issued by the Illinois Environmental Protection Agency.

9.2.2.2 Solid Wastes

Radioactive solid wastes are generated from routine operation of the uranium processes. The routine wastes generated consist primarily of contaminated filters, paper, wood, plastic, cloth, rubber, and scrap metal. These materials are normally shipped to a licensed disposal site or processor.

These materials are collected in marked containers, segregated by radioactivity monitoring, and then containerized. The containerized material may be compacted on site and shipped to a licensed processor or disposal site.

Contaminated pieces of process equipment and other scrap metal being discarded are decontaminated where feasible to recover uranium, volume-reduced as appropriate, then shipped to a licensed processor or disposal site. Non-contaminated scrap metal may be sold to various scrap metal dealers or disposed of as non-radioactive waste. *Radiological monitoring is performed to assure that the residual radioactivity level is below release criteria as stated in Section 2.5 of Regulatory Guide 8.30 (Ref. 5). Other recyclable materials may be released if residual radioactivity levels are less than these same levels.*

9.2.2.3 Shipping and Receiving

Honeywell receives uranium ore concentrates via common carrier from uranium mills throughout the world. Each shipment is unloaded at the Sampling Plant. *Upon completion of unloading, each trailer is monitored for residual radioactivity in accordance with appropriate USDOT or USNRC standards before the trailer is released from the plant. If a trailer is found to be contaminated at levels exceeding the controlling regulatory requirements, appropriate decontamination measures are taken, or the trailer is controlled as radioactive material.*

Outgoing shipments of UF6 product cylinders, low-level waste, or off-grade residues to be recycled are monitored in accordance with Section 2.8 of Regulatory Guide 8.30 to assure compliance with regulatory standards.

9.2.3 Airborne Effluent Monitoring Program

Honeywell implements a comprehensive environmental air monitoring program to demonstrate compliance with applicable environmental air

quality standards. The environmental air monitoring program is managed by procedure and consists of:

- Air samplers at four points along the restricted area fence line (Stations No. 9, 10, 12, and 13).
- Two air samplers located near the site boundary (Stations No. 8 and 11).
- An air sampler located off-site approximately one mile downwind of the FMB (Station No. 6).
- An air sampler located at the location of the nearest downwind residence (Station NR-7).

See Drawing No. MTW-4781 included with the Application Revision 02/08/2017.

Each sample filter is changed weekly and analyzed for uranium. A quarterly composite of the weekly samples is sent to a vendor analytical laboratory for Ra-226 and Th-230 analysis.

9.2.4 Liquid Effluent Monitoring Program

Compliance with applicable effluent release limits and water quality criteria is determined by sampling the plant effluent discharge and the Ohio River, which is the receiving stream for plant effluents.

The main plant effluent is continuously sampled and a daily composite is analyzed for uranium content. The daily samples are composited into a monthly composite sample, which is analyzed for uranium. The investigation level for uranium in the liquid effluent is 1.0 ppm Uranium as a monthly average. This concentration would produce an individual ingestion dose of <1 mrem/yr (EDE) at the nearest downstream municipality that could, but does not, use Ohio River water as a drinking water source.

Quarterly composites of the monthly samples are analyzed by a vendor laboratory for Ra-226 and Th-230. Effluent water samples are also collected in accordance with conditions prescribed in the plant NPDES permit.

9.2.5 Compliance Methods for 40 CFR Part 190 and Determination of Dose to the Nearest Resident

Honeywell calculates the nearest resident's inhalation dose using analytical data collected from the plant effluent stacks. Dose coefficients from ICRP 68 (Ref. 6) are used in conjunction with measured releases of airborne uranium. The dose factors assume a particle size of 1 μm (activity median aerodynamic diameter) and vary by solubility.

For dose calculation purposes, 100% occupancy is assumed for the nearest resident. With regard to solubility, all isotopes are taken to be Type M, other than Th-230 which is assumed to be Type S.

Calculations are performed for each significant isotope according to the solubility and air concentration measured. The EPA computer program "CAP-88" is used to model inhalation and ingestion dose from stack emissions for the nearest resident. Effluent concentration limits may be based upon ALI and DAC values derived from ICRP 68 dose coefficients in conjunction with calculations defined in 10 CFR 20 Appendix B (Ref. 7). The Environmental Report, submitted separately, provides a summary of stack emission data and doses calculated for the nearest resident.

If the average concentration of total alpha radioactivity (the sum of natural uranium, radium-226, and thorium-230) measured from samples collected from existing Station No. NR-7 (adjacent to the home of the nearest resident north-northeast of the plant) exceeds 3.0 x 10-14 µCi/ml over any calendar quarter, within 30 days Honeywell prepares and submits to the USNRC a written report that identifies the cause for exceeding the limit and the corrective actions to be taken to reduce radioactivity release rates. If the parameters important to a dose assessment change, Honeywell shall submit a report within 30 days that describes the changes in parameters and includes an estimate of the resultant change in dose commitment.

9.2.6 Ambient Radiation Monitoring

Honeywell performs continuous monitoring of ambient radiation using environmental dosimeters. An environmental dosimeter is located on or adjacent to the restricted area fence on each side of the plant, one dosimeter is located at the nearest property boundary, one is located at the Metropolis Airport approximately one-mile NE of the facility and two are located at the nearest residence (see Drawing No. MTW-4781 included with the Application Revision 02/08/2017). The dosimeters are exchanged at least quarterly for analysis by a vendor laboratory.

9.2.7 Wastewater Monitoring

Honeywell demonstrates compliance with applicable effluent release limits and water quality criteria by sampling the plant effluent discharge and the Ohio River, which is the receiving stream for plant effluents. The effluent discharges into a natural watercourse, which also carries run-off during periods of heavy precipitation. The effluent travels about 2,000 feet across Honeywell property before it enters the Ohio River. The quantity of effluent discharged is insignificant compared to the annual mean flow of the Ohio River. The MTW Environmental Report provides a summary of wastewater monitoring data.

9.2.8 Environmental Water and Sediment Sampling

Honeywell collects environmental water and sediment samples semi-annually from four locations on the Ohio River and at three area lakes and ponds. These samples are analyzed for uranium content to determine any potential impact of plant operation.

9.2.9 Environmental Soil and Vegetation Samples

Honeywell collects additional environmental soil and vegetation samples semi-annually. Six sample stations are located on-site at the same location as the air samplers. Seven additional stations are located off-site in the surrounding areas of Illinois and Kentucky covering a radius of about eight miles from the plant. Figures 9.2 and 9.3 illustrate the on-site and off-site sampling locations. Each sample is analyzed for uranium content.

9.2.10 Summary

Table 9-1 provides a summary of the environmental monitoring program.

9.3 ISA Summary

The MTW ISA Summary provides descriptions of identified accident sequences, analyses of their environmental effects, and the PFAP used to prevent and mitigate the identified accidents.

9.4 Management Measures

Section 11.0 of this Application discusses management measures implemented by Honeywell to provide reasonable assurance that PFAP will perform their intended safety function(s) when needed to prevent accidents or mitigate the consequences of accidents to an acceptable level.

9.5 References

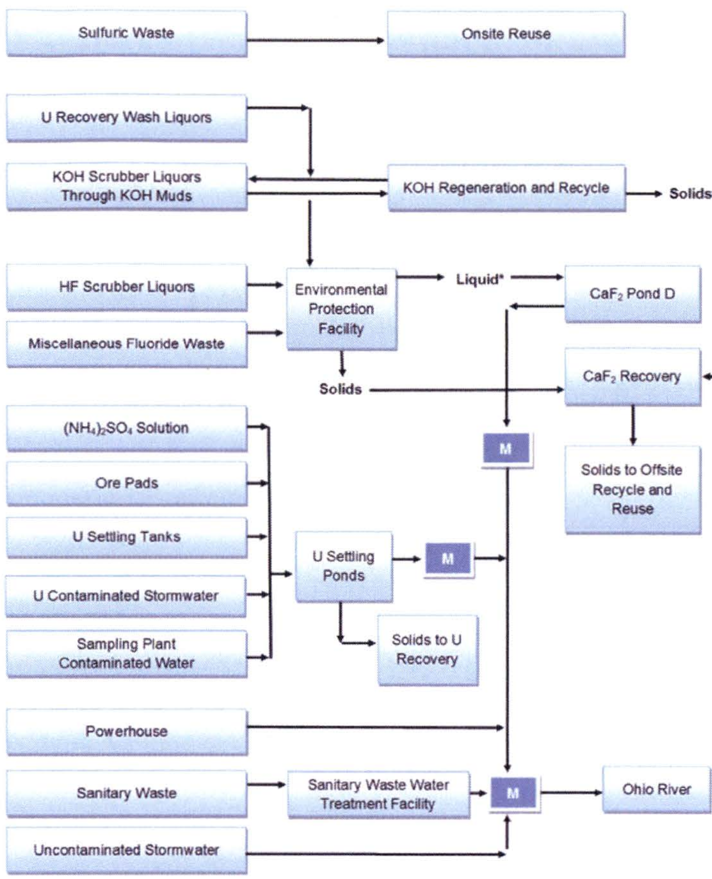
1. 10 CFR Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, USNRC.
2. Title 10, Code of Federal Regulations, Part 40, Section 40.65, Effluent monitoring reporting requirements, USNRC.
3. Environmental Report, Renewal of Source Materials License SUB-526, Honeywell International Inc., February 8, 2017.
4. Letter, USNRC to Honeywell International, Inc., Safety Evaluation Report, Amendment Application Dated July 30, 1993, Re Recycling Synthetic Calcium Fluoride (CaF_2), dated August 26, 1993.
5. Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities, Revision 1, USNRC, May 2002.
6. ICRP, 1994. Dose Coefficients for Intakes of Radionuclides by Workers. ICRP Publication 68. Ann. ICRP 24 (4).

7. Title 10, Code of Federal Regulations, Part 20, Appendix B, Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage, USNRC.

Table 9-1 – Environmental Monitoring Program Summary

Sample Medium	Number of Stations	Analytical Frequency	Sample Type	Type of Analysis
Onsite				
Air	6	Quarterly	Continuous	Uranium, Ra-226, Th-230
Soil	6	Semiannually	Grab	Uranium
Vegetation	6	Semiannually	Grab	Uranium
Ambient Radiation	5	Quarterly	Continuous	Gamma
Surface water	1	Monthly Monthly	Continuous Continuous	Uranium Suspended solids, dissolved solids, pH, fluorides, other chemicals
Sediment	2	Semiannually	Grab	Uranium
Offsite				
Air	2	Weekly	Continuous	Uranium, Ra-226, Th-230
Soil	8	Semiannually	Grab	Uranium
Vegetation	8	Semiannually	Grab	Uranium
Ambient radiation	3	Quarterly	Continuous	Gamma
Surface water	7	Semiannually	Grab	Uranium
Sediment	7	Semiannually	Grab	Uranium

Figure 9.1 – Waste Water Disposition



*Once EPF modifications are completed, liquid discharge will be rerouted to NDPES Outfall 002, and Pond D will be closed.

M — Designates a sampling station.

Figure 9.2 – Environmental Air Sampling Stations

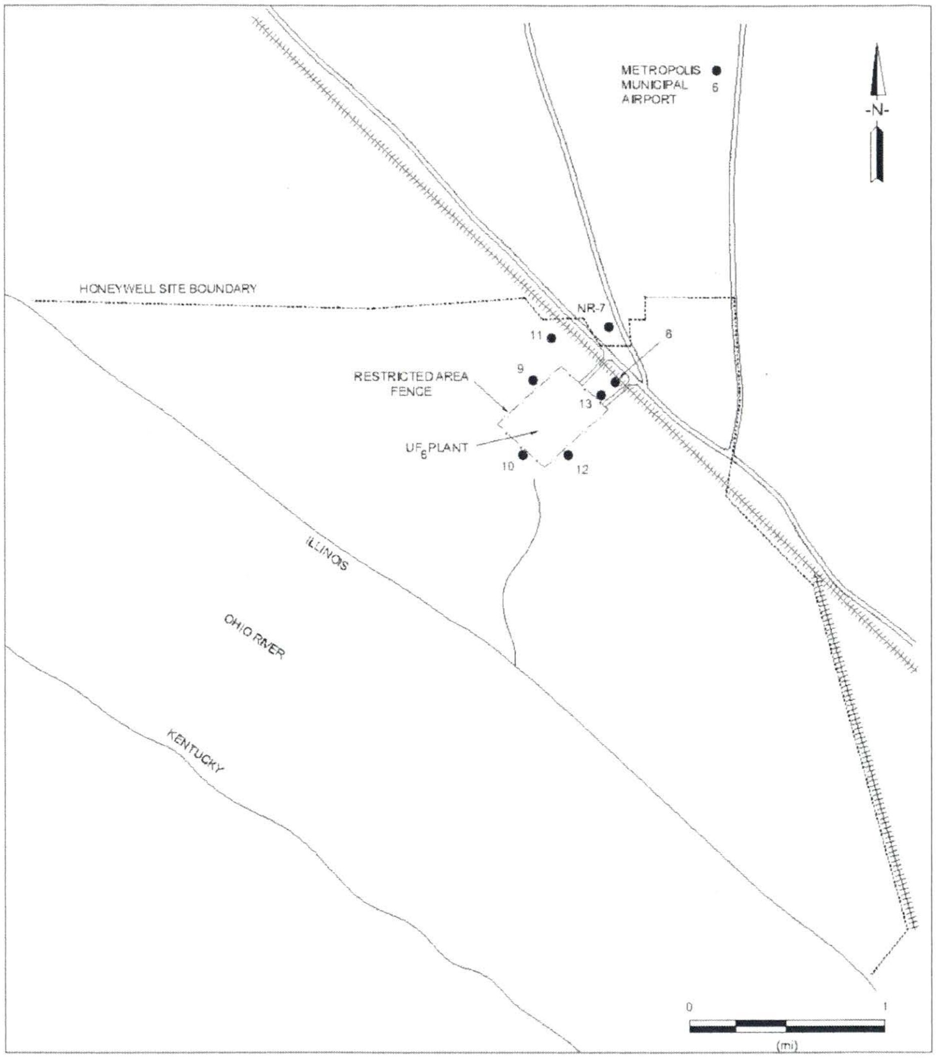
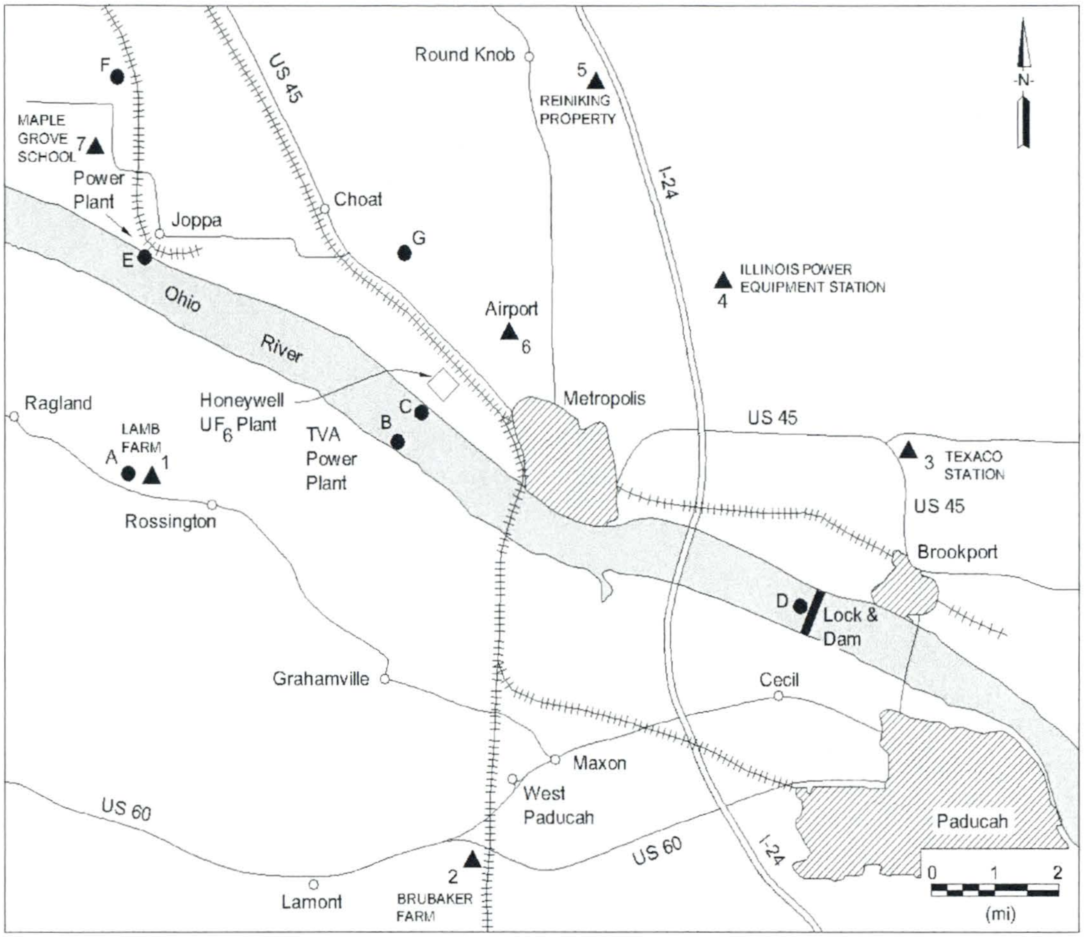


Figure 9.3 – Off-Site Sample Points



● Surface Water and Sediment (Mud) Samples ▲ Soil and Vegitation Samples

A	Lamb Farm
B	TVA
C	Plant Site Outflow
D	Bookport Dam
E	Joppa Power Plant
F	Lindsay Lake
G	Oak Glenn Lake

1	Lamb Farm
2	Brubaker Farm
3	Texaco Station
4	Illinois Power Equipment Station
5	Reiniking Property
6	Metropolis Airport
7	Maple Grove School

10.0 DECOMMISSIONING

10.1 Financial Assurance for Decommissioning

At the end of the plant life, the facility and site shall be decommissioned in accordance with a USNRC-approved decommissioning plan. Honeywell has prepared and periodically updates (in accordance with 10 CFR 40.36) (Ref. 1) a Decommissioning Funding Plan (DFP). Honeywell provides to USNRC documentation of a financial instrument reflecting an amount sufficient to cover the decommissioning cost estimated in the approved DFP.

Honeywell develops and implements changes to the Decommissioning Funding Plan in accordance with 10 CFR 40.36(d)(2).

10.2 References

1. Title 10, Code of Federal Regulations, Part 40, Section 40.36, Financial assurance and recordkeeping for decommissioning, USNRC.

11.0 MANAGEMENT MEASURES

Honeywell applies management measures specified in this section to PFAP, as identified in the MTW ISA Summary, to ensure the PFAP are available and reliable to perform their functions when needed. The following sections provide additional information regarding the management measures implemented at MTW.

11.1 Configuration Management

11.1.1 Scope

Honeywell has established a configuration management program to evaluate, implement, and track proposed changes to the site, structures, processes, systems, components, computer programs, and activities of personnel. The configuration management program provides assurance that PFAPs can perform their functions when needed.

The configuration management program is documented in approved written procedures.

11.1.2 Process Outline

Honeywell's Management of Change program includes the following elements.

A proposed change request is initiated and submitted addressing the following criteria:

- *The technical basis for the change;*
- *Impact of the change on safety and health and control of licensed material;*
- *Modifications to existing operating procedures including any necessary training or retraining before implementation of the change;*
- *Modifications to PSI;*
- *Authorization requirements for the change;*
- *For temporary changes, the approved duration of the change;*
- *The impact of the change on the facility's licensing basis documents; and*
- *Any required changes to the facility's USNRC license.*

A cross-functional review of the proposed change package is performed If necessary, a PHA is conducted with validated recommendations from the PHA included within the ISA and the scope of the field work package.

A review is conducted in accordance with Section 11.1.3 of this Application to determine if the change requires USNRC approval before the change is implemented. Changes to the review criteria provided in Section 11.1.3 of this Application require prior USNRC approval via a license amendment.

11.1.3 Changes Affecting the ISA Summary and License Application

11.1.3.1 Changes Affecting the MTW ISA Summary

Honeywell may implement changes to the site, structures, processes, systems, components, computer programs, and activities of personnel without prior USNRC approval if the proposed change does not:

- *Create new types of accident sequences that, unless mitigated or prevented, would exceed the performance requirements specified in 10 CFR 70.61 and that have not previously been described in the MTW ISA Summary; or*
- *Use new processes, technologies, or control systems for which Honeywell has no prior experience; or*
- *Remove, without at least an equivalent replacement of the safety function, a PFAP that is listed in the MTW ISA Summary and is necessary for compliance with the performance requirements of 10 CFR 70.61; or*
- *Alter any PFAP, as listed in the MTW ISA Summary, that is the sole item preventing or mitigating an accident sequence that exceeds the performance requirements of 10 CFR 70.61; or*
- *Create any condition or configuration that is otherwise prohibited by license condition or order.*

Honeywell's evaluations of proposed changes to the facility or its processes are performed by personnel familiar with the ISA methods discussed in Section 3.2.2 of this Application.

If Honeywell identifies a previously unknown credible accident scenario, or identifies sequences that may result in an increase in the consequences and/or likelihood of a previously-analyzed accident scenario (such as through routine updates to process hazards analyses), Honeywell promptly:

- *Evaluates the sufficiency of existing PFAP and associated management measures;*
- *Identifies new PFAP or implements other changes, as required; and*
- *Develops, reviews, approves, and implements associated changes to the MTW ISA Summary.*

PFAP with performance deficiencies, as identified through updates to the MTW ISA Summary, are addressed upon identification.

For changes that require USNRC approval prior to implementation, MTW will submit a license amendment request in accordance with 10 CFR 40.44 (Ref. 1).

11.1.3.2 Changes Affecting the License Application

Honeywell may make changes to the license application without prior USNRC approval using the configuration management process described in this section of the Application if these changes do not: 1) reduce the effectiveness of Honeywell's commitments as identified in this Application; 2) modify methodologies and associated assumptions used in developing the safety basis, such as the ISA methodologies; 3) modify the NRC-approved safety basis, or 4) conflict with existing license conditions.

If a proposed change to the license application does not meet these criteria, Honeywell will submit to the USNRC an amendment request pursuant to the requirements of 10 CFR 40.44. Such changes will not be implemented until USNRC approval is granted.

11.1.3.3 Reports of Changes to USNRC

Honeywell provides to USNRC summaries of changes to the site, structures, processes, systems, components, computer programs, and activities of personnel. For changes that do not require USNRC approval, Honeywell submits a report to USNRC providing a summary of such changes. For changes that affect the MTW ISA Summary, Honeywell submits to USNRC either a revised MTW ISA Summary or revised MTW ISA Summary pages. Honeywell develops the required reports using the guidance provided in Regulatory Guide 3.74, "Guidance for Fuel Cycle Facility Change Processes," (Ref. 2) and submits the required reports to USNRC within 30 days following the end of the calendar year in which the changes were implemented.

11.1.4 Change Implementation and Records

For any change approved by Honeywell for implementation, Honeywell promptly updates affected site documentation (e.g., policies, procedures, drawings, and training materials).

Honeywell maintains records of changes to the facility in accordance with internal document management and control policies. These records

include the written evaluation that provides the bases for the determination that the changes do not require prior USNRC approval.

11.2 Maintenance

Honeywell implements maintenance management functions to ensure the structures, systems and components are maintained as necessary to ensure PFAP are available and reliable to perform their safety function(s) when needed. Maintenance of PFAP, and any items that may affect the function of PFAP, encompasses planned testing and preventative maintenance, corrective maintenance, surveillance, monitoring, and functional testing. Honeywell implements a specific written procedure governing PFAP maintenance. In addition, maintenance activities affecting PFAP are controlled by special work packages.

Implementation of approved configuration management changes to hardware is also generally performed as a planned maintenance function. Planned testing (e.g., functional/performance testing, instrument calibrations) monitors the integrity and capability of PFAP, and any items that may affect the function of PFAP, to ensure they are available and reliable to perform their function when needed, to comply with the performance requirements assumed in the ISA documentation. Periodic testing is performed on a frequency necessary to maintain the availability and performance of the PFAP.

Planned preventative maintenance (PM) includes periodic refurbishment, partial or complete overhaul, or replacement of PFAP, as necessary to ensure the continued availability and reliability of the safety function assumed in the ISA documentation. In determining the frequency of any PM, consideration is given to appropriately balancing the objective of preventing failures through maintenance against the objective of minimizing unavailability of PFAP because of PM. In addition, feedback from PM, corrective maintenance and the results of incident investigations and identified root causes are used, as appropriate, to modify the frequency or scope of PM. Planned maintenance on PFAP, or any items that may affect the function of PFAP, that do not have redundant functions available, will provide for compensatory measures to be put into place to ensure that the PFAP function is performed until it is put back into service.

Corrective maintenance involves repair or replacement of equipment that has unexpectedly degraded or failed. Corrective maintenance restores the equipment to acceptable performance through a planned, systematic, controlled, and documented approach for the repair and replacement activities.

Following any maintenance on PFAP, and before returning a PFAP to operational status, functional testing of the PFAP, as necessary, is performed to ensure the PFAP can perform its intended safety function.

Process equipment and instrumentation information is entered in a computerized system.

Equipment PM(s), inspection, and testing frequencies are maintained by the computerized system. Frequencies are established based on review of applicable regulations, standards set by Honeywell, operational experience, manufacturer's recommendations, or request from regulatory agencies.

Procedures for PM(s) and inspections are stored, scheduled, and maintained by the computerized system.

Equipment drawings and manufacturer's information are maintained by Maintenance and Engineering personnel. PM and inspection records are maintained by Maintenance Planning and Reliability personnel.

Current PM listings are generated by the computerized system. Maintenance Planning and Reliability personnel are responsible for reviewing and maintaining the PM data used by the system.

11.3 Training and Qualification

Honeywell implements an employee training and qualification program to provide assurance that personnel working in the facility recognize the importance of, and are qualified to perform, assigned activities in a manner that protects workers, the public, and the environment. The training and qualification program includes safety training and technical and skills training commensurate with the assigned tasks. The training program also provides assurance that PFAP are available and capable of performing their intended safety functions.

11.3.1 Organization and Management of Training

11.3.1.1 Instructors

The selection of instructors is the responsibility of the department manager. To adequately cover the scope of required material, instructors usually have teaching or presentation experience and possess a thorough understanding of the lesson content for which they are responsible.

11.3.1.2 Testing and Feedback

Methods are used to ensure training is effective. In the classroom situation, this evaluation typically is in the form of a written test with a minimum passing score. A checklist or an oral examination may be used or the employee may be asked to provide a performance demonstration. The instructor may, if the situation permits, solicit feedback from the trainees to ensure effective training in the absence of a written examination.

Feedback to the trainee is reflected in the scoring of the evaluation mechanisms from the classroom and On-the-Job Training. If the trainee has not achieved the required score to qualify, retraining is instituted.

11.3.1.3 Employee Training Records

Training records for Honeywell employees are kept for each subject area, by computer or by hard copy, and maintained in accordance with MTW records retention procedures.

11.3.2 Position Training Requirements

11.3.2.1 New Employee Training

Metropolis Works employees are required to undergo training prior to performing work. The training each employee receives is dependent upon whether the worker is new to the plant site and the type of job to which the worker is assigned. Training subject matter includes industrial and radiological safety subjects and job-specific information, as appropriate to the individual's job responsibilities and previous experience.

Section 4.7 of this Application addresses requirements for radiation safety training.

Chemical safety training, which is included in general orientations, and some types of specialized training, may be conducted by Health Physics and Safety personnel. The training subjects include (to the extent appropriate to the employee's responsibilities):

- Personal protective equipment;
- Confined Space Entry;
- Electrical safety;
- Lock / Tag / Try;
- Special Work Permits;
- Fire protection;
- Medical activities;
- Radioactive materials;
- Air contaminants;
- Employee right-to-know; and
- Material handling (equipment).

11.3.2.2 Plant Operator Training

Honeywell provides initial and continuing training to plant operators (specifically, "Chemical Operators," individuals who routinely monitor plant parameters and manipulate controls associated with licensed material processing) in accordance with established plant

policies and procedures. A qualification description document establishes Chemical Operator Training and Qualification requirements.

Chemical operators training typically includes the following, as appropriate to the individual's responsibilities and previous education, training, and experience:

- Basic chemical concepts and plant industrial functions;
- Disciplined Operating concepts (e.g., Conduct of Operations);
- Systems Overview;
- Process/Unit skills training (e.g., On-the-Job Training);
- Process Operations Procedures (e.g., startup, normal operations, and shutdown);
- Procedural process (including review, verification, validation, approval and revision);
- Temporary and emergency operations;
- Alarm response and abnormal conditions;
- Operating limits and safety features (including PFAP);
- Safety and Health Hazards related to assigned work area(s);
- Emergency Response and Shutdown; and
- Chemical and Radiological Safe Work Practices.

Honeywell provides continuing training to maintain and enhance the ability of Chemical Operators to perform job assignments and to ensure facility safety and reliability.

Continuing training includes:

- Items identified as requiring continuing training because of job/task analysis;
- Changes to procedures and governing documents;
- Facility/process modifications;
- Industry operating experience and correction of performance problems;
- Applicable regulatory/requirements changes; and
- Applicable management directives.

11.3.2.3 Training of Maintenance Personnel

Honeywell maintenance personnel receive specialized training needed to perform PM inspection tasks (such as Non-Destructive Testing methods). Additional training is conducted on a variety of safety subjects, including an overview of the chemical processes used in the plant.

11.3.2.4 Contractor Training

Contracted work companies who will perform physical work on facility systems and equipment are required to submit a pre-qualification form prior to being awarded a contract. This form addresses safety and health programs, inspections, new employee orientation, supervisor safety instruction, etc.

Prior to an unescorted contractor performing work within the restricted area, each person receives a contractor's indoctrination addressing health and safety, safety equipment, first-aid and medical emergency procedures, health physics and hazard communications. Training topics include (to the extent appropriate to the areas entered and hazards encountered):

- Chemical and industrial safety training in accordance with applicable sections of 29 CFR 1910 (Ref. 3); and
- Emergency response training in accordance with the MTW Emergency Response Plan.

Contractor employees must pass a written test after completing the indoctrination. The indoctrination remains valid for a period of twelve months.

Refresher training is accomplished through attendance at annual radiation safety presentations.

Railroad personnel require intermittent site access to deliver rail car quantities of materials. Honeywell requires at least one railroad employee in each unescorted switching crew to have a current contractor's indoctrination.

Honeywell assigns a Honeywell Designated Representative (HDR) who is familiar with the proposed work to the contractor. The HDR coordinates work activities with the contractor.

11.3.2.5 Other Training

The MTW Emergency Response Plan establishes requirements for training of Emergency Response Team members.

Additionally, PHA Team leaders are required to attend vendor-provided training and Honeywell in-house training. The Honeywell training also includes training related to the MTW ISA process for those personnel that are involved in ISA and ISA Summary activities. Training and experience requirements for PHA Team leaders includes:

- Chemical industry experience;
- Initial training in PHA methodologies and dispersion modeling;
- Refresher training as required by Honeywell PSM procedures; and
- Must have actively participated in a PHA.

Training and experience requirements for ISA Team leaders includes;

- *Knowledgeable in ISA methodologies as defined in NUREG 1513;*
- *Experienced in chemical process engineering or radiological safety;*
- *Possess an understanding of PSM requirements; and*
- *Familiarity with process operations and site hazards*

11.4 Procedures

Honeywell has established a process to identify those operations that require procedural guidance to ensure proper execution and requires that these operations be conducted in accordance with approved procedures.

Written procedures govern the procedure control process. These procedures address operating procedure preparation, review, revision, approval, implementation, control, and cancellation.

11.4.1 Procedure Development

Honeywell has established written procedures governing the development and implementation of plant procedures. Written procedures govern a variety of plant activities, including administrative and management processes, plant operations, maintenance, health physics, environmental, laboratory, and safety activities. Steps in the Honeywell procedure development process include the following, to the extent applicable to the activity to be addressed by the procedure:

- Application of procedure development guidelines and determination of basis for the procedure;

- Information gathering;
- Determination of procedure use classification and applicable format;
- Initial review and comment;
- Procedure verification;
- Procedure validation;
- Final Review;
- Procedure Approval;
- Entering approved procedure in the document management system; and
- Conducting necessary training prior to implementation.

MTW procedures that govern activities related to PFAP include both Nuclear Service procedures (i.e., plant operations procedures – see below) and other types of procedures, including administrative, maintenance, and training procedures.

Nuclear Services procedures (NSP) are procedures that provide directions for and allow manipulation or operation of a system, component or piece of equipment affecting licensed material. MTW maintains several categories of NSPs, including Standard Operating Procedures, Abnormal Operating Procedures, Emergency Operating Procedures, Indicator Response Procedures, and Alarm Response Procedures.

Where applicable, NSP address the necessary chemical safety concerns within the document body (initial startup; normal, temporary, and emergency operations; emergency and normal shutdowns; and startup following turnaround or emergency shutdown). Each NSP addresses, as appropriate, upper and lower operational limits for pertinent process parameters, e.g., temperature, pressure, flow rates, concentration, composition, etc. Likewise, actions required to avoid process deviations or return to normal are outlined in the body of NSP.

NSP are typically developed by or under the guidance of an engineer or other individual assigned by the responsible manager, reviewed and approved in accordance with the change process discussed in Section 11.1 of this Application.

The Honeywell procedure for development and implementation of NSP also addresses the use of temporary procedures, procedure revision, and periodic review. NSP are reviewed on an appropriate cycle as defined by the Procedure Program requirements.

Each area has access to a current copy of its NSP(s).

11.4.2 Procedure Review

Each NSP is reviewed by Safety, Environmental, and Health Physics personnel to ensure that all pertinent issues related to their responsibilities are adequately addressed. Operating personnel may also participate in the review process.

Procedures are formally reviewed according to MTW's Periodic Review Program. NSP are certified current annually if subject to PSM requirements of 29 CFR 1910.119. Other procedures are reviewed on an appropriate cycle as defined by the Procedure Program requirements. In addition, any management-approved recommendation emanating from a hazard assessment team that impacts an NSP would be inserted in that NSP.

11.4.3 Procedure Revision

Procedure revisions are addressed using a graded approach, with the level of review dependent on the nature and scope of the change.

11.4.4 Procedure Use and Adherence

Honeywell establishes procedures governing use of and adherence to written procedures. These procedures address the following:

- Guidance to identify the manner in which procedures are to be implemented;
- Types of procedures that shall be present and referred to directly;
- Types of activities that do not require procedures or do not require procedures to be present;
- Methods by which changes to procedures can be made; and
- Actions to be taken to bring the facility to a safe condition in off-normal situations not covered by an approved procedure.

11.5 Audits and Inspections

Honeywell implements a program of audits and inspections to verify that plant operations, maintenance activities, radiation protection program, chemical safety (including USNRC-regulated hazards), fire protection program, emergency response program, and environmental protection program are conducted safely and in accordance with applicable regulatory requirements, license conditions, and written procedures. Training and qualification subjects are included within the scope of the program audits discussed above. The audit program includes ISA program elements related to the identification, analysis, and management of chemical hazards under USNRC jurisdiction. Audits also include procedures and records associated with the program under review.

Honeywell assigns primary responsibility for the audit and inspection program to the Regulatory Affairs Manager, who maintains written procedures for implementing the program. The Regulatory Affairs Manager assigns personnel to perform required internal audits. Auditors do not bear responsibility for the function and area being audited. The Nuclear Compliance Director and Regulatory Affairs Manager hold authority to shut down operations or require additional safety precautions as needed. Honeywell establishes written procedures to identify those audit findings requiring documentation in the corrective action program and management review.

In addition to the plant audit and inspection program, corporate HS&E personnel also conduct plant audits to ensure compliance with company, federal, and state standards for occupational health, safety, and pollution control.

Inspections are performed to ensure operations are being conducted in accordance with approved procedures. Personnel responsible for performing inspections include members of management, Audit and Inspections personnel, specified supervisors, Safety, Environmental, and Health Physics personnel.

Honeywell retains independent auditors from external organizations as necessary to ensure appropriate technical expertise is applied to the various audits and inspections. Inspection findings shall be reported to the responsible manager or supervisor.

11.6 Incident Reports and Investigations

11.6.1 Incident Investigations

Honeywell requires employees to report incidents, regardless of severity. Potential hazards (near misses) require a written report. Honeywell requires an investigation report for incidents resulting in personnel injury, equipment damage, or effects on the environment or members of the public.

It is the responsibility of the appropriate department manager to designate an Incident Investigation Team to perform the in-depth investigation. The team includes a trained investigator and may include Safety or Health Physics personnel and other resources as needed. The investigation report addresses the incident description, results, causes, and recommended corrective actions.

To evaluate incidents, MTW holds a Management Review Committee (MRC) meeting periodically to discuss and determine the appropriate path forward for the resolution of the incident. Incidents are reviewed and given a priority designation based on the safety or environmental significance of the incident. After the completion of the MRC review, the incidents are assigned to a specific person in the plant for resolution.

The HSE and Regulatory Affairs Managers are responsible for ensuring the proper and timely completion of required investigations, unless otherwise assigned by the Plant Manager.

11.6.2 Reports

Honeywell maintains specific site procedures for investigating, recording, reporting, and following up on reportable incidents as required by applicable regulations, including 10 CFR 40.60 (Ref. 4), 10 CFR 20, Subpart M (Ref. 5), and 10 CFR Part 21 (Ref. 6).

As indicated in Section 1.8 of this Application, USNRC has granted MTW an exemption from the reporting requirements of 10 CFR 40.60(b)(3). Specifically, USNRC has granted MTW an exemption from the requirement to report, within 24 hours, an event that requires unplanned treatment of a radioactively contaminated individual in the on-site medical facility. In lieu of reporting, MTW maintains a log of such events. (Ref. 6)

Regarding the reporting requirements of 10 CFR 40.60(b)(2), Honeywell utilizes the following clarifications to ensure compliance:

- *"Equipment required by regulation or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident" (10 CFR 40.60(b)(2)(i)) refers to Plant Features and Procedures (PFAP) that are classified as "Passive Engineered Controls" or "Active Engineered Controls" in accordance with the MTW ISA Summary.*
- *"Equipment is required to be available and operable when it is disabled or fails to function" (10 CFR 40.60(b)(2)(ii)) means that the PFAP was disabled or failed to function during a period in which the PFAP is required to function to ensure prevention or mitigation of the postulated accident, consistent with the intent of the designated PFAP.*

The Regulatory Affairs Manager is responsible for oversight of these activities.

11.7 Records Management

Honeywell implements a program to ensure the proper production, storage, and retention of records related to plant configuration, health and safety, and other plant activities. Included in this program are records of:

- *Management of Change Program records (5 years), e.g., Request for change (RFC) Descriptions*
- *Operational incidents (5 years), e.g., PFAP failures and corrective actions*

- *Events investigations (including events involving releases of radioactive materials beyond regulatory limits) (until license termination), e.g., PFAP investigations*
- *Audits and inspections (5 years), e.g. – PFAP Procurement and equipment maintenance*
- *Employee training (5 years); e.g., ERT training records*
- *Environmental measurements (until authorized by the USNRC), e.g., Air monitoring results*

Honeywell maintains plant operations and maintenance records consistent with corporate recordkeeping requirements.

Section 4.11 of this Application provides information regarding creation and retention of records related to the RP Program.

11.8 Other Quality Assurance Elements

11.8.1 Operator Attentiveness

Honeywell establishes written procedures to address requirements for board operator attentiveness.

11.8.2 Shift Briefings and Shift Turnover

Honeywell establishes written procedures to ensure an orderly Operations shift turnover process is conducted.

11.8.3 Pre-job Briefings

Honeywell establishes written procedures to ensure pre-job briefings are conducted for significant activities that involve licensed material.

11.8.4 Procedural Adherence

Honeywell establishes written procedures governing use of and adherence to written procedures.

11.9 References

1. Letter, USNRC to Honeywell Metropolis Works, Approval of Amendment Request to Modify License Condition 18 Regarding the Configuration Management Process, Honeywell Metropolis Works (TAC No. L32758), dated February 28, 2011.
2. Regulatory Guide 3.74, Guidance for Fuel Cycle Facility Change Processes, USNRC, January 2012.
3. Title 29, Code of Federal Regulations, Part 1910, Section 1910.119, Process Safety Management of Highly Hazardous Chemicals, U.S. Occupational Safety and Health Administration.

4. Title 10, Code of Federal Regulations, Part 40, Section 40.60, Reporting requirements, USNRC.

5. Title 10, Code of Federal Regulations, Part 20, Subpart M, Reports, USNRC.

6. Title 10, Code of Federal Regulations, Part 21, Section 21.21, Notification of failure to comply or existence of a defect and its evaluation, USNRC.

7. Letter, USNRC to Honeywell Metropolis Works, Approval of Exemption from the 24-Hour Reporting Requirement of Title 10 of the Code of Federal Regulations Section 40.60(b)(3) for Medical Treatment of Contaminated Individuals at the Honeywell Metropolis Works On-Site Medical Facility (Cost Activity Code 000224), dated January 30,2018.

12.0 MATERIAL CONTROL AND ACCOUNTING

12.1 Material Control and Accounting

Honeywell develops and submits Nuclear Material Transaction Reports addressing foreign-obligated source material in accordance with the requirements of 10 CFR 40.64 (Ref. 1). This activity is performed as follows:

Honeywell shall, within 10 days of receipt of source material, report to the Nuclear Materials Management Safeguards System (NMMSS) database, the shipper's values of the natural uranium. Shipper's values shall be reported (Blocks 1 through 27s of USDOE/USNRC Form 741) as required in Section 2.1.1 of NUREG/BR-0006 (Reference 2). The final quantity determination, as agreed upon with the supplier, shall be reported to the NMMSS database within 10 days of the date on which the agreement is finalized (Ref. 3).

12.2 Record Keeping

Honeywell retains records of the receipt, transfer, and disposal of source material. These records are kept electronically in a system that has the capability for producing legible, accurate, and complete records. The records are maintained in accordance with 10 CFR 40.61 (Ref. 4).

12.3 References

1. Title 10, Code of Federal Regulations, Part 40, Section 40.64, Reports, USNRC.

2. NUREG/BR-0006, Revision 8, Instructions for Completing Nuclear Material Transaction Reports, USNRC, April 1, 2017.

3. Letter, USNRC to Honeywell Metropolis Works, Approval of Amendment Request to Modify License Condition 21 Regarding Nuclear Materials Management Safeguards System Reporting Requirements, Honeywell Metropolis Works (TAC No. L32761), dated February 7, 2011.

4. Title 10, Code of Federal Regulations, Part 40, Section 40.61, Records, USNRC.

13.0 PHYSICAL PROTECTION

Consistent with 10 CFR 40.31(m) (which requires compliance with 10 CFR 73.21 and 73.22), Honeywell implements processes to ensure protection of Safeguards Information and complies with the Interim Compensatory Measures as required by the USNRC.